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SIMULATION-BASED METHODOLOGY FOR THE DESIGN OF WORLD-CLASS MANUFACTURING CELLS

by

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A dissertation submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of the Degree of
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ABSTRACT

IRIZARRY, MARIA DE LOS A. Simulation-Based Methodology for the Design of World-Class Manufacturing Cells. (Under the direction of Dr. James R. Wilson, and Dr. Jaime Trevino.)

The objective of this research is to develop a comprehensive simulation-based methodology for the design and evaluation of world-class manufacturing cells that will provide enhanced flexibility to cope with highly demanding product and customer trends. Cell performance is measured with an annualized cost function that encompasses ten major cost components: inventory carrying cost, setup cost, material handling cost, storage equipment cost, production labor cost, maintenance cost, quality cost, layout, and floor space cost. A manufacturing cell simulator with a modular structure is developed so that the proposed cell-design methodology can be readily applied to a wide variety of cell scenarios. The first phase of the methodology involves factor-screening experiments for the identification of design and operational factors that have a significant impact on cell performance. In the second phase of experimentation, (regression) metamodels are constructed to describe the relationship between the significant cell design and operational factors (the inputs) and the expected value of the resulting annualized cell cost (the output response). Canonical and ridge analyses of the estimated response surface are used to estimate the setting of the cell design and operational factors that minimize the cell's expected annual

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cost. The methodology is applied to an assembly cell for printed circuit boards. Compared to the current cell operating policy, the metamodel-based estimate of the optimum operating policy is predicted to yield average annual savings of approximately $440,000; and this represents a 20 percent reduction in annual cost. Similar savings should be achieved in other applications of the proposed methodology for manufacturing cell design and evaluation.

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DEDICATION

I want to dedicate my work first to my husband Pedro. For being a wonderful husband, father, and friend. His love, support, and encouragement were my strength and motivation.

I also dedicate my work to my son Pedro Javier for his love, patience, and understanding. You certainly helped to make the completion of my graduate work a reality.

I would also like to dedicate my work to my parents who in many occasions traveled to lend a hand with the kids. My long working hours were peaceful knowing my home was filled with their love.

I also dedicate my work to Kum Souk Lee for being so special to my daughters. I thank the Lord for her love and friendship.

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BIOGRAPHY

Maria de los A. Irizarry was born on December 20, 1954 in Bronx, New York. She graduated from the University of Puerto Rico, Mayaguez campus, in May 1977 where she received a degree of Bachelor of Science in Industrial Engineering. In May 1980 she completed a Master of Engineering in Industrial Engineering degree at Texas A&M University, College Station, Texas.

Maria worked as instructor for the Industrial Engineering Department at the University of Puerto Rico from January 1982 until May 1987. On Spring 1987, she was awarded the Industrial Engineering Department Academic Excellence Award. As an independent consultant between 1987 and 1992, she worked on projects at Baxter Healthcare Corporation, Allergan Medical Optics, Avon Mirabella, Stryker P.R. Inc., and AT&T Atlanta Works. Maria has served as instructor on APICS-sponsored seminars in the areas of Production Activity Control and Capacity Management.

On June 1992, she moved to Raleigh, North Carolina with her husband Pedro and her eleven year old son Pedro Javier. She began her Ph.D. program in Industrial Engineering at North Carolina State University in the Fall of 1992. While in graduate school, she gave birth to two lovely daughters, Agnes and Alexandra. Maria has participated in research projects as a member of the World-Class Manufacturing Research Team at North Carolina State University.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Shrinking product life cycles, an increasing product mix, and continuously increasing customer expectations are redefining competitiveness in world markets. Customer orders occur more frequently, in smaller lots and with increased variety, all required in a shorter time window. Companies thus must design manufacturing systems with the flexibility to respond to this new reality, ensuring superior quality, quick response, and competitive costs. Traditional manufacturing systems lack the characteristics required to cope with rapidly emerging technological and social trends while remaining competitive in global markets.

An alternative approach to manufacturing that offers a potential for high flexibility, superior quality, on-time deliveries, and low production cost is a hybrid system called cellular manufacturing. This approach is one of the cornerstones for the implementation of just-in-time concepts and for becoming a world class manufacturer. Cellular manufacturing is a production system that provides the economic advantages of flow production lines while retaining the flexibility of job shop production systems. The basic building block of a cellular manufacturing system is the manufacturing cell [BLAC88].

Cellular manufacturing entails the processing of similar parts by a group of dedicated machines arranged in close proximity. These machines are

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grouped based on production requirements or part-geometric characteristics. Numerous case studies found in the literature reveal the benefits achieved through the implementation of manufacturing cells. Typical results include reductions in work-in-process inventories and lead times as well as improvements in throughput, quality, and on-time delivery. Although numerous success stories are found in the literature, many companies are still reluctant to transform their facility layout from a job shop to a cellular configuration.

1.2 Importance of the Study

The design of manufacturing cells is a highly complicated process. It entails the consideration of many factors having complex relationships [MCGI91]. Grouping machines into cells does not ensure that the benefits associated with cellular manufacturing will be achieved [STEU92]. Implementation of manufacturing cells without careful analysis can result in a highly inflexible manufacturing system with poor results.

Manufacturing cell issues can be divided basically into the following two major categories: (1) cell formation, and (2) cell design and operation. Cell formation entails the grouping of parts into families and machines into cells. Cell design includes issues such as layout, configuration of the material handling and storage system, and unit load size. Cell operation encompasses issues such as quality control, equipment breakdowns and preventive maintenance, machine setup time, product lot sizing, operator assignment, operator movement rules, product scheduling, and sizing and placement of inventory buffers. Machine

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stoppages due to material replenishments, lot sequencing, and demand variability represent other operational issues of interest.

Most of the research work in cellular manufacturing has focused on cell formation, material handling system design (especially automated guided vehicles), and cell layout. Wemmerlov, in a survey performed with U.S. industries that are users of cellular manufacturing, found that most problems faced by these companies are operation-related [WEMM89]. Another significant finding from the survey was that feasibility studies and cell design were the second highest expense category.

Performance of a manufacturing cell can be measured in numerous ways. Throughput, work-in-process, manufacturing lead time, material handling cost, machine setup cost, and inventory carrying costs are some examples found in the literature. Every decision made during the design process has an impact on cell performance, whether related to cell formation or cell design and operation. A weakness of the procedures developed so far is the consideration of only one or, at best, a few performance issues [WEMM89].

Companies working towards becoming world class manufacturers need to evaluate the impact of implementing just-in-time elements on the performance of cells. Issues such as total productive maintenance (TPM) and quality at the source (QAS) require substantial investments and may not have a significant benefit in the manufacturing process performance. Smaller lots and smaller unit load sizes may impact labor and machine utilization. The impact of teamwork

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and multiskilled workers on cell operation are other issues of interest. Cell design methodologies addressing the impact of world class elements on cell performance are seldom found in the literature.

In summary, research to date does not provide: (a) methodologies with a comprehensive performance measure to assess design decisions, (b) methodologies addressing cell operation issues during the cell design process, and (c) methodologies for evaluating the impact of implementing just-in-time and world class elements on cell performance. The development of comprehensive cell design methodologies will help industries to improve their understanding of cellular manufacturing by being able to measure cell performance under a wide variety of scenarios prior to implementation. The willingness of continuous improvement practitioners to migrate to cellular manufacturing should increase sharply if such methodologies and tools are available.

1.3 Scope and Objectives of the Research

The first objective of this research is to develop a manufacturing cell design methodology with the following characteristics:

1. The methodology encompasses cell design and operation issues at the design stage. Design issues to be addressed are cell layout, configuration of the material handling and storage system, and unit load size. Operation issues to be addressed are lot size, setup times, machine breakdowns and maintenance, machine minor stoppages, part scheduling, sizing of inventory buffers, number of operators, operator assignments, and operator movement

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rules. Other issues that can be evaluated are demand variability and lot sequencing.

2. The methodology incorporates a comprehensive performance measure. The performance measure will be a total annual cost model capable of evaluating the impact of multiple cell design and operation issues. The components of the total annual cost function are: (a) inventory carrying cost, (b) setup cost, (c) material handling cost, (d) storage cost, (e) direct labor cost, (f) maintenance cost, (g) quality cost, (h) layout cost, (i) floor space cost , and (j) lateness cost.
3. The methodology accounts for just-in-time and world class elements such as multiskilled workers, quick changeover teams, autonomous maintenance, total preventive maintenance, and quality at the source.

The second objective of this research is to develop a generic manufacturing cell computer simulation model to facilitate the implementation of the cell design methodology. The focus will be in the design of manned manufacturing cells.

The manufacturing cell design methodology entails:

1. Selection of cell design and operation factors of interest.
2. Use of a comprehensive annualized cost function to track cell performance.
3. Execution of screening experiments using the generic manufacturing cell computer simulation model to determine significant design and operation factors.

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4. Execution of follow-up simulation experiments to estimate a (regression) metamodel describing the expected performance of the simulation model, with cell design and operation factors as independent variables and cell total annual cost as the dependent variable.
5. Optimization of cell performance using the developed metamodel to estimate the settings of the design and operation factors that minimize the cell's expected total annual cost..

The development of a generic manufacturing cell computer simulation model requires:

1. Plant visits for the characterization of manufacturing cells. This encompasses machine types, product flows, configurations of material handling and storage equipment, cell layouts, and cell sizes.
2. Selection of design and operation factors of interest to manufacturing cell users.
3. Selection of just-in-time and world class manufacturing elements to be included in the simulation model.
4. Development of a total annual cost function to measure cell performance under a variety of cell design and operation scenarios.
5. Design, implementation (coding), and verification (debugging) of the manufacturing cell computer simulation model.

The manufacturing cell design methodology will be tested using the generic manufacturing cell simulation model with data from an actual industry case.

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In summary, the design methodology in conjunction with the generic cell simulator should help industries to improve their understanding of cellular manufacturing. Resources could be optimized to achieve a competitive advantage.

1.4 Organization of the Dissertation

This dissertation is divided into five chapters. Chapter 2 presents a literature review on cellular manufacturing. It includes definition and benefits of cellular manufacturing, and frameworks and methodologies for the design of manufacturing cells. Chapter 3 describes the research work for the design of a generic cell simulator. The main issues discussed are the characterization of machines types and product flow, the selection of world class manufacturing practices, the development of a comprehensive annualized cost function, and the design of the generic cell simulator. Chapter 4 presents the proposed simulation-based methodology. The methodology is applied to a cell which assembles printed circuit boards. Chapter 5 contains a summary of the research work with conclusions and recommendations for future research.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter expands on the definition of manufacturing cells. Benefits expected from the implementation of cellular manufacturing are presented in Section 2.3. Manufacturing cell design frameworks found in the literature are reviewed in Section 2.4, with strengths and weaknesses discussed in Section 2.5. Some conclusions are presented in Section 2.6.

2.2 Definition of Manufacturing Cells

Cellular manufacturing is an approach for the redesign and reorganization of a manufacturing facility that exploits the sameness of parts and processes to achieve the benefits of flow production systems while retaining the flexibility of job shop layouts. A manufacturing cell is a collection of machines, processes, and/or workstations dedicated to producing a collection of similar parts or products. This collection of similar parts is called a part family.

Product flow within the cell can be either jumbled (as job shop layouts) or straight (as in flow lines). However, world class manufacturing cells are usually flow line cells. Cells could be used either for parts fabrication, assembly, or a

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combination of these activities. Similarities between parts within the family allows manufacturing in small lot sizes with quick changeovers. Another characteristic of manufacturing cells is that unit load size is small and the material handling effort to move parts between machines is significantly less than in job shop environments.

The manufacturing lead time is the time it takes a product to be completed (from beginning to end). In job shop environments a large percentage of the lead time is spent waiting (for machines or material handling resources), being transported (by a material handling resource), or sitting idle (in a storage area). That percentage in some cases can be as high as 95 percent [BLAC88]. Dedicating machines to families of parts and locating machines in close proximity to one another, as with cells, significantly reduces waiting, handling, and storage times. The intention is to keep the products moving through the process until completed.

Manufacturing cells can be considered as single entities for production scheduling. The need to plan and schedule each single operation for each one of the parts is eliminated with the implementation of cells. Cell capacity is adjusted to deal with changes in demand by increasing or decreasing the number of operators in the cell. Cell operators can perform any of the operations within the cell since they are usually trained to be multiskilled. The functions of quality control and preventive maintenance are integrated into the manufacturing system. Cell operators are responsible for product quality and machine

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performance. Quality control and preventive maintenance personnel act as facilitators.

2.3 Benefits of Cellular Manufacturing

The concept of manufacturing cells is promising, and the benefits to be achieved from the implementation of a well conceived cell are many. Droy [DROY87] contends that a properly designed cell may achieve "benefits beyond everyone's expectations". He claims that a cell should realize lead time reductions of 60 to 90 percent, and cost reductions of: (1) 30 to 50 percent for quality, (2) 50 to 80 percent in inventory, (3) 30 to 50 percent in direct labor, (4) 30 to 50 percent for engineering support, (5) 50 to 90 percent for material handling, (6) 80 to 90 percent for supervision, and (7) 50 to 80 percent for production control.

Greene and Sadowski [GREE83] list some of the benefits and disadvantages of cellular manufacturing. The benefits to be expected are reductions in the following: control requirements, material handling, setup time, tooling requirements, in-process inventory, and expediting. On the human side, benefits include broadened operator expertise and human relations. On the other hand, the disadvantages include reduced shop flexibility and machine utilization, with a possibility of increasing lead times and job tardiness.

Steudel and Desruelle [STEU92] present a list of the benefits reported by many companies, and they explain how and why those benefits can be achieved.

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Some of those benefits are: (1) a reduction of 70 to 90 percent in production lead times and work-in-process inventories, (2) a reduction of 75 to 90 percent in material handling, (3) reductions of 20 to 45 percent in the amount of factory floor space required to produce the same number of products, (4) decreases in machine setup times by 65 to 80 percent, (5) reductions of 50 to 80 percent in quality-related problems, (6) simplification of shop-floor control, and (7) better communication between personnel in product design and manufacturing engineering. Steudel and Desruelle recognize that cellular layout configurations have some disadvantages when compared to job shop layouts. They list three as the most common limitations: (1) reduced machine utilization, (2) less flexibility than job shop layouts, and (3) equipment failure as having more costly and damaging effects in throughput capacity.

Wemmerlov and Hyer [WEMM89] reported the results of a survey involving 32 firms that have implemented the concept of cellular manufacturing. Some of the reported benefits involved reductions in the following: throughput time, work-in-process inventory, material handling, numbers of fixtures, setup times, finished goods inventories, and labor costs. In addition to these benefits, Wemmerlov and Hyer reported improvements in operator job satisfaction and part quality. A survey was performed by Trevino [TREV94] involving 13 companies in North Carolina, all of them users of cellular manufacturing. Some of the benefits reported by these companies include: (1) reductions in work-in-process, raw materials, and finished goods; (2) improvements in product quality, throughput, and delivery performance; (3) reductions in product lead time, floor space requirements, and setup times; and (4) cost reductions. Koelsch

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[KOEL90] and Al-Qattan [ALQA89] present other claims of benefits attributable to cellular manufacturing.

The claims of benefits attributed to cellular manufacturing provide evidence of the advantages to be expected from its implementation. However, as many researchers recognize, the benefits can only be achieved with a well-conceived cell incorporating the dynamics of cell performance. An overview of frameworks for the design of manufacturing cells is presented in the section that follows.

2.4 Frameworks for the Design of Manufacturing Cells

Wemmerlov and Hyer [WEMM87] view the design of cells as an iterative process consisting of three basic steps: design, evaluation, and justification. Design issues are divided into two categories, those that relate to system structure and those that relate to system operation. Issues considered under system structure are: the selection and grouping of parts into families, the selection and grouping of machines into cells, selection of material handling equipment, and choice of cell layout. System operation, on the other hand, considers typical problems related to the operation of cells, such as: maintenance policies; inspection policies; production planning, scheduling and control; assignment of responsibilities to operators and staff; reporting mechanisms; and reward systems. Wemmerlov and Hyer emphasize that decisions related to system structure cannot be evaluated independently of

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decisions related to system operation since both affect system cost and performance.

Kinney and McGinnis [KINN87] describe the cell design process as consisting of five steps, namely: (1) part selection, (2) machine selection, (3) layout, (4) selection of material handling equipment, and (5) staffing. Part selection involves the determination of the group of parts to be processed in the cell. Machine selection involves the determination of how many machines of each machine type to include in the cell. Decisions must then be made regarding layout, selection of material handling equipment, and staffing. The success of the cell design should be determined from the evaluation of preselected cell performance measures. Kinney recommends evaluating cell performance with respect to planned production rates for the family of products to be processed in the cell. If cell performance is not acceptable, then another iteration of the whole process should follow until a satisfactory design has been obtained.

Another framework for the design process is presented by Steudel [STEU91]. The whole process consists of two basic steps: (1) parts and machine grouping; and (2) detailed cell design, testing and evaluation. A third step described in his methodology focuses on the implementation phase. Parts and machine grouping consists of: (1) selection and grouping of parts into families, (2) selection and grouping of machines into cells, and (3) the assignment of part families to machine cells to form workcells. Cell design is divided into five categories of design parameters. These are: (1) workstation configuration, (2) shift conditions, (3) operator assignment, (4) work-in-process storage, and (5)

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operating policies. A workstation is defined as the collection of machines required to perform a specific operation in the cell. Under this definition, workstation configuration means the number of machines per workstation. Shift conditions, the second parameter category, deals with the number of shifts per day and the number of hours per shift. Design decisions related to operator assignment are number of operations in the cell, operator cross-training, and operator assignment to workstations. The only work-in-process storage parameter mentioned by the author is buffer size. The last category of design parameters encompasses operating policies. Design decisions under this category are lot sizes, transfer batch sizes (or unit load sizes), and setup policy.

In spite of the fact that the three sources cited offer slightly different frameworks for the design of manufacturing cells, they all agree in three areas. First, all of them view the design process as being iterative. The whole design cycle is repeated until a superior design is identified. Second, their description of the design process contains the same set of activities. In general those are: selection of parts and machines, physical configuration of the cell, and decisions related to operational issues such as quality control and maintenance policies. Last, the generation and evaluation of design alternatives should consider design and operational issues simultaneously since both affect cost and cell performance. The most commonly cited cell design and operation factors in research papers, case studies, and surveys of cell users are:

- number of parts per cell
- number of machines per cell

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- product mix
- demand variability
- lot size
- setup times
- transfer batch size
- storage policy (centralized vs. decentralized)
- configuration of work-in-process buffers (size and location)
- cell layout
- material handling equipment
- production control policy (push vs. pull)
- scheduling policy (FIFO, EDD, SPT)
- quality control policy
- maintenance policy (breakdown maintenance vs. preventive maintenance)
- number of cell operators
- operator assignments

Some of the factors listed above are quantitative while others have a qualitative nature. Quantitative factors are those whose levels can be associated with points in a numerical scale. Examples of quantitative factors are number of parts in the cell, number of operators in the cell, and setup times. On the other hand, qualitative factors are those for which the levels cannot be measured on a numerical scale. Maintenance and quality policies are some examples.

2.5 Methodologies for the Design of Manufacturing Cells

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The objective of this section is to present an overview of methodologies for manufacturing cell design. The modeling approaches include: probability models, mathematical models, heuristics, simulation, and metamodels.

2.5.1 Probability Models

Probability models use basic principles of probability or stochastic processes to study system performance. Since they incorporate the stochastic and dynamic nature of the system, they represent an improvement over deterministic models. One class of a probabilistic model is provided by discrete-time Markov chains. A Markov chain may be represented by nodes symbolizing the state of the system that are connected by directed arcs (branches) showing the transitions between the states of the system. The state of the system can be defined in terms of the number of parts in the buffers, the number of machines processing parts, or the number of busy operators. Steady-state probabilities are obtained by solving a set of simultaneous linear equations developed using the Markov chain describing the states of the system. These probabilities are then used to obtain performance measures such as steady-state operator and machine utilization, and steady-state system throughput rate. Markov chains have been applied to the design of transfer lines [BUZA67, DALL88, GERS83, GERS87].

Although Markov chains can account for the uncertainties and dynamics of the system, they assume time-invariant inputs. This is a major drawback in mimicking real-life situations. For this reason, Markov chains are typically used

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to compare different system configurations early in the design process. Markov chains are most suitable for small or simple manufacturing cells since the number of states often grows exponentially with the size of the system [LEUN90].

A second class of probabilistic models is provided by queuing models. These models are used to study system performance under steady state conditions. System performance measures are usually steady-state averages. Queuing models have been used in the design of nonautomated as well as automated cellular manufacturing systems. Solberg was among the first to formulate a queuing network model of a flexible manufacturing system [SOLB76]. Buzacott and Shanthikumar used queuing concepts to predict performance of a flexible manufacturing system under various work-in-process storage policies [BUZA80]. Case studies on the application of queuing theory for lead time reduction are presented by Suri [SURI89] and Suzanne [SUZA92]. O'Grady and Menon [OGRA86] present an extensive review on the use of queuing models for the design of flexible manufacturing systems.

Queuing models are simple and quite efficient. They do not require a large amount of input data and can be executed quickly using a computer. That is why they are called rapid modeling tools [SURI93]. Some of the software packages currently available for general use are CAN-Q, QNA, and MANUPLAN [SNOW88]. A survey of software packages for manufacturing is presented in Snowdon and Ammons [SNOW88]. The primary limitation of queuing models is in the simplifying assumptions required to have analytically tractable models.

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One fundamental assumption is that processing times are exponentially distributed, which is not true for complex cellular manufacturing systems. However, given their simplicity and efficiency they are recommended in the early design stages to explore and select a subset among a large number of alternative designs.

2.5.2 Mathematical Programming Models

A mathematical programming model consists of a set of equations relating system performance to system decision variables. It is formulated as an objective function subject to a set of constraints. A solution to the set of equations is obtained to either maximize or minimize the objective function. For example, an objective function could be the total annualized cell manufacturing cost, which is to be minimized over all feasible combinations of the decision variables. Constraints on the decision variables could be limits on machine capacities, numbers of operators, buffer sizes, and hours per shift.

Mathematical programming models have been used for production planning and scheduling of both nonautomated and automated manufacturing cells. Stecke constructed a nonlinear integer programming model to solve production planning issues for a flexible manufacturing system [STEC81, STEC83]. A conclusion of her work was that such models were too large to be computationally feasible [OGRA86]. Wilson proposed an integer programming model for the assignment of tooling in automated manufacturing cells [WILS84]. Mathematical programming models have been used by researchers to determine

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the optimum number of kanbans [BITR87, BERK92, LI91]. Mathematical programming has also been used for the machine cell layout problem. Sunderesh developed a methodology to solve the machine cell layout problem which involves three stages [SUND89]. In the first stage a clustering algorithm is used to identify machine cells and part families. In the second and third stages, the machine cell and machine layout problems are solved using a mathematical programming model. The model's objective function to be minimized is the total cost of performing the required trips between cells and machines.

The objectives of probability and mathematical programming models differ somewhat. Markov chains and queuing theory guide the design process by evaluating system performance. Mathematical programming on the other hand is used to obtain the design which optimizes system performance. The latter models, however, cannot generally deal with the stochastic and dynamic nature of manufacturing cell operations.

2.5.3 Heuristics

Heuristics are methods developed to quickly obtain good feasible solutions. The widespread use of heuristics is mainly due to the computational difficulties of mathematical programming and probabilistic models. Heuristics have been used to solve machine cell layout, lot sizing, and cell scheduling problems. Sunderesh developed a mathematical programming model for cell layout and employed a heuristic algorithm to obtain a solution to the mathematical programming model [SUND89]. A heuristic was developed by

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Sundaram and Sundrarajan to solve the lot sizing problem in cellular manufacturing systems. The objective of the heuristic was minimization of setup and inventory carrying costs. Dessouky and Mackulak developed a heuristic solution to the problem of scheduling jobs when a changeover penalty exists [DESS90]. Other works on the development of heuristics for manufacturing cell scheduling are presented in Logendran [LOGE91] and Sundaram [SUND88]. O'Grady and Menon cite several surveys on the application of heuristics to manufacturing systems [OGRA86].

Researchers recommend the use of heuristics to overcome the computational difficulties of mathematical programming and probabilistic models. These provide approximate but good solutions to complex problems.

2.5.4 Discrete Event Stochastic Simulation

Simulation has been used for years to model manufacturing and production systems. However, it was not until the 1980s that simulation became a tool commonly used by researchers and practitioners in the manufacturing and production areas. One of the factors contributing to this trend was the introduction of the personal computers, with capabilities that were previously available only on large mainframes. Other factors were the introduction of new simulation languages specifically designed for manufacturing simulation and software packages that do not require any computer programming by the user. Nevertheless, caution should be exercised when selecting "canned" packages since convenience of use is at the expense of losing some flexibility and level of

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detail in the simulation model. A simulation software buyer's guide was published recently in Industrial Engineering [INDU96].

Gunasekaran describes simulation models as "the best known method to evaluate performance of just-in-time systems" [GUNA93]. Simulation models are very flexible. They can be tailored to a specific objective and made as general or detailed as required to achieve a desirable level of accuracy. Simulation is applicable to all manufacturing systems.

Simulation studies of cellular manufacturing systems have appeared only in the recent literature. Some researchers have focused on the effect of conversion from a job shop system into a cellular manufacturing system. Morris and Tersine examined the influence of several factors in a firm's operating environment on cellular layout performance [MORR90]. The factors analyzed were: (1) ratio of setup to process time, (2) material transfer time between workstations, (3) demand stability, and (4) flow of work within cells. Although none of the operating variables produced a clear advantage for cellular layouts, Morris and Tersine were able to postulate the "ideal" environment for cellular layouts.

Suresh also investigated the effects of partitioning job shops to implement cellular manufacturing [SURE92]. He studied the effects of lot size, setup reduction, cell size and allowance of intercell movements. He showed that partitioned systems with an insufficient degree of setup reduction are inferior to unpartitioned systems.

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Another researcher who studied the conversion from job shops to cellular manufacturing systems is Durmusoglu [DURM93]. The objective of his study was to compare a job shop system with large lot sizes and a cellular system with smaller lot sizes using SMED (Single Minute Exchange of Dies). He used simulation and economic analysis to justify the conversion. His conclusion was that setup time reduction is a key step for conversion.

Alexander et al. proposed a macro/micro approach to the simulation of cellular manufacturing systems [ALEX90]. A "macromodel" was used to simulate the overall production system. This includes the manufacture of batches of parts and their assembly into end items. A "micromodel" was used to simulate the processing of units, one at a time, over the individual machines in the cell. The focus of this study was on cell layout.

Several recent papers have addressed the issues of sequencing and scheduling. Taylor and Taha evaluated buffering strategies for cellular manufacturing systems [TAYL93]. They simulated a cellular manufacturing system with decentralized buffers associated with each manufacturing cell, and central buffers at key routing decision points. They concluded that decentralized buffers facilitate the use of push dispatching rules, while centralized buffers facilitate the use of pull dispatching rules. The results of the study emphasize the need to consider physical and conceptual CMS design, product design, and control policies concurrently throughout the design process.

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Shenoy and Kasilingam developed a simulation model to analyze the performance of a hypothetical cellular manufacturing system under various combinations of dispatching and loading policies [SHEN91]. The performance criteria used were machine utilization, tool utilization, cell utilization, part waiting time, and automated guided vehicle (AGV) utilization. The dispatching rules studied were first-in first-out (FIFO), shortest processing time (SPT), longest processing time (LPT), and last-in first-out (LIFO). Results showed that equipment utilization depended more on the number of the AGVs and their speed rather than the dispatching rules.

Three approaches for assigning workers to tasks and controlling the flow of jobs through a cellular manufacturing system were analyzed by Askin and Lyer [ASKI93]. The scheduling approaches considered were: (1) individual machine loading with batches sequenced on a FIFO basis, (2) cell dedication wherein the cell was dedicated to a single product at a time, and (3) assignment of each batch to a single cross-trained operator responsible of performing all batch operations. Queuing theory was used to obtain analytical approximations for the first two strategies, and simulation was used to confirm the analytical approximations. The results obtained showed that the approach selected to schedule a manufacturing cell can make a significant impact on throughput time. When the cell consisted of only one machine, the choice of policy was not important. For larger cells, the best scheduling policy was highly dependent on service time distributions, machine utilizations, and lot sizes. In most cases multiple product cells were the best choice.

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The effect of product mix on cell performance was studied by Kekre [KEKR87]. He studied the impact of increasing the number of items made in the cell and also the effect of job sequencing by shortest setup time. Kerke used queuing theory and validated the results obtained with simulation. Optimum lot size and queue time were found to increase as product mix increased up to a certain point beyond which adding more part types had very little effect. Sequencing by shortest setup time was found to have small benefits when items were very similar.

Simulation has been extensively used for the design of material handling systems. Savory et al. [SAVO91] developed a simplified approach for the design of nonaccumulating conveyors in flexible manufacturing systems. He assumed that conveyor movement was continuous and that part movement was FIFO. Another assumption in the model was that the conveyor is available at all times. A large amount of literature can be found in the area of automated guided vehicles (AGVs). Savory [SAVO91] studied the impact of AGVs on the performance of flexible manufacturing systems. He developed a simulation model to estimate the performance of AGVs, robots, and conveyors. Conveyors were found to consistently outperform both robots and AGVs.

In comparison to the design issues covered above, a very limited amount of simulation work has focused on other cell issues such as machine preventive maintenance programs, quality control strategies, and cell balancing.

Hurley developed a simulation-based methodology for estimating and optimizing the effects of design and operation factors on the performance of

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manufacturing cells [HURL94]. Her methodology was applied to a specific manufacturing cell scenario dealing with the assembly of service parts for the electric power generating industry. She considered operational issues such as: lot sizing, number of cell operators, setup times, machine processing times, and material handling distances. Other factors included in the study were: maintenance programs, quality control strategies, and scheduling policies. Central to the methodology is an annualized cost function to measure cell performance. A metamodel describing the relationship between quantitative factors and cell performance was developed for each combination of qualitative factors. Hurley determined the optimum levels of quantitative factors by evaluating the metamodels at various levels of the factors and selecting those that yield the lowest cost. The optimum level of qualitative factors was determined using the Ryan-Einot-Gabriel-Welsh multiple comparisons procedure.

One of the major sources of variability in a production system is machine breakdowns. However, some studies assume that machines will never break down. Product quality is another element that can have a significant impact on the performance of manufacturing systems. Dyck et al. describe a simulation study performed to analyze the impact of changes in the level of quality on system performance [DYCK91]. They found that as quality deteriorates, system utilization declines at an increasing rate under the JIT environment. Nevertheless, as with breakdowns, many studies assume perfect systems with zero scrap and rework.

Cell balancing impacts cell productivity, work in process, and cell capacity. Very few papers were found dealing with these issues. Steudel

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[STEU91] studied the impact of operator assignment strategies at a cell used to manufacture gears. He found that cell output rate could vary as much as 24 percent with different operator assignment strategies.

Simulation is considered by some researchers as the best method to evaluate performance of manufacturing systems. It is highly flexible, can be applied to any manufacturing system scenario, and can be programmed to capture any desired performance measure. Simulation can be used to model job flows and routing, machine behavior, and complex control and sequencing rules. For this reason, predictions of performance made by the model can be very accurate [BUZA85]. However, simulation has certain limitations that merit some discussion. Those can be summarized as follows:

1. Simulation is time consuming. A significant amount of the analyst's time must be devoted during model development, and a significant amount of computer time must be devoted to achieving a desired level of accuracy in results.
2. The results from simulation do not lend themselves to easy interpretation. Since a wide variety of results can easily be generated, it is a challenge to differentiate the vital few from the trivial many.
3. Evaluating modeled system performance at factor levels other than the ones used in the experiments requires rerunning the simulation.
4. Simulation does not give direct guidance as to ways of optimizing performance. It does not provide hints on how to change factor values to improve performance.

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2.5.5 Metamodels

As stated before, simulation is considered the best modeling tool when the objective is to imitate the complexity and dynamic behavior of the system of interest. Gunasekaran et al. [GUNA93] describes simulation as "the best known method used to evaluate performance of JIT." Metamodels on the other hand, are an excellent mechanism of simplifying the interpretation of results from the simulation by explaining the relationship between cell design and operation factors and cell performance. Yu et al. [YU93] explain that "there is consensus among researchers that metamodels are easier to manage and provide more insight than simulation alone".

Metamodels are defined by Friedman as "any analytic auxiliary model which is used to aid in the interpretation of a more detailed model" [FRIE88]. One type of metamodel is the linear regression model. A set of experiments based on the factors of interest (independent variables such as cell design and operation issues) is designed and carried out with a simulation model. The output from the simulation experiments is used as the dependent variable to perform linear regression analysis. The result is a regression model relating system response to the set of factors or predictor variables of interest. Since the metamodel is built using the results from another model (the simulation model), Kleijnen [KLEI79] defines a metamodel as "a model of a model".

The identification of factors that influence cell performance is vital to the design and operation of manufacturing cell systems [BUZA85]. Metamodels can help to identify significant factors as well as to understand the relationship

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between those factors and system performance. A metamodel can be represented as:

$$Y = f(X_1, X_2, X_3, \ldots, X_n) + \varepsilon,$$

where:

Y = Response variable of interest;

X_i = level of the ith predictor variable (a design and operation factor) of interest ($i=1,\ldots,n$); and

ε = residual error representing the inability of the (regression) metatmodel to predict Y exactly.

The response variable (Y), which is the output of the simulation, is expressed as a function of the design and factors (X_i), which are inputs to the simulation. Therefore, the data used by the metamodel are the inputs and outputs of the simulation model.

Metamodels have many uses [FRIE88]. First, they minimize the need of the simulation analyst for answering "what if" questions, during both design and operation of the system under study. Metamodel predictions can be accurate as long as the predictor variable values are within the range used for the simulation experiments, provided the functional form of the metamodel is a reasonably accurate approximation to the expected simulation response. Metamodels can be used to understand the interrelationships among the design factors of interest. They also provide a mechanism of simplifying the interpretation of results from the simulation model.

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The use of metamodels in postsimulation analysis has been steadily increasing in popularity since the late 1980s. About 57 percent of all reported work relates to manufacturing applications [YU94]. However, the focus of metamodels in manufacturing has been on shop floor control rather than on design of manufacturing systems.

Jothishankar and Wang [JOTH92] used metamodels to study the effect of eight predictor variables on the throughput of a JIT kanban system. They simulated a manufacturing system with two assembly cells, one fabrication cell, and one incoming receiving cell. A 2^{8-4} fractional factorial design with resolution IV was used to reduce the number of design points required to estimate the effect of the predictor variables on system throughput. The simulation model was written in SIMAN, and MINITAB was used to develop the regression metamodel. The latter was validated by comparing predictions using the metamodel with results from a new set of 16 simulation runs. The average deviation of the metamodel-based prediction from the simulation-generated result was found to be within 1.38 percent. Their conclusion was that metamodels can yield good predictions of throughput time, and thus could be used to identify the combination of variables to achieve minimal throughput time.

Other authors discuss the application of metamodels to flexible manufacturing systems. Kleijnen and Standridge describe the use of metamodels to study the impact of four inputs on system throughput [KLEI88]. The metamodels were constructed using the results from a deterministic

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simulation model of the flexible manufacturing system under study. Two approaches were used to build the metamodels: (1) based on an intuitively selected fraction of input combinations, and (2) based on a formal 2^{4-1} fractional factorial design. The formal design gave more accurate estimates of the input effects based on the variance of the estimated effects. The metamodel was used by the authors to better understand how the flexible manufacturing system works.

Lin and Chiu used metamodels to study the behavior of a fixed flow automatic robotics cell [LIN93]. Their interest was first on cell behavior under steady state conditions, and second on dynamic performance under the influence of machine breakdowns and job changes. The input variables of interest were the number of machines in the cell, the utilization level of the cell, variations in process time, variations in time between arrivals, and the speed of a robot. Cell performance was based on part flow time and work-in-process inventory level. The steady state metamodels were validated by comparing predicted values with simulation results. The results were satisfactory, with an average difference of 2.3 percent. The authors recommend (a) using the cell steady state metamodels to estimate the cell capacity in production planning, and (b) using the dynamic metamodels to provide feedback.

Hira and Pandey [HIRA83] developed regression models to study the efficiency of a manual flow line having finite intermediate storage. The regression models were used to predict the output from a balanced production line and to study the effect of buffer distribution on the performance of the line.

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The manual flow line was considered balanced when the processing time distribution for all stations were identical and the interstage buffers had equal capacity. They assumed no machine breakdowns, and no work rejects or reworks at any of the stages in the line. Predictions from the linear regression models were compared to simulation results, and the difference between the two were found to be insignificant at the significance level $\alpha = 0.01$. The regression models revealed that a balanced line is generally the most productive. Also, the work-in-process inventory remained low in lines having interstage buffers of smaller size at the beginning of the flow line and of larger size toward the end.

The four cases presented above show how metamodels have been applied to manufacturing environments to gain insight into system behavior and predict performance. The emphasis on those metamodels applications was for shop floor control. However, there was no attempt by any of the authors to optimize system performance.

Optimization of system performance was the objective of three studies found in the literature review. One was on the application of metamodels for the optimization of a maintenance float problem. The second paper used metamodels for the bottleneck station of a printed circuit board fabrication line. The last one, a very comprehensive study, applied metamodels and response surface design to optimize performance of a computer-integrated manufacturing system. These studies are now discussed.

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Lin and Cochran studied the behavior of a complex flow line for the fabrication of printed-circuit boards [LIN87]. Their effort was focused on lamination, which is the bottleneck operation. Boards are batched prior to this operation and unbatched into smaller lots appropriate for the machine capability of the next operation. The objective of the study was to find the quantitative relationship between batch size and product lead time for different types of boards, and to determine the batch size that would minimize product lead time. Empirical equations from the between-board and within-board analysis of simulation results were developed to show the relationship between batch size and product lead time. The set of empirical equations were used to predict product lead time without actually making simulation runs. A procedure of seven steps was developed by the authors to predict or minimize lead time. Optimization is actually achieved by evaluating an empirical equation which uses batch size as the independent variable.

Metamodels were applied by Madu and Chanin to a maintenance float system with an Erlang-2 failure distribution [MADU92]. The objective of the study was to determine the number of standby units and repair persons needed to minimize the cost of lost production. The input variables of interest were the number of units required to be working at all times (N), mean time to repair (MTTR), mean time between failures (MTBF), number of standby units (F), and number of repair persons (S). The response variable of interest was equipment utilization (EU), which is to be minimized subject to a constraint on the minimum acceptable service level. A metamodel showing the relationship between the input variables and the response variable was constructed by applying ANOVA

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and regression analysis to the simulation results. Validation of the metamodel was achieved by comparing predictions from the metamodel with results from a new set of simulation runs. The average absolute percentage error was 6.25 percent, which is considered appropriate by the authors. The optimum levels of F and S were obtained by evaluating the metamodel at all possible combinations of these two variables. Only those combinations for F and S that satisfied the constraint on service level were used to determine the minimum cost combination using a total cost function defined in terms of N, S, and F.

Response surface methodology is used to find the settings of the input variables of interest that optimize the system response. It is a sequential procedure in which the initial objective is to move rapidly to the general vicinity of the optimum by estimating the gradient of the response surface; then in the final stage, the procedure estimates the optimal settings of the input factors by a more refined approximation to the local curvature of the response surface. The set of values for the input variables that optimize the predicted response is called the stationary point.

Response surface methodology was used by Shang and Tadikamalla to optimize the output from a computer-integrated manufacturing system of an automated printed circuit board manufacturing plant [SHAN93]. The input variables of interest were lot size, line balance, MTBF, MTTR, time limit of the paste life, and capacity of the input buffer. A screening experiment was designed and the simulation runs for each design point were performed to determine which of the input variables of interest had a significant impact on the response

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(plant yield). Response surface methodology was used to (a) investigate the relationship of the yield to the significant factors, and (b) find the factor levels at which the system yield was optimized. The authors recommend the integration of simulation and statistical methods to "improve a factory's operating efficiency and effectiveness."

Hurley proposes a methodology for the design of manufacturing cells [HURL94]. She uses metamodels to determine the setting of design and operation factors that minimize a cell annualized cost function. A metamodel describing the relationship between quantitative factors and the cell's annual cost was developed for each combination of qualitative factors considered. Each metamodel was evaluated to identify the quantitative factor values yielding the lowest cost. The global minimum was then identified from these results using the Ryan-Einot-Gabriel-Welsh multiple comparisons procedure.

Hurley's methodology has several shortcomings. The simulation model she developed to study the impact of implementing world class manufacturing practices is not generic, since it only applies to the assembly cell she used as case study. The annualized cost function can be improved by: (1) eliminating the assumption of zero investment costs on some cost components, (2) adding costs associated with the implementation of new layouts or changing existing layouts, (3) costing space requirements with cost per square feet times cell size in square feet instead of focusing on space requirements for work-in-process, and (4) relaxing the assumptions on team work to reflect a wider variety of approaches for cost reduction projects. Her methodology does not incorporate

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screening experiments to identify significant design and operation factors. The nature of the response surface (simple minimum, stationary ridge, rising ridge, falling ridge, or saddle system) was not determined since canonical and ridge analysis were not part of the methodology. The fact that the optimum setting for cell design and operation issues was always at the perimeter of the design region suggests that additional experimentation outside the selected region should have been considered. The magnitude of the standard error of the metamodel's prediction at the stationary point suggests that metamodels of higher order (higher than second-order) should have been examined in search for an improved estimate of the response surface.

Simulation and metamodels can help in the design and operation of manufacturing systems. However, most of the applications so far have been oriented towards shop floor control rather than manufacturing system design [YU94]. Few authors have worked on the use of response surface for the optimization of system performance.

2.6 Conclusions

In summary, most of the research work has been focused on cell formation. Research in the area of cell design and operation focused primarily on production planning and scheduling, cell layout, product lot sizing, product sequencing, and material handling. The factors most frequently addressed were: (1) setup time, (2) cell size, (3) lot size, (4) sizing and placement of inventory

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buffers, (5) dispatching and loading policy, (6) product mix, (7) variability in process times, and (8) demand stability.

Relatively little research has concentrated on cell operation issues such as unit load (batch) size, machine minor stoppages (such as material replenishments), machine breakdowns, machine repair, machine preventive maintenance, product quality, operator assignments, operator movement and destination policies, and cell balancing. Papers addressing the impact on cell performance of implementing world class concepts are rare. Elements of interest in this research work are: (1) multiskilled workers, (2) quick changeover teams, (3) autonomous and preventive maintenance, and (4) quality at the source.

The performance measures most commonly cited were: (1) operation and machine utilization, (2) product flow time, (3) cell throughput, (4) material handling cost, (5) work-in-process inventory levels, (6) setup cost, and (7) inventory carrying costs. Each research paper usually addressed only or two of the above.

There is a need for research work on the development of methodologies addressing cell operation issues at the design stage. Furthermore, there is a need for the development of a comprehensive cell performance measure, capable of addressing multiple aspects of cell design and operation issues.

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CHAPTER 3

DEVELOPMENT OF THE GENERIC COMPUTER SIMULATION MODEL

3.1 Introduction

This chapter discusses in detail the elements addressed in the design of a generic computer simulation model for manufacturing cell environments. As part of the output the user obtains an annualized cost based on design and operational issues relevant to world-class scenarios. Chapter 3 constitutes the first of two archival journal articles developed by the author.

In preparation for the development of the generic manufacturing cell simulation model, we studied manufacturing cell environments to identify which cell characteristics deserved attention in the construction of the model. Our objective was to build into the model the capability of simulating cell behavior with a reasonable level of detail. Key elements addressed in the cells studied include: (1) cell size and material handling equipment, (2) machine types, (3) product flow, (4) cell design and operation issues of interest to cell users, and (5) cell performance measure. The following sections present a brief description of each element.

3.2 Cell Size and Material Handling Equipment

The study of cell characteristics was performed by collecting data from four manufacturing cells. These cells encompass a wide range of products, equipment characteristics, cell size, staffing requirements, and degree of automation. The industries chosen for the study include: (1) printed circuit board assembly, (2) service part fabrication for computer peripherals, (3) service-part

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machining for electric power generation, and (4) equipment assembly of electric power meters.

Some specifics about these cells are provided in Table 3.1. The machines in use range from highly automated equipment to automated machine operations with manual product loading and unloading. Material handling at cells consisted basically of combinations of powered and gravity conveyor systems, transfer cars, and manual handling. Cell size ranged from six to fifty machines.

Based on this analysis the material handling options to be included in the model are: powered conveyors, gravity conveyors, transfer cars, and manual handling. On all options the user can define the need for containers, container types, container capacity, and carts. Cell size will be limited to fifty machines and fifty operators.

Table 3.1 Characteristics of manufacturing cells examined in this study

Cell	Product	Manufacturing operations	Operator tasks	Material handling	Cell size	No. of operators
1	Printed circuit boards with surface-mounted and thru-hole components	Combination of: automated machines for component assembly, paste curing, wave soldering, and hand-loading operations.	Inspection, assembly, and testing operations.	Combination of automated and manual handling: powered conveyors, transfer cars, and carts.	19	19
2	Service parts for computer peripherals	Automated machines for assembly, inspection, and testing operations.	Few product inspections and packaging operations.	Highly automated: powered conveyors.	50	9
3	Service parts for power generation units	Automated machining operations with manual product loading and unloading.	Machine loading and unloading and product inspection.	Manual: carts.	10	13
4	Electric power meters	Automated machining operations with manual product loading and unloading.	Machine loading and unloading and product inspection.	Manual: pallet jacks.	6	10

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3.3 Machine Types

The machines used in the cells were studied to identify modeling requirements to simulate the production of units. The characteristics of interest are those that regulate product flow and define simulation events. The analysis of 85 machines led to the identification of four types of machines commonly used in cells. Figure 3.1 describes how parts are serviced in these four machine types.

Machine type 1 is the most common machine type. It represents 67% of the population sampled. Only one part can be processed at a time. The total processing time consists of part loading, machine cycle, and part unloading.

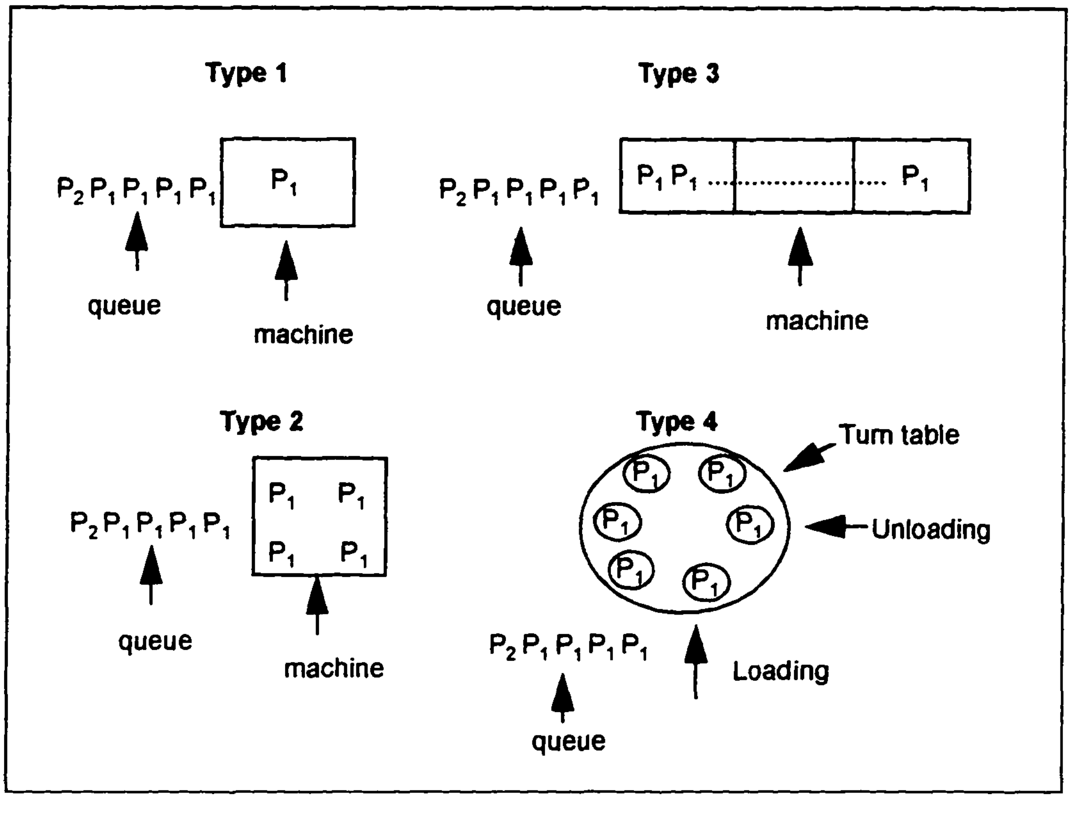

Figure 3.1. Graphic representation of machine types

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Machine type 2 is one in which n parts of the same type can be processed simultaneously. This type of machine represents 20% of the population sampled. Total processing time consists of loading n parts, one machine cycle, and unloading n parts. All parts exit simultaneously.

Machine type 3 allows a finite number of parts to reside in the machine simultaneously. Part interarrival times are random, residence times are fairly constant, and parts exit the machine one-at-a-time following a first-come first-served discipline. Examples of this type of machine are conveyor-based cleaning systems and wave solders used on the assembly of printed circuit boards. It represents 5% of the population sampled.

Machines of type 4 are a special case of the previous type and apply to index tables and turn tables. In this scenario all parts move through the same pre-defined sequence of steps. The pace of the table is set by the longest process step, so a part exits the machine at that rate. When the table is full of parts, a new part enters at the same time a new part exits. This scenario represents 7% of the machine population.

Machine types 1 through 4 represent 99% of the population studied. The remaining 1% corresponds to a burn-in oven used in the testing of printed circuit boards. The burn-in oven (depicted in Figure 3.2) can process many parts of different types simultaneously. Machine capacity is defined for each part family and all parts exit simultaneously. This machine can be classified as a specialized piece of equipment, being used in specific types of industries.

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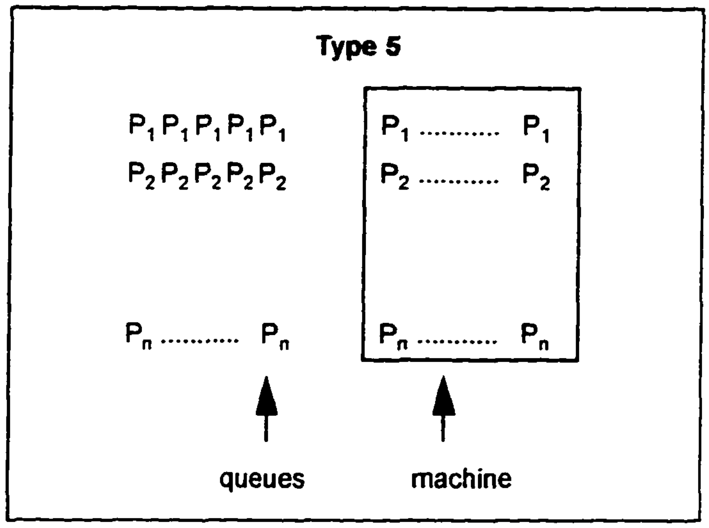

Figure 3.2. Graphic representation of the burn-in oven

Machines used in cells will consist of combinations of machines type one through four and some highly specialized equipment. The development of a fully generic cell simulator, capable of modeling all types of machines used in cells, is not practical due to the proliferation of highly specialized types of machines that can be used in some cells. A feasible approach is the development of a model capable of emulating the behavior of the most frequently found machine types, with flexibility for including specialized machines of interest to the user. For the four machine types considered, a desirable model characteristic is the user's ease of machine definition. Selection of a machine type is done by using a machine type number, which is used internally to access the appropriate software module.

Another modeling issue critical for mimicking the way products flow through the cell is the interaction between operator and machine. The types of interactions identified in this study are: (1) operator not needed, (2) operator not needed while the machine is running, and (3) operator needed at all times. The first option is used for completely automated machines. The second option is

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used on those machines where the operator is needed for setup, part inspection, or machine maintenance, while the operator is not needed for loading, unloading and processing. The last option is used on those machines were the operator needs to be present at all times. Machines at cells 3 and 4 described in Table 1 fall in the last category. Even though the machine operations are highly automated, the operator is required to remain in the area while the machine is processing parts. Selection of options is done through a machine-operator code number.

3.4 Characterization of Product Flow

The number of parts that move at once, better known as unit load size, is a key modeling issue for product flow. Strategies for product flow depend on product characteristics, machine types, and the material handling approach. The analysis of product flow strategies for the cells covered in this research led to the conclusion that product flow within the cell needs to be defined at each machine. Product flow at each machine can be divided into three stages, as depicted in Figure 3.3.

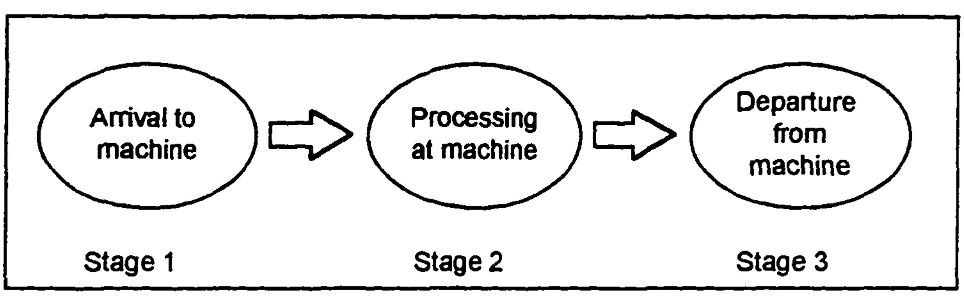

Figure 3.3. Stages of product flow

Product flow at stage one defines the unit load size upon arrival but prior to machine processing. Product flow at stage two focuses on the number of parts

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to be processed simultaneously. Product flow at stage three considers the different scenarios before the processed part(s) move to the next machine in the product routing. The result of the analysis of product flow strategies was the identification of four scenarios for stage one and six scenarios for stage three. Stage two only requires the selection of a machine type and definition of machine capacity.

The possibilities for stage one of product flow are presented in Figure 3.4. In the first two options units arrive one by one and are ready for processing (branch 1) or accumulate before processing can begin (branch 2). In the two other options, a batch of units arrive and are processed one by one (branch 3) or processed in groups until the batch has been completed (branch 4).

The selection of an option is done through a machine arrival scenario code. Any machine type can be combined with any of the machine arrival scenarios as long as the combination is feasible. For example, it would not make sense to select option number four, process in sub-batches, if the machine can only process one part at a time. The combination of a machine code and an arrival code is used internally to access a module designed for that specific combination of machine-arrival scenario. Currently the model contains only those machine-arrival combinations of interest in this research work. The simulation model is highly modular. Therefore, it can be expanded by adding modules to address other machine-arrival scenarios of interest to the user.

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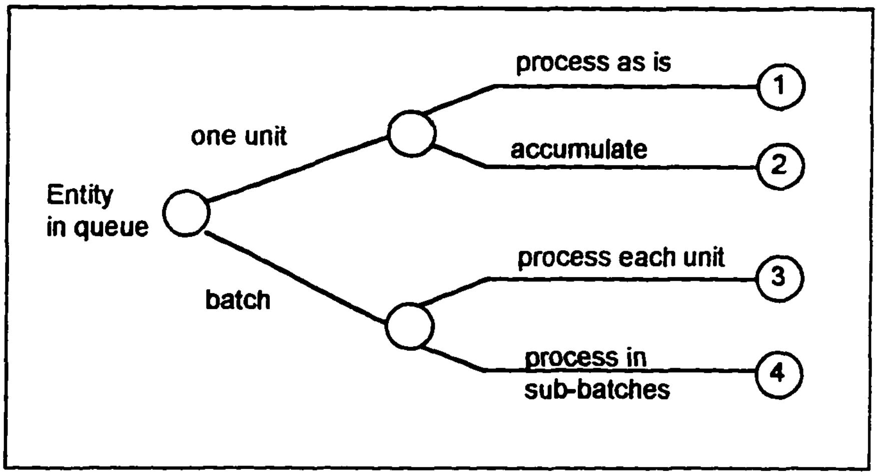

Figure 3.4. Scenarios at stage one of product flow

The possibilities for stage three of product flow are presented in Figure 3.5. Departure scenarios define the action to be taken with the entity(s) once processing has been completed. Entities departing from a machine can represent one or various units of a given product. The number of units is constrained by machine capacity. The departing entity can be allowed to flow as it exits (branches 1 and 3), or it might be accumulated until a desired number of units has been reached (branches 2 and 4). Branches 5 and 6 are used for cases in which each entity is transformed into more than one end item. This happens in the assembly of printed circuit boards. The product starts with panels which at a certain point in the product routing are cut into one or more printed circuit boards. A departure scenario is chosen through a departure code number which is used internally to access the machine-departure module needed to address that combination.

The definition of arrival and departure scenarios at each machine gives the user a lot of flexibility to model manufacturing cells in which the unit load size is constantly changing. This modeling capability is particularly appropriate for

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cell scenarios 1 (printed circuit boards) and 2 (computer peripheral service parts).

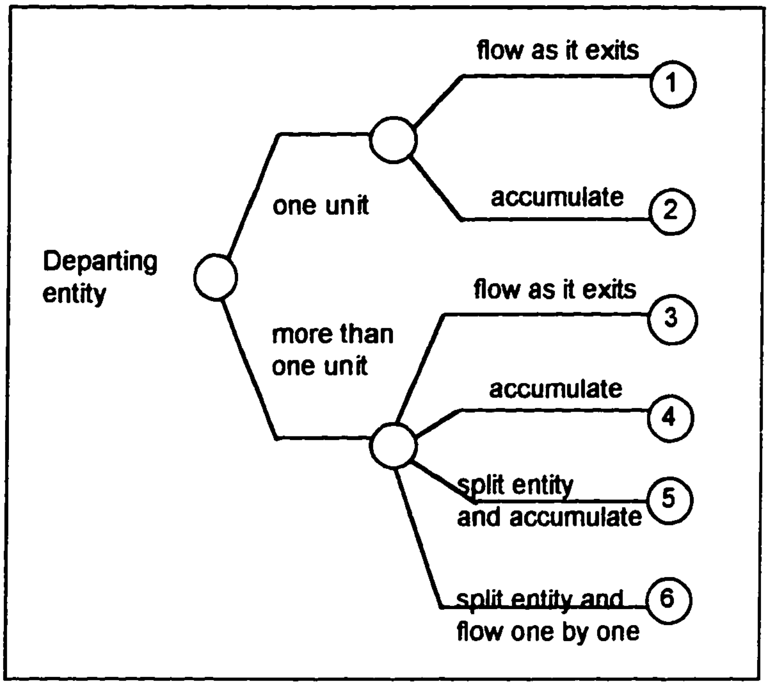

Figure 3.5. Scenarios at stage three of product flow

3.5 Cell Design and Operation Issues

The selection of cell design and operation issues to be addressed by the simulation model was based on the results from the literature review and interviews with users of manned manufacturing cells. These are presented in Table 3.2. A discussion of cell design and operation issues follow.

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3.5.1 Cell Design Issues

Cell design issues include: (1) layout, (2) selection of material handling and storage system, and (3) unit load size. A brief review of each issue is now presented.

Table 3.2. Cell design and operation issues

Design	Operation
Cell layout	Maintenance policy
Material handling equipment	Quality policy
Storage system	Scheduling
Unit load size	Inventory buffers
	Number of operators
	Operator assignments
	Operator movement rules
	Operator destination rules
	Setup time policy
	Lot size

3.5.1.1 Layout and Space Requirements

One expected benefit from the implementation of cells is a reduction in space requirements. Steudel reports reductions of 20 to 45 percent in floor space requirements [22]. Space requirements are determined by the cell layout. Cell layout is defined using a vector of linear distances between pairs of machines. Since it is not generally possible to characterize all relevant aspects of a cell layout by a single number, cell layout is considered as a qualitative

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factor for experimentation purposes. Different layouts can be examined by changing the vector of linear distances.

3.5.1.2 Material Handling and Storage

The efficiency of the material handling activity is improved by reducing distances between machines. This translates into reductions in indirect labor (assigned to move parts around), handling equipment, and storage requirements. Steudel reports reductions in material handling costs of 70 to 90 percent with the implementation of manufacturing cells [22].

The options on the material handling and storage system were presented in Section 3.2. Selection of an option is done through an option code. A material handling option needs to be defined for each pair of machines. This gives the user a lot of flexibility to model cells with wide variety of material handling alternatives. Currently the user can choose among combinations of powered conveyors, gravity conveyors, transfer cars, and manual handling. The use and characteristics of containers and carts is defined through input data.

3.5.1.3 Unit Load Sizing

The close proximity between machines in a cell results in reduced handling distances and allows the implementation of smaller unit load sizes. The simulation model can be used to analyze the impact on cell performance of different unit load sizes. The model has the capability of simulating cells where the product unit load size is constantly changing. Unit load sizes are input using a vector of values, defined only at those machines where changes in unit load

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size are expected to occur. Unit load size is a quantitative factor in the design of simulation experiments.

3.5.2 Cell Operation Issues

One of the objectives of this research work is the design of a simulation model capable of representing world class manufacturing environments. Some of the manufacturing practices adopted by world class manufacturers are: (1) autonomous and preventive or predictive maintenance, (2) quality at the source, (3) quick changeovers, (4) multiskilled workers, (5) small inventory buffers, (6) small lots and (7) the reduction of minor machine stoppages. The simulation model has been designed to study the impact on cell performance of adopting those world class practices.

3.5.2.1 Maintenance Practices

Case studies reviewed in the literature show an 80 percent reduction in the rate of machine failures with the implementation of a preventive maintenance program [20,12]. This translates to an average time between failures that is about five times longer if the mean time to failure is much larger that the mean time to repair (MTBF>>MTTR). Studies also show a reduction of more than 50 percent in unscheduled machine downtime (repair time) [12,13]. For modeling purposes, the time between breakdowns could be based on calendar time or accumulated run time. The model can emulate two major scenarios of machine maintenance: (1) breakdown maintenance, and (2) autonomous with preventive maintenance.

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Under the first scenario machines are given maintenance only when they break down. The second scenario has a combination of autonomous maintenance and preventive maintenance. Autonomous maintenance is given by operators on a daily basis. It represents activities such as machine dusting, oiling, and minor adjustments. Preventive maintenance is under the responsibility of maintenance personnel. It could be weekly, monthly, or as desired based on a user defined maintenance schedule. Autonomous maintenance has been modeled to occur during regular shift hours. However, preventive maintenance is assumed to occur after working hours. The impact of implementing a preventive maintenance program can be studied using data files reflecting the current and expected breakdown-repair scenario.

3.5.2.2 Quality Practices

The quality control strategy traditionally used by companies consists of an inspection point close to the end of the production process, performed by quality assurance personnel. Quality at the source is a concept aimed at detecting quality problems as early as possible after they occur. It can be implemented in different ways, such as self and/or successive inspection performed by the operators, the use of mistake-proof devices positioned right after value-adding processes, and through better control of the key variables that impact machine behavior (better known as source control). Case studies reviewed in the literature show reductions of 80 to 90 percent in the number of defects per month with the implementation of such approaches [19].

Currently, the simulation model offers the following options: (1) traditional inspection with or without QA stations, (2) self and successive inspection at value-adding processes, (3) self inspection only at value-adding processes, (4)

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pure inspection stations, and (5) test stations. Selection of a quality option is done through a quality code defined for each machine in the cell. Quality is a qualitative factor for experimentation purposes. Different scenarios can be tested by changing scrap and rework data files, and adding files on inspection times. In some cases cell layout, operator assignments and other issues change with the implementation of quality at the source. In those cases it is necessary to change those data files accordingly.

3.5.2.3 Changeover Practices

Quick changeover has been proven to be a key factor for the efficient operation of cells [KEKR87,AURR93]. It requires training and involvement of cell operators. A team consisting usually of cell operators, setup people, maintenance technicians, and engineers is created to work on areas of opportunity for setup time reduction. Setup time reductions of up to 50 percent are readily achievable with little or no investments on equipment just by planning and organizing before the setup is performed.

In the traditional scenario an operator working at a machine center is moved to perform other operations when a setup is needed. Only the setup personnel are involved in the setup activity. The setup team under quick changeover includes the machine operator as well as other individuals if needed. In this scenario the setup activity is divided into external and internal setup. External setup consists of those setup activities that, as identified by the setup team, can take place while the machine is running. Therefore, machine downtime is reduced. The machine operator is not typically involved during the external setup. Internal setup consists of those setup activities that cannot take place until the machine has stopped. The entire setup team is involved during

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the internal setup activities. Selection of a setup scenario is done by choosing a setup code: (1) zero if the machine does not require setups, (2) one for traditional setup, and (3) two for quick changeover.

3.5.2.4 Multiskilled Operators

Multiskilled operators can be developed through cross-training and coaching. Since they can be assigned to more than one process in the cell, this practice provides greater flexibility if the cell needs to react to changes in product mix and demand patterns. Availability of multiskilled operators can be simulated through the use of an operator assignment matrix. Different assignment scenarios can be studied by changing the assignment matrix. Issues related to multiskilled operators include: when should the operator move, and where should he/she move to. With respect to when, two rules have been coded: (1) move when one unit load has been completed, and (2) move when idle (no parts waiting in queue). With respect to where to go, two rules have also been coded: (1) move to the next machine assigned, and (2) move to the machine assigned with the longest queue. The user has available a total of four combinations of when/where rules. Each one can be tested with a variety of assignment matrices.

3.5.2.5 Inventory Buffers between Processes

One of the expected benefits of implementing manufacturing cells is a significant reduction in the levels of work-in-process. Reductions of 70 to 90 percent have been reported in the literature [22]. Levels of work-in-process in a manufacturing cell will be the result of the adopted combination of design and operation strategies. An approach for the control of work-in-process levels is the

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implementation of finite inventory buffers. In pull production systems, machines up the line are blocked from production once the buffer has reached its maximum level. The simulation model represents this environment with finite inventory buffers. The model allows the selection of finite or infinite buffers between processes.

3.5.2.6 Lot Sizing

The concept of manufacturing cells has been used by companies to respond quickly to an increasing product mix and remain competitive in global markets. This increasing product mix translates into smaller lot sizes. Shifting to smaller lot sizes might require reductions in setup, changes to the material handling system, quality policy, or any other operation factor that may have a negative impact on cell performance under this new environment. The impact of smaller lot sizes can be studied under any combination of cell design and operation scenarios. Lot sizes are input using a file in which the following items are specified: (1) part number, (2) lot number, (3) lot size, (4) release date, and (5) order due date. Each record in the stream of numbers represents an order of a customer or a group of customers. Release dates are used to emulate arrivals of customer orders to the manufacturing cell. Due dates are used to calculate lateness cost.

3.5.2.7 Machine Minor Stoppages

Machine minor stoppages are those caused by material replenishments, machine adjustments, or any other activity that requires stopping the machine for short periods of time. Frequent machine stoppages can deteriorate cell performance. The simulation model has been designed with the capability of including minor machine stoppages. A machine code number is used to signal

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the need for such stops. The time between stops and downtime duration are input using vectors of data.

3.6 Cell Performance Measurement

Performance of a manufacturing cell can be measured in numerous ways. Throughput, work-in-process, manufacturing leadtime, material handling cost, machine setup cost, and inventory carrying costs are some examples found in the literature. Every decision made during the design process has an impact on cell performance, whether related to cell formation, or cell design and operation. A weakness of the procedures developed so far is the consideration of only one or, at best, a few performance issues [WEMM89].

Comparison between cell scenarios in this research work is done using a comprehensive annualized cost function. It has the capability of reflecting the expected benefits of manufacturing cells: (1) reduced levels of work-in-process, (2) shorter manufacturing leadtime, (3) improved on-time delivery, (4) reduced material handling, (5) less space requirements, and (6) improved quality. The function consolidates ten cost components: inventory carrying cost (IC), lateness cost (LT), setup cost (SU), material handling cost (MH), storage equipment cost (ST), production labor cost (PL), maintenance cost (M), quality cost (Q), layout (L), and floor space cost (FS). The sources of such costs are summarized in Figure 3.6. Each cost component is discussed in detail in the following subsections.

3.6.1 Inventory Carrying Cost (IC)

The inventory carrying cost measures the opportunity cost associated with having funds tied up in inventory. It includes work-in-process and finished

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goods inventory. The inventory carrying rate represents the interest that could be earned if the funds were invested elsewhere. Setup, lot size, unit load size, inventory buffers, and quality strategies are some of the cell operation issues that may have a significant impact on the levels of work-in-process and finished goods inventory. The formula used to measure inventory carrying costs is presented in equation (3.1).

$$IC = \sum_{j=1}^{OP+1} \sum_{n=1}^{NP} [\bar{I}_{nj} * PNCOST_{nj}] * ICR \tag{3.1}$$

where;

IC	= annual inventory carrying cost,
n	= index for product number,
NP	= number of different products,
j	= index for operation number,
OP	= number of operations performed in the cell,
OP+1	= index for finished goods inventory.
$\bar{I}_{nj}$	= time-averaged inventory of product n at operation j,
$PNCOST_{nj}$	= value of product n at operation j,
ICR	= inventory carrying rate,

The time-averaged inventory of each product at each operation is a random variable whose value is captured as part of the simulation results. All other values are user inputs.

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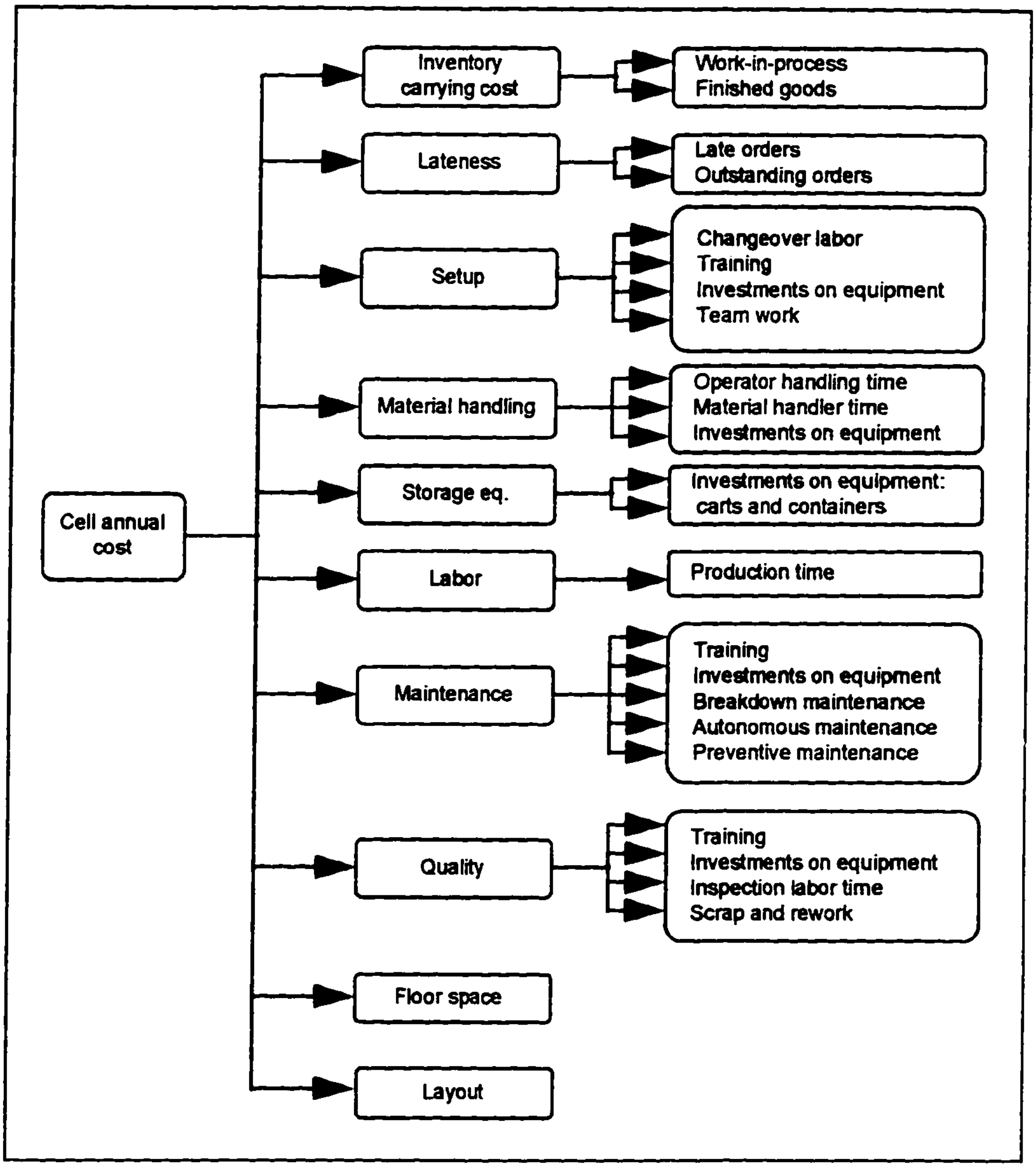

Figure 3.6. Components of the cell annual cost function

3.6.2 Lateness Cost (LT)

The lateness cost component measures the cell's level of customer service. Cells with a high customer service level are those with a high on-time delivery rate. An order is considered to be completed on time only if the entire

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order is completed by the due date. Hurley proposed a lateness cost based on a late charge rate and the value of the part [HURL94]. The function for late charge rate is presented in equation (3.2):

$$Rate_{mn} = \min\left\{ \exp\left[\frac{\ln 2}{RA} * \frac{Late_{mn}}{CLT_n}\right] - 1 \;,\; 1 \right\} \tag{3.2}$$

where;

$Rate_{mn}$= late change rate of the mth late order of product n,

m = index for late order,

n = index for product number,

RA = ratio of lateness to manufacturing lead time at which an order is canceled or charged a penalty cost equal to the full product cost,

$Late_{mn}$= (completion date of the mth late order of product n) – (due date of order m for product n),

CLT_n = cell manufacturing lead time for product n.

The late charge rate represents the fraction of the product cost that is charged on late orders. As a function of the order lateness $Late_{mn}$ for the mth late order of product n, the charge rate is exponential between zero and RA, with a maximum charge rate of one. As RA increases the late charge rate decreases. The ratio RA is arbitrarily set by the user.

A lateness cost is also calculated for outstanding orders, those released for production not completed by the end of the year. These are charged the full cost of the product. The total lateness cost function is presented in equation (3.3):

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$$LT = \sum_{m=1}^{NLO} \sum_{n=1}^{NP} Rate_{mn} * PNCOST_{n,OP+1} * LS_{mn} + \sum_{k=1}^{OD} \sum_{n=1}^{NP} OP_{kn} * PNCOST_{n,OP+1} \tag{3.3}$$

where;

LT = annual late delivery penalty cost,

$Rate_{mn}$ = late charge rate on late order m of product n,

$PNCOST_{n,OP+1}$ = cost of product n at finished goods,

LS_{mn} = number of units in late order m of product n,

NLO = number of late orders in one year of simulation,

k = index for outstanding orders,

OD = total number of outstanding orders, that are released orders but not completed at the end of the year.

OP_{kn} = number of units in outstanding order k of product n,

Order lateness ($Late_{mn}$), number of late orders (NLO), and number of outstanding orders at the end of the year (OD) are time-averaged random variables. Observed values come from simulation runs. All other values are user inputs.

3.6.3 Setup Cost (SU)

Costs associated with setups include: changeover labor (operators and other employees involved), operator training on quick changeover concepts, and investments in equipment, tools, and fixtures for the implementation of quick changeover. Setup costs are determined using the function presented in equation (3.4):

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$$SU = \sum_{k=1}^{WS} TRINT_k * SUCS * CWG + \sum_{k=1}^{WS} (WCINT_k + EXTSU_k) * SUCS * CWG$$
$$+ \sum_{k=1}^{WS} WCINT_k * WG$$
$$+ \ (SUTR + SUINV) \left\{ \frac{i\,(1+i)^{NYRS}}{(1+i)^{NYRS} - 1} \right\} + TWORK \left[\frac{1}{(i+1)} \left\{ \frac{i\,(1+i)^{NYRS}}{(1+i)^{NYRS} - 1} \right\} \right] \qquad (3.4)$$

where;

SU = annual setup cost,

k = index for machine,

WS = number of machines in the cell,

$TRINT_k$ = setup time (minutes/year) on machine k under the traditional system of long setup times,

SUCS = setup crew size (does not include the operator),

WG = operator wage ($/minute)

CWG = crew wage ($/minute),

$WCINT_k$ = internal setup time (minutes/year) on machine k under the scenario of quick changeovers,

$EXTSU_k$ = external setup time (minutes/year) on machine k under the scenario of quick changeovers,

SUSC = setup code: 0 for traditional, 1 for quick changeovers,

SUTR = total operator training cost for setup time reduction, incurred at the beginning of the study,

TWORK= total labor cost for the team's work on setup time reduction projects, incurred at the end of the first year of the study,

SUINV = total investment costs, incurred at the beginning of the study, for the implementation of quick changeovers,

i = annual interest rate,

NYRS = period of the study (years).

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$TRINT_k$ accumulates machine downtime due to setups on the traditional setup scenario in which the machine is stopped during the entire setup activity. The setup activity with quick changeovers is divided into two phases: external and internal setup. $EXTSU_k$ and $WCINT_k$ accumulate external setup times (machine is running) and downtime due to internal setup (machine is stopped), respectively. Only one setup scenario can be tested in a given simulation run. Therefore, if $WCINT_k$, and $EXTSU_k$ are greater than zero, then $TRINT_k$ will be zero since nothing is been accumulated in that variable. SUTR, SUINV, and TWORK are zero under the traditional setup scenario.

The crew size (SUCS) represents the number of employees involved in the setup activity, not including the machine operator. It is assumed that the machine operator is not involved in the traditional setup activity. Therefore, the changeover labor cost is based on the setup crew size only. The operator is involved during the internal portion of the quick changeover activity. Therefore, the changeover labor cost consists of two components: crew labor during internal and external setup, and operator labor during internal setup.

Training and investment costs are assumed to occur at the beginning of the first year and are annualized over the period of the study. Teamwork activities for the implementation of quick changeovers are assumed to occur throughout the first year of the study. Labor cost for teamwork activities are accrued at the end of the first year and annualized over the period of the study.

Since teamwork and training hours represent a small percentage of the total working hours, they were assumed to occur during overtime. Some companies prefer using outside consultants instead of project teams. In those

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cases teamwork cost is replaced by consultant's cost. The equation has the flexibility to accommodate different project strategies.

Machine setup times ($TRINT_k$, $WCINT_k$, and $EXTSU_k$) are random variables with values obtained from simulation results. All other values are input by the user.

3.6.4 Maintenance Cost (M)

The implementation of a preventive maintenance program requires training operators and in many cases investments to upgrade machine conditions. Costs included in this component are: labor and part replacement during breakdown maintenance, operator training, investments in equipment, labor and replacement of parts during preventive maintenance, and labor during autonomous maintenance. The function used to calculate maintenance costs is presented in equation (3.5).

Autonomous maintenance is performed by machine operators on a daily basis. Machine preventive maintenance and breakdown maintenance are under the responsibility of maintenance personnel.

$$M = \sum_{k=1}^{WS} LTA_k * WG + \sum_{k=1}^{WS} \left(RT_k * MCS * CWG + PC_k * NBKD_k \right) +$$
$$\left(MTR + MINV \right) \left\{ \frac{i\left(1+i\right)^{NYRS}}{\left(1+i\right)^{NYRS} - 1} \right\} + \sum_{k=1}^{WS} PMCOST_k \tag{3.5}$$

where;

M = annual maintenance cost,

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LTA_k = total downtime on machine k due to autonomous maintenance (minutes/year),

RT_k = total downtime on machine k due to repair (minutes/year),

MCS = maintenance crew size,

WG = operator wage ($/minute)

CWG = crew wage ($/minute),

PC_k = part replacement cost at machine k,

$NBKD_k$ = number of breakdowns per year at machine k ,

MTR = total operator training cost incurred at the beginning of the study for the implementation of autonomous maintenance,

MINV = total investment cost incurred at the beginning of the study for the implementation of preventive and autonomous maintenance,

$PMCOST_K$ = preventive maintenance expected cost for machine k ($/yr.) including labor and scheduled replacement of parts.

Labor spent by operators on autonomous maintenance activities (LTA_k), machine repair times (RT_k), and the number of machine breakdowns ($NBKD_k$) are random variables with values obtained from simulation runs. Costs on training, equipment investment, and preventive maintenance interventions are estimated and input by the user.

3.6.5 Quality Cost (Q)

Product quality has a significant impact on manufacturing performance in environments handling low inventory levels. Achieving a high customer service level greatly depends on the ability to manufacture a quality product. The quality cost component includes costs associated with product inspection, scrap and

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rework, training on quality concepts, and investments in equipment to ensure quality at the source (e.g. mistake-proof or source control of process).

Inspection and rework costs are divided into two major categories: those incurred under traditional inspection and those incurred under quality at the source. It is assumed that inspection and rework under the traditional inspection system are performed by quality assurance (QA) personnel and off-line rework operators, respectively. Machine operators are not involved on those activities. Therefore, labor costs associated with the traditional system are: QA inspectors down the line and off-line operators needed for rework. For product n $QAIT_n$ is the annual accumulated QA inspection time and RWK_n is the annual accumulated off-line operator rework time. It is assumed there is only one QA inspection station and one off-line rework station in the cell. However, there could be more than one QA inspector and off-line rework operator. The simulation model determines the number of QA inspectors and off-line rework operators needed.

Operators perform inspection and rework activities under the quality-at-the-source scenario. Thus, labor costs associated with this scenario include: operator inspection and rework times for product n at operation j, which are respectively accumulated by the simulation in variables OIT_{nj} and $ORWKT_{nj}$.

A quality scenario could consist of a combination of quality at the source and a QA inspection station down the line. Therefore, $QAIT_n$, RWK_n, OIT_{nj} and $ORWKT_{nj}$ could all be greater than zero simultaneously. $SCRP_{nj}$ accumulates the number of scrapped parts of product n at workstation j under both environments. Quality costs are determined using equation (3.6).

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$$Q=\sum_{n=1}^{NP} QAIT_n * QAWG + \sum_{n=1}^{NP} RWK_n * \mathrm{WG} + \sum_{j=1}^{OP}\sum_{n=1}^{NP} OIT_{nj} * \mathrm{WG} +$$
$$\sum_{j=1}^{OP}\sum_{n=1}^{NP} ORWKT_{nj} * \mathrm{WG} + \sum_{j=1}^{OP}\sum_{n=1}^{NP} SCRP_{nj} * PNCOST_{nj} +$$
$$(\mathrm{QINV}+\mathrm{QTR})\left\{\frac{i\,(1+i)^{NYRS}}{(1+i)^{NYRS}-1}\right\} \tag{3.6}$$

where;

- $QAIT_n$ = inspection labor (minutes/year) on product n performed by QA personnel under the traditional inspection system,
- RWK_n = off-line operator rework time (minutes/year) on product n under the traditional inspection system,
- QAWG = quality assurance personnel wage rate ($/minute),
- OIT_{nj} = operator inspection labor (minutes/year) on product n at machine j under quality at the source,
- $ORWKT_{nj}$ = operator rework labor (minutes/year) on product n at machine j under quality at the source scenario,
- $SCRP_{nj}$ = scrapped parts of product n at workstation j accumulated annually over either quality scenario,
- QTR = total operator training cost in quality concepts incurred at the beginning of the study,
- QINV = total investments in equipment to ensure quality at the source incurred at the beginning of the study.

Costs associated with the implementation of quality improvement strategies are: labor during inspection and rework operations, scrap, investments, and training on quality concepts. The investment component can be used to account for investments such as machines, tools, fixtures, and computer software for the collection of quality data. $QAIT_n$, RWK_n, $SCRP_{nj}$, OIT_{nj},

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and $ORWKT_{nj}$ are random variables with results captured during the simulation runs. All other components in the equation are user inputs.

3.6.6 Material handling (MH)

The elements considered under material handling costs are: labor during handling activities, and investments on equipment. Material handling could be performed by operators or material handlers. For product n at operation j, OHT_{nj} and $MHHT_{nj}$ represents annual accumulated operator and material handler handling time, respectively. Material handling costs are evaluated using equation (3.7).

$$MH = \sum_{j=1}^{OP} \sum_{n=1}^{NP} OHT_{nj} * WG + \sum_{j=1}^{OP} \sum_{n=1}^{NP} MHHT_{nj} * HWG + \mathrm{MHINV}\left\{ \frac{i\,(1+i)^{NYRS}}{(1+i)^{NYRS} - 1} \right\} \tag{3.7}$$

where;

MH = annual material handling cost,

OHT_{nj} = operator handling time (minutes/year) for product n at machine j,

$MHHT_{nj}$ = material handler time (minutes/year) for product n processed at machine j,

MHINV = total investment on material handling equipment incurred at the beginning of the study,

HWG = material handler's wage rage ($/minute).

OHT_{nj} and $MHHT_{nj}$ are random variables with values captured from simulation runs. All other values are user inputs.

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3.6.7 Storage Cost (ST)

Storage costs include investment in storage equipment. Cell storage space cost is captured by the floor space cost (FS). The types of storage equipment covered in this research are containers and carts. Container types are defined by product and product destination. This results in great flexibility to change container types as the product flows through the cell. Container capacity is defined for each container type. Carts in the cell are assumed to be of one type only with capacity to handle the entire product unit load in one trip. Storage costs are evaluated using equation (3.8).

$$ST = \left\{ \sum_{s=1}^{NCONT} (MAXCO_s * COCO_s) + (MAXCA * CACO) \right\} \left\{ \frac{i\,(1+i)^{NYRS}}{(1+i)^{NYRS} - 1} \right\} \tag{3.8}$$

where;

ST = storage annual cost,

s = index for container type,

NCONT = total number of container types,

$MAXCO_s$ = maximum number of container type s in use,

$COCO_s$ = cost of container type s (\$/unit) incurred at the beginning of the study,

MAXCA = maximum number carts in use,

CACO = cart cost (\$/unit) incurred at the beginning of the study.

The cost of carts and containers is based on the expected maximum number of carts and containers in use over one year of cell operation. It could also be based on the average number in use. $MAXCO_s$ and MAXCA are random random variables with values obtained from simulation runs. All other values are user inputs.

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3.6.8 Production Labor Cost (PL)

This cost component accounts for labor spent on cell activities not accounted for in autonomous maintenance, setup, material handling, and product inspection and rework. It includes processing parts, replenishing materials, waiting for parts, and idle time. Production labor cost is determined using equation (3.9).

$$PL = \left(MPEMP * NOP - \left\{\sum_{k=1}^{WS}(WCINT_k + LTA_k) + \sum_{j=1}^{OP}\sum_{n=1}^{NP}\left(OHT_{nj} + OIT_{nj} + ORWKT_{nj}\right)\right\}\right) * WG \tag{3.9}$$

where;

PL = annual production labor cost,

MPEMP = available minutes per year per operator,

NOP = number of cell operators,

$WCINT_k$ = labor (minutes/year) at machine k during internal setup under quick changeovers,

LTA_k = labor (minutes/year) at machine k during autonomous maintenance,

OHT_{nj} = labor (minutes/year) on material handling activities for product n at operation j,

OIT_{nj} = labor (minutes/year) on inspection for product n at operation j,

$ORWKT_{nj}$ = labor (minutes/year) on rework for product n at operation j.

All of the above except MPEMP, NOP, and WG are random variables with values determined by the simulation.

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3.6.9 Layout Cost (L)

Layout costs are those incurred in changing the cell layout, including labor and materials needed to change the shop-floor arrangement. Personnel involved during layout changes include engineers, mechanics, line supervisors, operators, and inspectors. Materials needed depend on facility requirements. Examples are pipes, tubing, cables, and machine and product covers. The layout cost is estimated and input by the user.

3.6.10 Floor Space Cost (FS)

Total floor space cost is obtained by multiplying the cell size in square feet by space cost in dollars per sq. ft. per year. Space requirements are a function of machine dimensions, expected inventory levels, material handling equipment in use, and number of operators. Cells with high levels of work-in-process and finished goods inventory typically require more floor space.

3.6.11 Total Annualized Cost

The cell annual cost is calculated by adding the cost components discussed above as presented in equation (3.10).

$$TAC = IC + LT + SU + MH + ST + PL + M + Q + L + FS \qquad (3.10)$$

The total annual cost function summarizes the result of the chosen cell design and operation strategies, and offers a comprehensive mechanism for the evaluation and comparison of alternative strategies.

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3.7 Computer Simulation Model

The simulation model was designed using SLAM II, an advanced Fortran-based simulation language [14]. SLAM II provides network, discrete-event, and continuous modeling capabilities. The simulation model contains approximately a total of 20,000 lines of source code. It is discrete-event oriented with Fortran user-written subroutines.

Model development was performed sequentially, starting with only a few cell design scenarios. Model verification was performed after addition of each new scenario. Programming errors and logic flaws were found using DBX, a source-level debugger available on most UNIX platforms. The following sections discuss software modularity, execution speed, and statistical capabilities for the model that has been developed by the author.

3.7.1 Modular Characteristics of the Simulation Model

The simulation model handles the occurrence of 25 event types which are identified in Table 3.3. User input codes and data files are used to activate simulation modules upon the occurrence of an event. An example of the interaction between modules is depicted in Figure 3.7. The figure illustrates how modules are activated when a part processing is completed (departure). This logic sequence applies to the case where an operator is needed at the machine at all times. Therefore, he is available for activities such as part inspection, material handling, or machine setup. Boxes shaded in gray represent the occurrence or scheduling of events. The pound (#) sign denotes that more than one module of that kind were developed to address the machine types, arrival scenarios, and departure scenarios identified during the characterization of

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machines and product flows. For example, DEPSC1 is activated when the machine departure code is 1. D1M1 is activated from DEPSC1 to deal with the combination of departure scenario 1 and machine type 1.

Table 3.3. Description of simulation events

Event Number	Activated module	Event description
1	LARRVL	Arrival of a lot for production
2	CSUCIN	Completion of a successive inspection
3	CSUCIR	Completion of successive rework
4	DEPART	Completion of machine processing
5	CSELIN	Completion of self inspection
6	CSELIR	Completion of self rework
7	ULARRL	Arrival of a unit load
8	CMHOP	Completion of an operator handling activity
9	CTRASU	Completion of traditional setup
10	CWCSU	Completion of world class setup
11	CQAINS	Completion of inspection by QA
12	CTRARW	Completion of rework on the traditional scenario
13	AUTOMT	Request for an autonomous maintenance
14	CAUTOM	Completion of autonomous maintenance
15	GATHER	Collection of output statistics
16	BREAKD	Occurrence of a machine breakdown
17	CREPAI	Completion of machine repair
18	CLRSTA	Clearing output statistics
19	CSCRAP	Completion of scrapped parts (to complete lot)
20	MINSTP	Occurrence of a minor machine stoppage
21	CAUTOM	Completion of minor stoppage (same as cautom)
22	TCRET	Return of a transfer car
23	CLOAD	Completion of machine loading
24	CULOAD	Completion of machine unloading
25	THRUPT	Collection of throughput statistics

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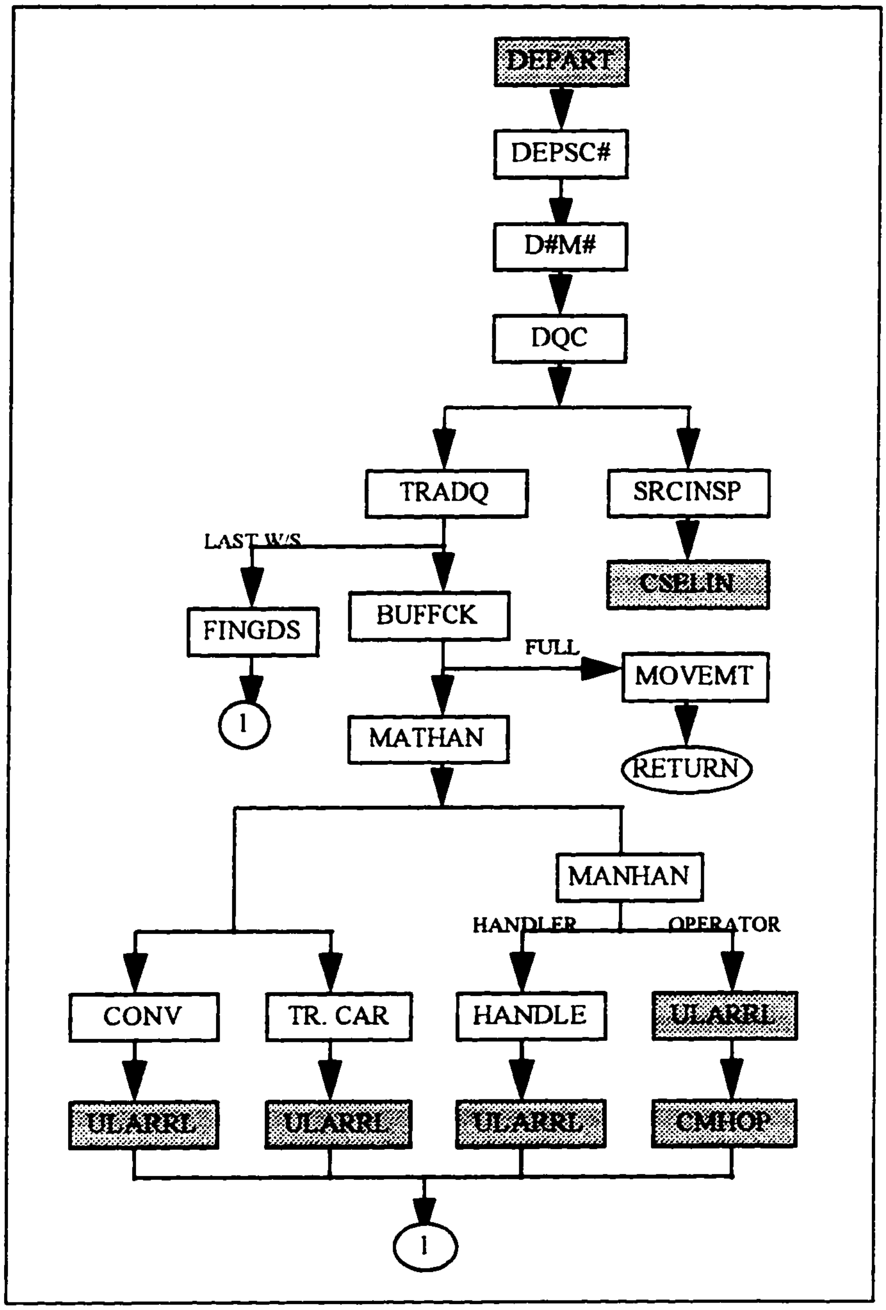

Figure 3.7. Activation of modules to simulate a departure

The departure event activates a departure scenario module. This module calls the departure-machine (DM) module needed to simulate the activities expected to occur for that combination of departure scenario and machine type.

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DM activates a module called departure quality code (DQC), a generic quality module, that activates specific modules designed to deal with quality scenarios. A machine quality code is used at DQC to determine the quality module to be activated. DQC calls TRADQ or SRCINSP for traditional and source inspection quality scenarios, respectively.

FINGDS is called within TRADQ if the current machine is the last one in the part routing. Otherwise, it calls BUFFCK to determine it there is space available at the next machine's buffer. If the buffer is full, the current machine is blocked, and MOVEMT is called to move the operator to another machine. When there is space available, TRADQ calls MATHAN, a generic material handling module. MATHAN activates the material handling module needed to allocate handling resources and schedules the arrival of the departing part (ULARRL) to the next machine in the routing. When handling is manual, it also schedules the completion of a material handling activity by an operator (CMHOP). Under source inspection, SRCINSP activates a module designed to generate inspection times and schedules the completion of inspection (CSELIN).

Once the simulation model has taken care of all activities associated with the departing part, it activates those modules needed to process parts waiting in queue. The interaction between those modules is presented in Figure 3.8. MQPUL is called within DM to verify if there are enough parts in queue for one machine cycle. If there are not enough parts, a machine operator code is used to determine if he is dedicated or shared (assigned to more than one machine). DESTIN is activated to find the destination of shared operators.

The simulation model contains two movement rules for shared operators. Therefore, even if there are enough parts in queue for a machine cycle, it needs

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to be determined whether he will stay or move to another machine. This decision is made at MOVEMT. This module activates DESTIN when the decision is to move the operator.

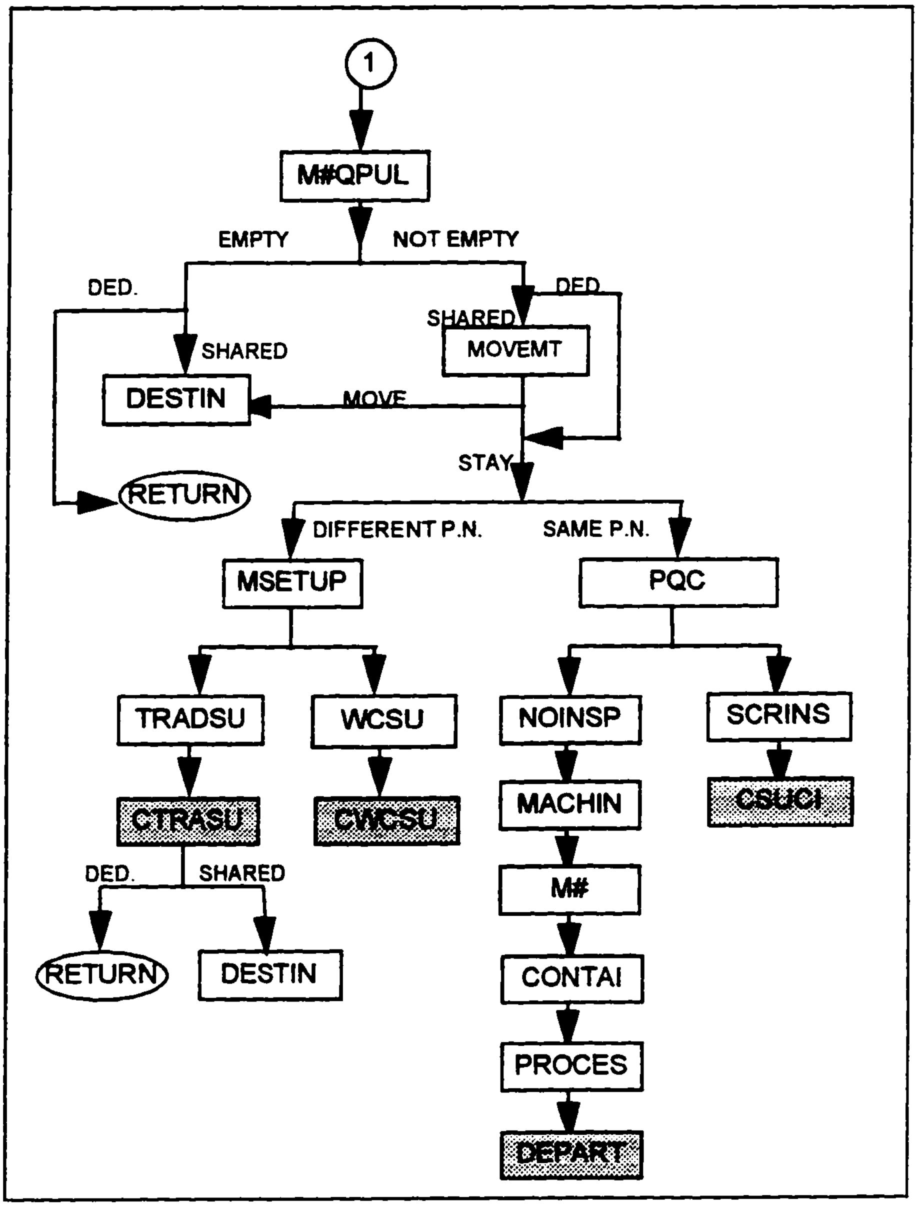

Figure 3.8. Activation of modules to select and process an entity

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MSETUP is activated within DM when the next part number to be processed is not the same as the last part number processed at that machine. MSETUP is a generic setup module that activates specific modules designed to deal with setup scenarios. A setup code is used at MSETUP to activate either TRADSU or WCSU for traditional and world class setup scenarios, respectively. TRADSU and WCSU schedule the completion of a setup. Operators are not involved in traditional setups. Therefore, if the operator is shared, TRADSU activates DESTIN to move him to another machine.

PQC is activated within DM when the next part number does not require a machine setup. The machine quality code is used at PQC to activate NOINSP or SCRINS for traditional and source inspection quality scenarios, respectively. SCRINS schedules the completion of a successive inspection (CSUCI). NOINSP activates MACHIN, a generic module designed to deal with the different machine types included in the model.

A machine code is used at MACHIN to activate M, the module designed to simulate processing of parts at that specific type of machine. This module activates CONTAI to allocate storage resources and PROCES to generate the processing time. It pulls parts waiting in queue and schedules the completion of machine processing (DEPART).

The simulation model contains a total of 126 modules. This modularity characteristic gives modeling flexibility to reflect many combinations of cell design and operation scenarios. It also provides model adaptability, since other scenarios of interest to the user can be incorporated by adding new modules. A listing of the source code has been included in Appendix A.

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3.7.2 Execution Speed

Execution time for the simulation of 243,000 minutes of production at a cell for the assembly of printed circuit boards was approximately 25 minutes (using a DECstation 5000/25 with 28 megabytes of RAM). This run length represents one year of production working two eight hour shifts per day, five days a week. A few of the cell scenarios studied resulted in high levels of work-in-process inventory with poor cell performance (high annual cost). Simulation time on those cases increase to close to five hours.

3.7.3 Statistical Capabilities

The statistical characteristics are those that describe the model's ability to deal with the stochastic nature of the system under study. Some of the elements that define the statistical capabilities of a model are: standard probability distributions, warm-up period, and random number generators.

An important activity in a simulation project is the collection and statistical analysis of cell data to model system randomness such as machine processing times, part inspection times, time between machine breakdowns, machine repair times, and machine setup times. Accuracy of simulation results is a function of the ability to replicate system randomness. The simulation model contains nine standard probability distributions to sample values for random variates: exponential, uniform, Weibul, triangular, normal, lognormal, Erlang, Gamma, and beta.

The statistical capabilities determine the model's efficiency and accuracy of results. Model efficiency is measured in terms of number of replications

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needed to achieve a desired level of accuracy in the simulation output. The number of replications needed is a function of the output variance. Variability of the simulation output on any one replicate ("within" variation) is reduced by allowing a warm-up period. The model allows a user defined warm-up period, at the end of which output statistics are reset to zero.

Common random numbers and synchronization of random numbers are two variance reduction techniques used for the comparison of alternative system configurations ("between" variation). They ensure that differences in performance are due to system configuration and not to variability on the sequence of random numbers. Implementation depends on the number of random number generator streams available. The user has access to 100 random number generator streams.

3.7.4 Simulation Input

A list of input data files is presented in Table 3.4. The pound (#) sign indicates that one file is needed for each scenario tested. For example, the study of three scenarios of quick changeovers requires three files (exsu1.dat, exsu2.dat, and exsu3.dat) to describe external machine setup times.

Not all the files listed are needed to execute the simulation model. As an example, a traditional quality scenario does not include inspections by operators. Therefore, a machine quality code of 1 prevents opening files related to product inspection times.

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Table 3.4. Input data files

File	Description
auto#.dat	Probability distributions for autonomous maintenance.
brck#.dat	Probability distributions for times between breakdowns.
cius#.dat	Machine codes to request and/or return containers.
coca#.dat	Containers capacity.
coco#.dat	Containers cost.
cont#.dat	Container types.
conv#.dat	Conveyor speed and length.
costf.dat	General data: customer lead time, simulation run length, ...
dem#.dat	Stream of numbers representing product demand.
exp#.dat	Description of the experiment (factor levels).
exsu#.dat	External setup times.
family.dat	Part numbers contained in each family of products.
insu#.dat	Internal setup times.
lay#.dat	Layout cost, floor space cost, and cell layout.
mach#.dat	Machine characteristics: number, type, operator code, ...
masc#.dat	Arrival scenario code for each machine.
mbuf#.dat	Machine buffer size.
mcrew.dat	Maintenance crew size and wage.
mdrl#.dat	Operator movement and destination rules.
mdsc#.dat	Departure scenario codes for each machine.
mhop#.dat	Material handling option between pairs of machines.
mqcd#.dat	Quality codes for each machine.
msto.dat	Probability dist. for time between stoppages and stop time.
msut#.dat	Setup codes per machine: 0=no setup, 1=traditional, 2=quick .
mtyp2.dat	Mach type 2: capacity by part number.
mtyp3.dat	Mach type 3:Number of families, capacity by family, cycle time.
opas#.dat	Operator assignments.
opcd#.dat	Operator codes: 1=dedicated, 2=shared.
parts.dat	Number of parts, number of families, number of lots.
pmcd.dat	Preventive maintenance codes.
pnco.dat	Part number cost at each operation in the part routing.
pnrt.dat	Part routing and probability distribution for processing times.
prepc.dat	Part replacement cost during machine maintenance.
prwkc.dat	Part rework cost.
qins#.dat	Probability distributions for Inspection times.
qrte#.dat	Scrap and rework rates by part number and machine.
rep.dat	Probability distributions for times to repair.
sucr#.dat	Setup crew size, wage, teamwork cost.
ul#.dat	Unit load size by part number and machine.

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3.7.5 Simulation Output

The simulation output report includes the observed total cell annual cost, and a detailed breakdown of each component on the cost function. A sample of the simulation output has been included in Appendix B. The results as presented can be used to perform further analysis.

Breaking down the total cell annual cost into its individual components facilitates understanding differences among cell scenarios. As an example, a cell for the assembly of printed circuit boards was studied under three scenarios: current design, and alternatives one and two. The simulation results are summarized in Table 3.5 and a bar chart of the cost components is presented in Figure 3.9.

Table 3.5. Cost components on three scenarios for the assembly of p-c boards

	IC	LT	SU	M	Q	MH&ST	PL	L	FS	TAC
Current	25687	523294	39920	3558	1057394	29790	289242	0	192000	2160886
%	0.01	0.24	0.02	0.00	0.49	0.01	0.13	0.00	0.09	
Alt. 1	6202	26389276	76326	358746	695843	29577	264685	25000	192000	28037656
%	0.00	0.94	0.00	0.01	0.02	0.00	0.01	0.00	0.01	
Alt. 2	27698	68291	57908	4085	705975	11486	277827	25000	192000	1370279
%	0.02	0.05	0.04	0.00	0.52	0.01	0.20	0.02	0.14	

The total annual cost under the current cell design is $2,160,886. The most significant cost components are quality and lateness which represent 49 and 24 percent of total cost, respectively. These results stress the need to address product quality and the cell's level of customer service.

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Alternative one evaluates the impact of implementing quality at the source, machine preventive maintenance, smaller lot sizes, and smaller unit load size. The total annual cost on this alternative is $28,037,656 — an increase of 1300 percent over the current scenario. Analysis of the cost components show a significant increase in lateness, where $25,124,360 (not presented here) is due to late orders. This is primarily the result of processing in smaller lot sizes without addressing the issue of machine setup time.

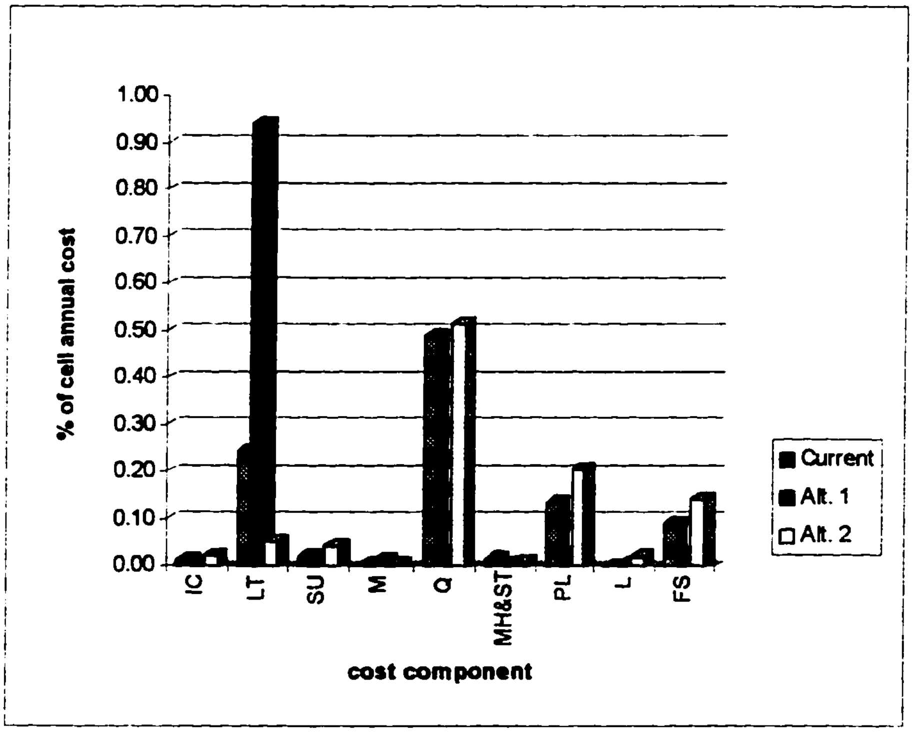

Figure 3.9. Cost components for three cell scenarios

Alternative two assesses the impact of implementing quality at the source and smaller lot sizes while reducing setup times by 75 percent and addressing minor stoppages at strategic machines. This combination of world class

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manufacturing practices result in a cell annual cost of $1,370,279 — a reduction of 37 percent over the current scenario. Compared to the current cell configuration, alternative 2 yielded a 77 percent reduction in lateness cost and 33 percent reduction in quality cost.

The results presented above demonstrate the need to assess the impact of design and operation strategies prior to implementation. The best combination of manufacturing strategies is unique for each cell.

A comprehensive cost function has been formulated for the evaluation and comparison of alternatives. Nonetheless, the generic cell simulator includes in the output report other statistics of interest to users of cellular manufacturing (see Appendix B). Those are:

- Total cell production by part number,
- Cell weekly throughput,
- Requirements on storage equipment,
- Requirements on QA inspectors and off-line rework operators,
- Total scrap by part number,
- Machine utilization,
- Levels of work-in-process inventory,
- Number of setup and maintenance crews needed.

The simulation output report includes the SLAM II standard summary report with statistics on waiting times and manufacturing lead time.

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3.8 Conclusions

An objective of this research work was the design of a generic manufacturing cell simulator capable of evaluating the impact of implementing world class manufacturing practices. The research focused on manned manufacturing cells. Four cells were studied to identify those characteristics to be included in the model: machine types, product flow, material handling and storage equipment, and cell size. World class manufacturing practices included in the model were chosen based on the literature review and interviews with users of cellular manufacturing.

Machines at four manufacturing cells were studied to identify those characteristics that regulate product flow and define simulation events. The review of 85 machines identified four main types. Cells consist of combinations of those machine types plus some highly specialized equipment, used in specific types of industries.

Product flow in manufacturing cells depend on product characteristics, machine types, and the material handling approach. To emulate product flow effectively it is vital to model three critical stages (arrival, processing, and departure) at every machine. The analysis of manufacturing cells identified four scenarios at arrival and six scenarios at departure. The scenario at part processing is defined through the selection of a machine type.

Development of a fully generic cell simulator, capable of modeling all machine types and combinations of arrival and departure scenarios, is not practical due to the development time requirements. The modular structure of the simulation model allows flexibility to reflect a wide variety of cell scenarios

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and results in model adaptability, since other scenarios can be incorporated by adding new modules.

The model includes approximately 20,000 lines of source code, 126 modules, and 25 event types that activate the appropriate modules. Exercising the model requires a significant amount of cell information (times, costs, machine performance, etc.). This is the trade-off cost to obtain accurate simulation results.

A second objective of this research work was the development of a comprehensive cell performance measure. The author proposes an annualized cost function that allows the evaluation of implementing relevant world class manufacturing practices. The impact of cell design and operation issues can be easily evaluated by comparing the resulting cost breakdown between scenarios.

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CHAPTER 4

CELL DESIGN METHODOLOGY

4.1 Introduction

The methodology proposed herein provides users with a systematic and analytic procedure for the design and evaluation of manufacturing cells. It can be used in the design of new cells and in the reconfiguration of existing ones. The methodology addresses cell design and operation issues with focus on the impact of implementing world class manufacturing practices. Chapter 4 constitutes the second of two archival journal articles developed by the author.

The building blocks of the methodology are depicted in Figure 4.1. It includes: computer simulation to emulate cell behavior under alternative configurations, engineering economics for the development of a cell performance measurement, design of experiments for the efficient collection and analysis of data, analysis of variance (ANOVA) to study the impact of design and operation factors on cell performance, and regression analysis and metamodels for the optimization of cell performance.

By far the most important building block is the computer simulation software developed by the author which incorporates the economic analysis concepts in the calculation of a total cost function for the evaluation of proposed manufacturing cells. The software allows for the design of statistical experiments and the subsequent use of ANOVA and regression analysis which permits the development of metamodels, predictors of the simulation response (total cost) based on relevant world class manufacturing practices.

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The proposed methodology is presented in Figure 4.2. It consists of four major steps: selection of design and operation issues, development of a comprehensive performance measure, identification of critical design and operation factors, and optimization of cell performance. A description of each step is presented below.

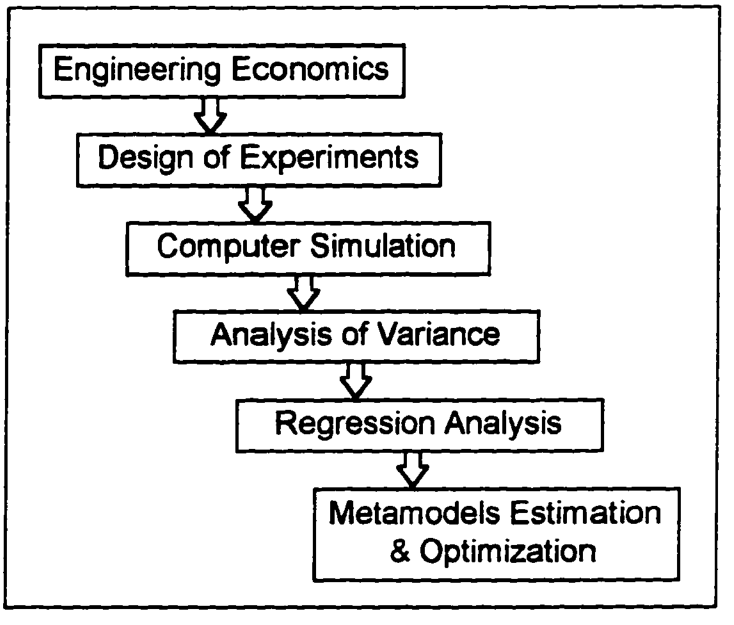

Figure 4.1 Building blocks of the cell design methodology

4.2 Selection of Cell Design and Operation Factors

The factors affecting cell performance have been classified into design and operation factors. Design factors are those that characterize the physical arrangement of the manufacturing cell. This includes layout, material handling equipment, storage system, and unit load size (the number of units moved at once between machines). Operational factors describe those management practices adopted to control cell operations. Included among operational factors are maintenance policy, quality policy, scheduling approach, inventory buffers,

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number of operators, operator movement and destination rule, setup time policy, and lot sizing.

The decision of which design and operation issues to be addressed in a study is case specific. All the issues mentioned above may be considered relevant for the design of a new manufacturing cell. When the objective of the study is the reconfiguration of a cell, the relevant issues are only those that address the need to restructure.

The methodology proposed herein was applied to a cell for the assembly of printed circuit boards (PCBs). A description of the cell is presented in Figure 4.3. The squares represent processes, and the circles represent operators. The objective of the study was to analyze product quality and the cell's customer service level. The study focused on evaluating the impact of implementing quality at the source, quick changeover, autonomous and preventive maintenance, smaller lots, smaller unit load sizes, and minor stoppages at the pick and place machines. The cell material handling system, manning requirements, inventory buffers, and part scheduling practices remained constant throughout the study.

Analysis of scrap and rework data identified paste, glue, and the pick and place machines as the major sources of quality problems. One scenario for the implementation of quality at the source is depicted in Figure 4.4. Inspection points have been placed after the paste, glue, and pick and place operations. Manning requirements remain the same since inspections are highly automated and were assigned to the operators already in charge of those processes. Minor cell layout changes were needed to accommodate the new equipment. Thus, layout was not treated as a major issue during experimentation.

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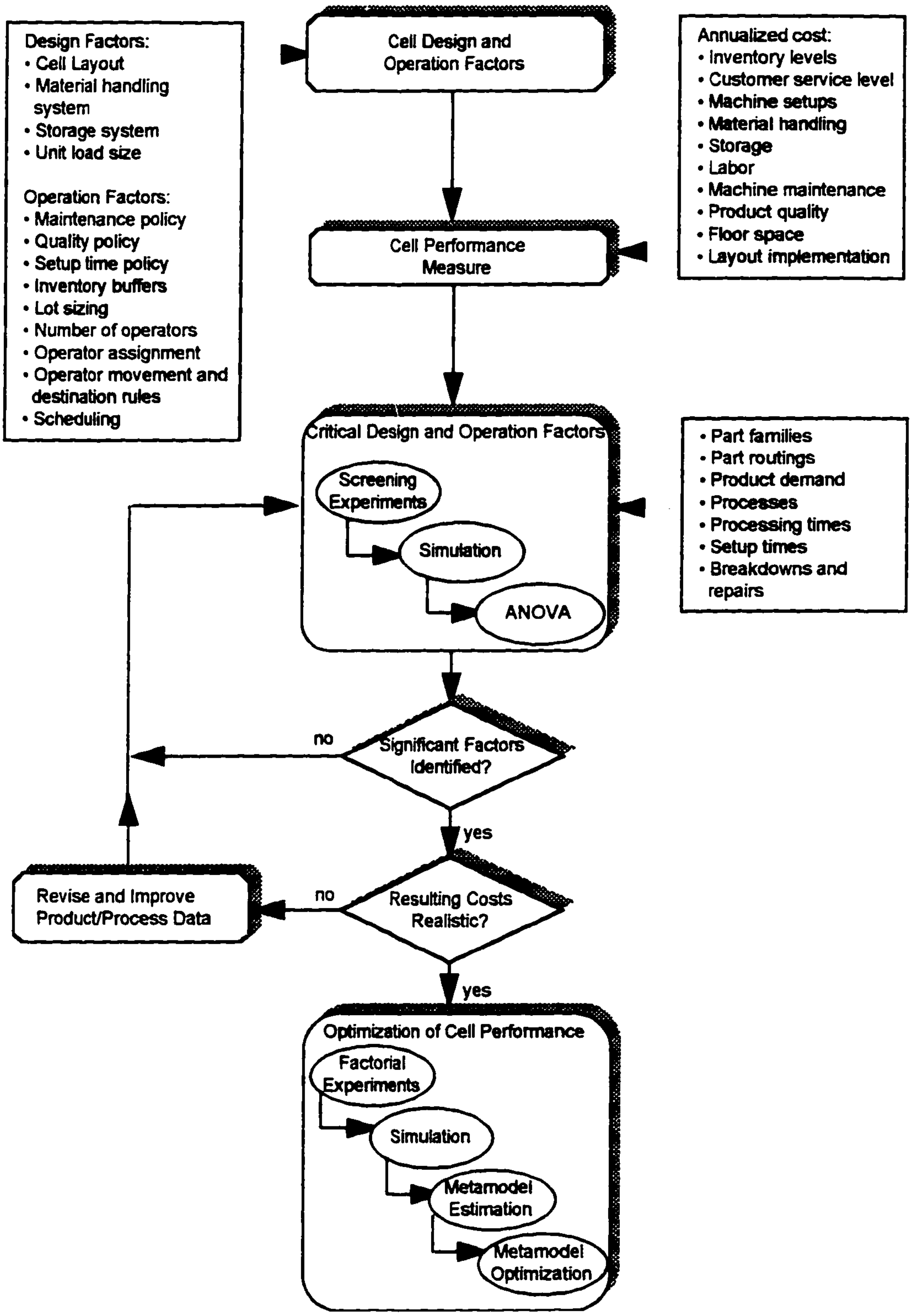

Figure 4.2 Cell design methodology

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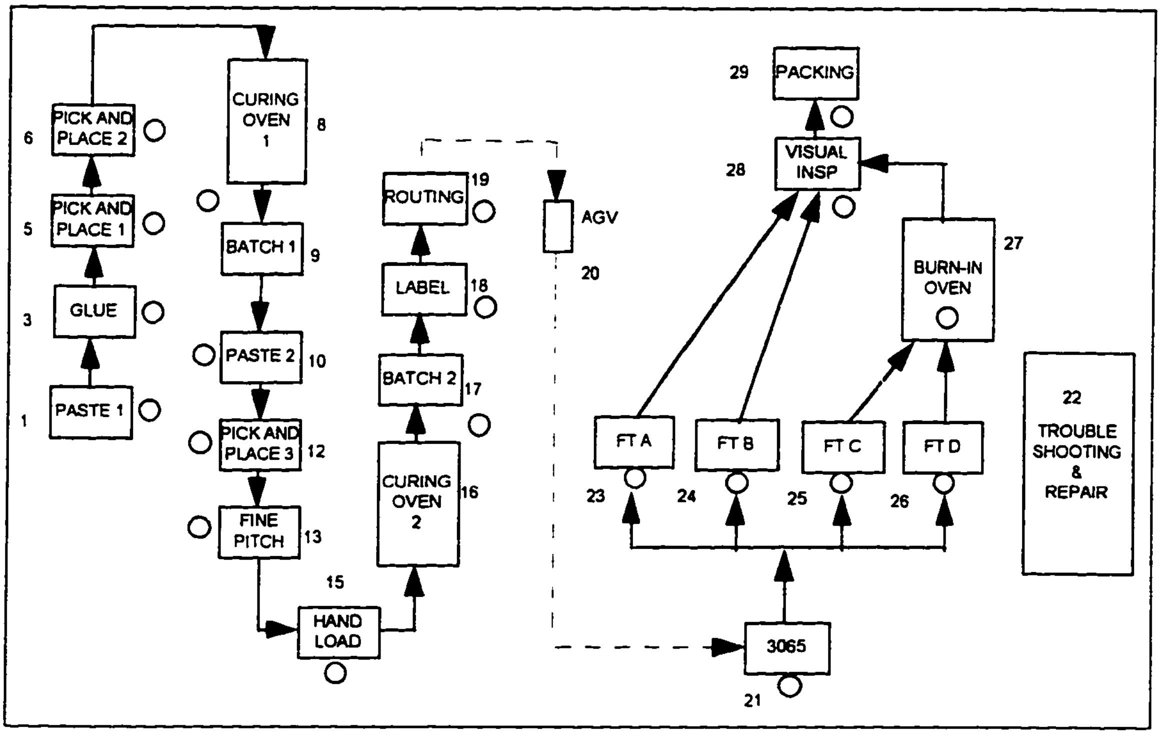

Figure 4.3 Cell for the assembly of printed circuit boards

The impact of implementing quick changeover techniques was only relevant at the pick and place machines. Setup times under quick changeover are represented as a percentage of current setup times. Autonomous and preventive maintenance are implemented at all machines. Cleaning, lubrication, and minor machine adjustments (these activities are better known as autonomous maintenance) are performed by operators on a daily basis. Preventive maintenance is under the responsibility of maintenance personnel. Minor stoppages at the pick and place machine are caused by the part replenishment frequency (mainly resistors, capacitors, memories, and specialized integrated circuits). The alternatives under study are small versus large rolls of such components.

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The last two operational issues are unit load size and lot size. Unit load size is defined as a percentage of the lot size. A production lot represents a group of customer orders. The impact of smaller lots is studied by releasing customer orders as they arrive (small lots) versus combining orders before the release occurs (large lots).

The cell operational issues addressed in this study (i.e., quality policy, maintenance policy, setup policy, lot size, unit load size, and machine minor stoppages) become factors for experimentation.

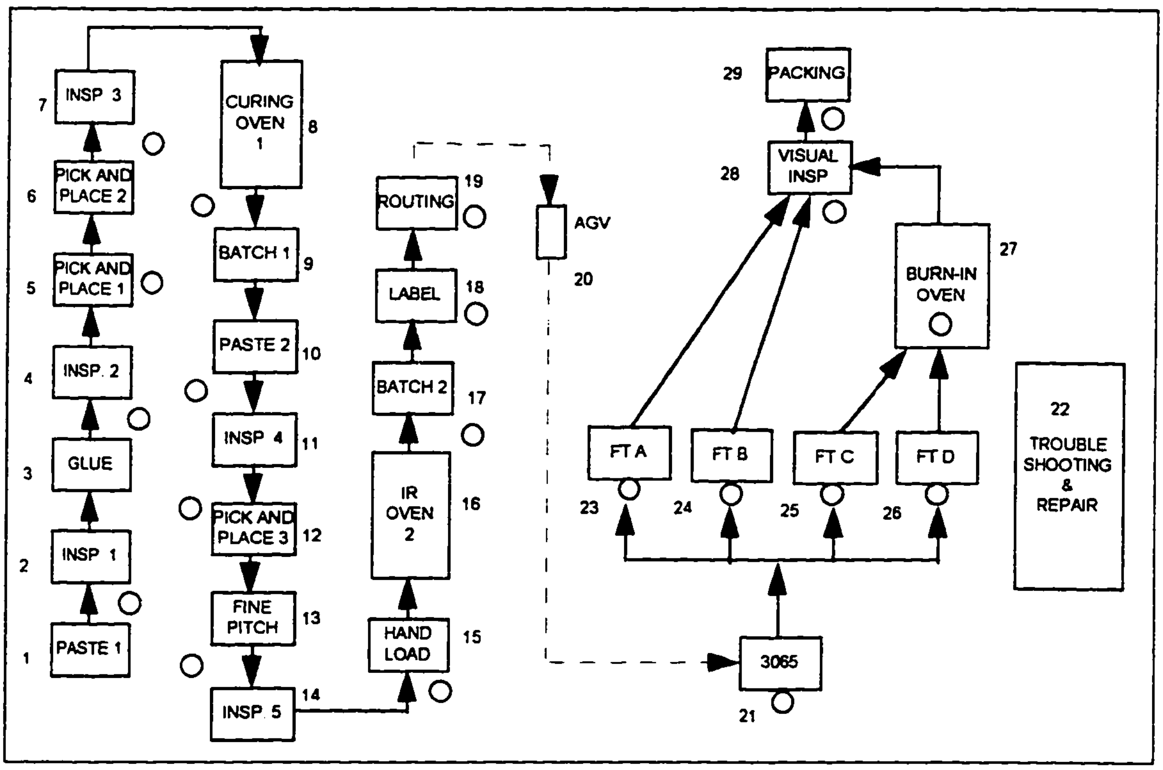

Figure 4.4 Layout for the implementation of quality at the source

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4.3 Development of a Cell Performance Measure

The second step of the methodology is the development of a cell performance measure. Performance of a manufacturing cell can be measured in many ways. Throughput, work-in-process, manufacturing leadtime, material handling costs, and machine setup costs are some examples found in the literature. The author proposes a performance measure capable of addressing multiple aspects of cell performance. It reflects differences in performance among alternative cell configurations in terms of the expected benefits of manufacturing cells: reduced levels of work-in-process inventory, improved service levels, reduced throughput times, less costly setups, simplified material handling, reduced storage requirements, improved quality, and reduced space requirements.

The performance measure proposed herein is an annualized cost function that consolidates ten cost components: inventory carrying costs (IC), lateness cost (LT), setup cost (SU), material handling cost (MH), storage equipment cost (ST), production labor cost (PL), maintenance cost (M), quality cost (Q), relayout (L), and floor space cost (FS). A detailed description of each cost component is presented in Section 3.6.

4.4 Setting the Lateness Ratio RA

The late charge rate ($Rate_{mn}$) proposed in equation (2), of Section 3.6.2 represents the fraction of the product cost that is charged on late orders. As a function of the lateness of an order, the charge rate increases exponentially between zero and RA, with a maximum charge rate of one. RA is defined as the ratio of lateness to manufacturing lead time at which an order is canceled or

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charged a penalty equal to the full product cost. As RA increases, the late charge rate decreases. The ratio RA is arbitrarily set by the user.

Different values of RA were tested by simulating the PCB assembly cell depicted in Figure 4.4. Table 4.1 summarizes the results obtained for RA = 1 through 5. The values in Table 4.1 are the percentage of total cost represented by each cost component. The lateness cost with RA = 1 represents 46.97% of the total cell annual cost. Lateness has a significant weight in the cost function when compared to other issues such as product quality. With RA = 3 the lateness cost represents 24% of the cell annual cost, with the simulation results showing a cell service level of 81 percent. It was agreed by representatives of the printed circuit board assembly cell that RA=3 (with 24.33 percent of the cost caused by lateness and 81% on-time delivery) to be representative of reality. A bar chart of the results is depicted in Figure 4.5. The bar heights represent the percentage of total cost for each component. They facilitate the comparison between scenarios.

Table 4.1. Percentage of total cost represented by each cost component

	Inv.	Late	Setup	Maint.	Quality	H & St	Labor	Layout	Space
RA=1	0.83	46.97	1.29	0.11	34.29	0.96	9.34	0.00	6.20
RA=2	1.08	31.23	1.67	0.15	44.47	1.25	12.11	0.00	8.04
RA=3	1.18	24.33	1.84	0.16	48.93	1.37	13.33	0.00	8.85
RA=4	1.24	20.45	1.93	0.17	51.44	1.45	14.01	0.00	9.30
RA=5	1.28	17.97	1.99	0.18	53.05	1.49	14.45	0.00	9.59

Total number of orders processec	3374
Number of late orders:	649
On time delivery:	81%

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4.5 Identification of Critical Design and Operation Factors

The identification of factors with a significant influence on cell performance is vital to the design and operation of cellular manufacturing systems [BUZA85]. Since it is likely that only a few of the selected cell design and operation factors will have a significant impact on cell performance, screening experiments have been incorporated in the methodology. Only these significant factors should be considered in further experimentation.

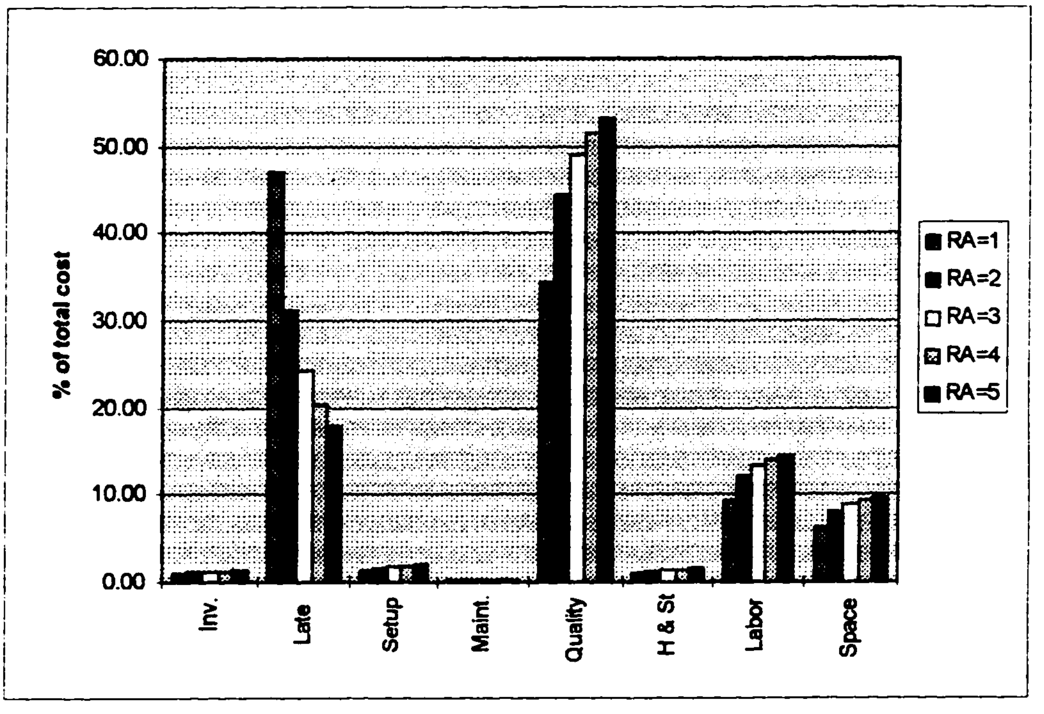

Figure 4.5 Cost components for values of RA

Factors for experimentation can be classified into two groups: quantitative and qualitative. Quantitative factors are those whose levels can be associated with points in a numerical scale, such as setup times (SU) and unit load size

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(UL). Qualitative factors are those whose levels cannot be associated with a numerical scale. The PCB assembly cell covered in this study operates in a manufacture to order environment. A production lot at the PCB assembly cell represents one or more customer orders. The size of a production lot is determined by the number of units requested by customers. Customer orders could be released for production following two strategies: (1) release individual customer orders (small lot size), and (2) release a group customer orders (large lot size). Since the actual size of the order cannot be controlled, lot size (LT) is treated as a qualitative factor. For the PCB assembly cell, quality (QL), maintenance (MA), lot size (LT), and machine minor stoppages (ST) are qualitative factors. The levels used for the screening experiment are presented in Table 4.2. Each factor is studied at two levels. Level one represents the current condition at the printed circuit board cell and level two the proposed cell operating policies.

Table 4.2. Description of factor levels

Factor	Level 1 (-)	Level 2 (+)
SU	Long setup times	Quick changeovers (75% reduction)
UL	Large (≈ 50% of lot size)	Small (≈ 10% of lot size)
QL	Traditional inspections	Quality at the source
MA	Breakdown maintenance	Autonomous and preventive maint.
LT	Large lots (groups of customer orders)	Small lots (individual customer orders)
ST	Small rolls of components	Bigger rolls of components

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The design for the screening experiment is a 2^{6-1} fractional factorial design, in two blocks of 16 design points each as shown in Table 4.2 [MCLE95]. This is a resolution V design (no main effect or two factor interaction is confounded with any other main effect or two factor interaction). The objective of the screening experiment is to obtain an estimate of important one factor effects and two factor interactions. Cell performance at each design point was evaluated using the generic cell simulator presented Section 3.7.

The cell runs two shifts per day (450 minutes each), five days a week, 52 weeks per year. This represents 234,000 minutes per year. The cell's weekly throughput was analyzed to determine the length of a warm-up period. The simulation was considered in its steady state when the simulated weekly throughput was approximately the average cell's weekly throughput based on historical production data. Steady state was achieved after 9000 minutes of simulation time. The total simulation length is 243,000 minutes to compensate for the warm-up period of 9000 minutes.

Each design point was simulated for one year of production except design points 1 (all factors at low level) and 28 (all factors at high level). Ten independent repetitions at each one of these two experimental conditions were performed to obtain an estimate of the experimental error.

The resulting total annualized cost (TAC) figures for each experimental condition in the screening experiment are presented in Table 4.3. The simulation output includes a breakdown of the total cell annual cost into its individual components. The TAC breakdown is presented in Table 4.4 to facilitate the understanding of the differences between experimental conditions.

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The statistical analysis of results was performed using the general linear model (GLM) procedure of the Statistical Analysis System (SAS) software [DELW96]. The report generated by SAS is presented in Appendix C. Residuals were tested for normality. The skewness and excess kurtosis were both approximately zero. A stem and leaf and normal probability plot of residuals are included in Appendix C to document the compliance with normality assumptions.

The significance probabilities were analyzed to identify significant main effects and two factor interactions. For a confidence level of 95%, the significant main effects were lot size (LT), unit load size (UL), setup times (SU), maintenance (M), and minor stoppages (ST). The significant two factor interactions were: lot size and unit load size (LTxUL), lot size and setup times (LTxSU), lot size and minor stoppages (LTxST), and setup times and minor stoppages (SUxST).

The results obtained from the screening experiment merit some discussion. An analysis of the breakdown of cost components presented in Table 4.3 shows that quality represents more than 40 percent of the total cost in 60 percent of the scenarios evaluated. In some cases it represents as much as 63 percent of the annualized cost. However, quality was not identified as a critical operational factor.

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Table 4.3. Results from screening experiment

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Design point	LT	UL	SU	QL	MA	ST	BLOCK	Cost $/YEAR
1	-1	-1	-1	-1	-1	-1	1	2170280.
1	-1	-1	-1	-1	-1	-1	1	2166304.
1	-1	-1	-1	-1	-1	-1	1	2176116.
1	-1	-1	-1	-1	-1	-1	1	2197316.
1	-1	-1	-1	-1	-1	-1	1	2142670.
1	-1	-1	-1	-1	-1	-1	1	2181240.
1	-1	-1	-1	-1	-1	-1	1	2184299.
1	-1	-1	-1	-1	-1	-1	1	2173688.
1	-1	-1	-1	-1	-1	-1	1	2186503.
1	-1	-1	-1	-1	-1	-1	1	2180851.
2	1	1	1	1	-1	-1	1	1391530.
3	-1	1	1	-1	1	1	1	2274293.
4	1	-1	-1	1	1	1	1	16267381.
5	1	1	1	-1	1	-1	1	2029203.
6	-1	-1	-1	1	1	-1	1	2168647.
7	1	-1	-1	-1	-1	1	1	15328751.
8	-1	1	1	1	-1	1	1	1617552.
9	1	1	-1	-1	-1	-1	1	26517870.
10	-1	-1	1	1	-1	-1	1	1676204.
11	1	-1	1	-1	1	1	1	2028651.
12	-1	1	-1	1	1	1	1	2087279.
13	-1	-1	1	-1	1	-1	1	2311724.
14	1	1	-1	1	1	-1	1	28037656.
15	-1	1	-1	-1	-1	1	1	2077920.
16	1	-1	1	1	-1	1	1	1370279.
17	1	-1	1	-1	-1	-1	-1	1736158.
18	-1	1	-1	1	-1	-1	-1	1773894.
19	1	1	-1	-1	1	1	-1	21696176.
20	-1	-1	1	1	1	1	-1	2007732.
21	-1	1	-1	-1	1	-1	-1	2442737.
22	1	-1	1	1	1	-1	-1	1718942.
23	-1	-1	1	-1	-1	1	-1	2034498.
24	1	1	-1	1	-1	1	-1	12242492.
25	-1	1	1	-1	-1	-1	-1	1985830.
26	1	-1	-1	1	-1	-1	-1	24392574.
27	-1	-1	-1	-1	1	1	-1	2492354.
28	1	1	1	1	1	1	-1	1735281.
28	1	1	1	1	1	1	-1	1736043.
28	1	1	1	1	1	1	-1	1735491.
28	1	1	1	1	1	1	-1	1733878.
28	1	1	1	1	1	1	-1	1740264.
28	1	1	1	1	1	1	-1	1738834.
28	1	1	1	1	1	1	-1	1737445.
28	1	1	1	1	1	1	-1	1742127.
28	1	1	1	1	1	1	-1	1739344.
28	1	1	1	1	1	1	-1	1738027.
29	1	-1	-1	-1	1	-1	-1	29063736.
30	-1	1	1	1	1	-1	-1	1962582.
31	1	1	1	-1	-1	1	-1	1736615.
32	-1	-1	-1	1	-1	1	-1	1807899.

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Table 4.4. Breakdown of the annualized cost results from the screening experiment

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RUN	ICC	LATE	SETUP	MAINT	QUALITY	MH	PROD.LAB.	LAYOUT	SPACE	TAC
1	25677.	528102.	39936.	3559.	1062026.	29789.	289190.	0.	192000.	2170280.
2	27593.	86807.	57836.	4093.	705581.	30938.	261682.	25000.	192000.	1391530.
3	29773.	347321.	29954.	330026.	1055682.	16659.	272878.	0.	192000.	2274293.
4	6276.	14617101.	77870.	358780.	699635.	11215.	279504.	25000.	192000.	16267381.
5	27588.	69209.	57894.	330177.	1063858.	30894.	257583.	0.	192000.	2029203.
6	25978.	509341.	39863.	358641.	705184.	29728.	282913.	25000.	192000.	2168647.
7	6147.	13715171.	77863.	3564.	1036901.	11287.	285818.	0.	192000.	15328751.
8	30029.	338745.	30003.	4116.	703910.	16659.	277091.	25000.	192000.	1617552.
9	6219.	24920274.	76392.	3594.	1018848.	29589.	270954.	0.	192000.	26517870.
10	28525.	375252.	29954.	4085.	706130.	30014.	285244.	25000.	192000.	1676204.
11	27456.	68600.	57942.	330330.	1067264.	11480.	273579.	0.	192000.	2028651.
12	27398.	443467.	39961.	358674.	709431.	16567.	274782.	25000.	192000.	2087279.
13	28034.	368981.	29930.	330058.	1051812.	29856.	281053.	0.	192000.	2311724.
14	6202.	26389276.	76326.	358746.	695843.	29577.	264685.	25000.	192000.	28037656.
15	27407.	456893.	39848.	3604.	1060480.	16668.	281021.	0.	192000.	2077920.
16	27698.	68291.	57908.	4095.	705975.	11486.	277827.	25000.	192000.	1370279.
17	27250.	72081.	57954.	3646.	1092825.	11582.	278820.	0.	192000.	1736158.
18	26979.	485224.	39786.	4130.	703831.	16595.	280349.	25000.	192000.	1773894.
19	6378.	19741092.	77382.	329176.	1054634.	29958.	265556.	0.	192000.	21696176.
20	28679.	363909.	29866.	358796.	699911.	29787.	279785.	25000.	192000.	2007732.
21	26860.	473799.	39777.	329060.	1088489.	16545.	276209.	0.	192000.	2442737.
22	27482.	68638.	57933.	358881.	705240.	11478.	272291.	25000.	192000.	1718942.
23	28384.	381429.	29906.	3623.	1083017.	29888.	286251.	0.	192000.	2034498.
24	7702.	10929912.	78295.	4106.	706209.	30282.	268986.	25000.	192000.	12242492.
25	29503.	340572.	29900.	3633.	1095693.	16658.	277872.	0.	192000.	1985830.
26	5542.	23094870.	76658.	4109.	697665.	11235.	285493.	25000.	192000.	24392574.
27	25943.	503052.	39822.	329192.	1088346.	29761.	284239.	0.	192000.	2492354.
28	27975.	86719.	57923.	357930.	700735.	30806.	256193.	25000.	192000.	1735281.
29	4441.	27139372.	75932.	329003.	1030155.	10994.	281840.	0.	192000.	29063736.
30	29523.	333138.	29925.	358888.	705906.	16625.	271577.	25000.	192000.	1962582.
31	27726.	72344.	57872.	3625.	1089248.	30923.	262876.	0.	192000.	1736615.
32	26362.	496247.	39817.	4113.	706052.	29876.	288432.	25000.	192000.	1807899.

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A mean plot of the cell annualized cost by quality scenario is presented in Figure 4.6. The mean annualized cost for the current quality scenario (-) is $5,500,631. The mean annualized cost with the implementation of quality at the source (+) is $4,715,975., which represents yearly savings of $748,656. The proposed quality at the source scenario requires investments in training, relayout, and equipment. The annualized cost of these investments, over three years with an interest rate of 15 percent, is $472,635. The benefit cost ratio for the proposed scenario is only 1.66. Benefit cost ratios for significant factors were much higher. For example, setup had a benefit cost ratio of 3,206.

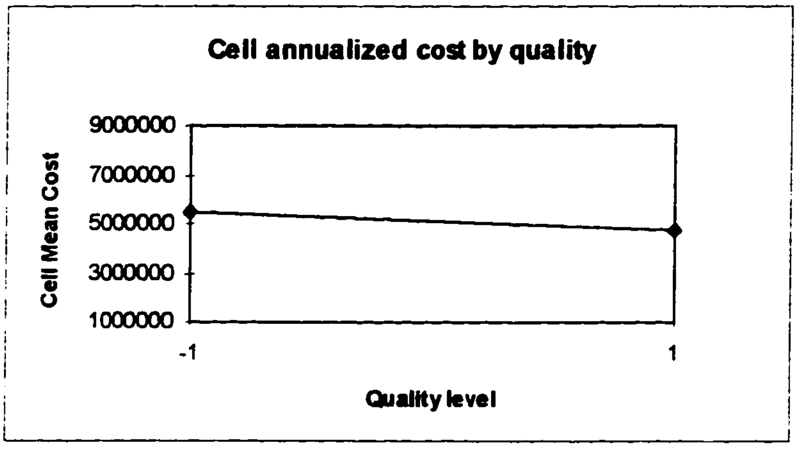

Figure 4.6 Mean plot of cell annualized cost by quality scenario

Another interesting result relates to the maintenance policy. The regression coefficients of the regressor variables are presented in Table 4.5. The regression coefficient of maintenance policy is positive. Maintenance is a factor that does not interact with any other factor. Therefore, maintenance should be set at its low level to minimize costs. A mean plot of the annualized cost by maintenance scenario is presented in Figure 4.7. The average annualized cost for the current scenario (-) is $4,777,973. The average annualized cost with the implementation of autonomous and preventive

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maintenance (+) is $5,438,633. Hence, the investments and interruptions caused by maintenance have a negative impact on cell performance. Maintenance should therefore be set at its low level for further experimentation.

The screening experiment has identified four significant factors, which should be considered in the next stage of experimentation. Two of the factors are qualitative (lot size and machine minor stoppages) and two are quantitative (setup times and unit load size). These four factors will be considered in the optimization of the cell performance (next step in the design methodology).

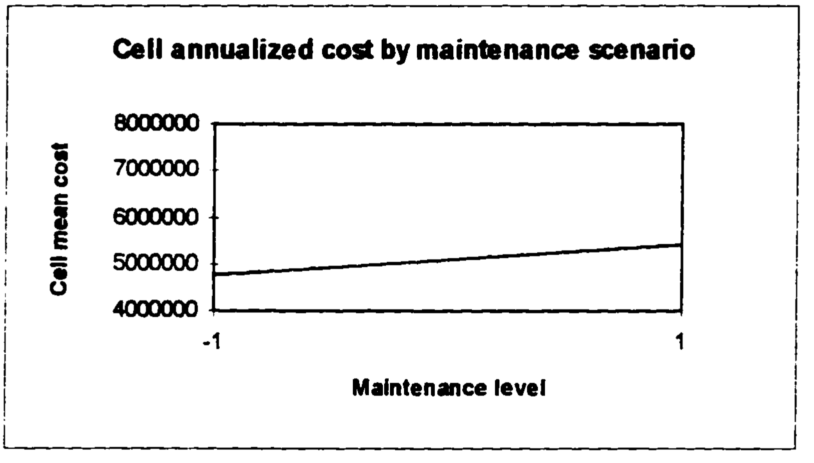

Figure 4.7 Mean plot of cell annualized cost by maintenance scenario

4.6 Optimization of Cell Performance

After the screening experiment results were obtained, a second experiment was needed to analyze the response surface for cost and identify the optimal factor settings. A response surface design was used to achieve this task. The experiment includes two qualitative factors (lot size and machine stoppages) at two levels each for a total of four combinations. A response function on quantitative factors (setup time and unit load size) is estimated at each

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combination of qualitative factors with a 3^2 full factorial design. A layout of the macroexperiment is presented in Figure 4.8.

Table 4.5. Regression coefficients of the regressor variables

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General Linear Models Procedure

Dependent Variable: TRAC Total Annual Cost

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	22	2.8331E+15	1.2878E+14	47.10	0.0001
Error	27	7.3825E+13	2.7342E+12		
Corrected Total	49	2.9069E+15			

R-Square	C.V.	Root MSE	TRAC Mean
0.974604	32.36995	1653555	5108303

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT	6881023.722	24.23	0.0001	283969.7975
LT	4941840.350	17.96	0.0001	275156.0991
UL	211566.288	0.77	0.4486	275156.0991
SU	-4912923.462	-17.86	0.0001	275156.0991
QL	-372870.337	-1.36	0.1866	275156.0991
MA	756282.788	2.75	0.0105	275156.0991
ST	-1213668.525	-4.41	0.0001	275156.0991
BLK	-162853.163	-0.59	0.5589	275156.0991
LT*UL	122988.784	0.43	0.6684	283969.7975
LT*SU	-4957541.966	-17.46	0.0001	283969.7975
LT*QL	-321410.591	-1.13	0.2677	283969.7975
LT*MA	477047.659	1.68	0.1045	283969.7975
LT*ST	-1324426.028	-4.66	0.0001	283969.7975
UL*SU	-103989.528	-0.37	0.7171	283969.7975
UL*QL	-129620.153	-0.46	0.6517	283969.7975
UL*MA	168344.347	0.59	0.5582	283969.7975
UL*ST	38595.784	0.14	0.8929	283969.7975
SU*QL	323849.097	1.14	0.2641	283969.7975
SU*MA	-481765.778	-1.70	0.1013	283969.7975
SU*ST	1330247.159	4.68	0.0001	283969.7975
QL*MA	-32182.403	-0.11	0.9106	283969.7975
QL*ST	-168431.716	-0.59	0.5580	283969.7975
MA*ST	134071.659	0.47	0.6406	283969.7975

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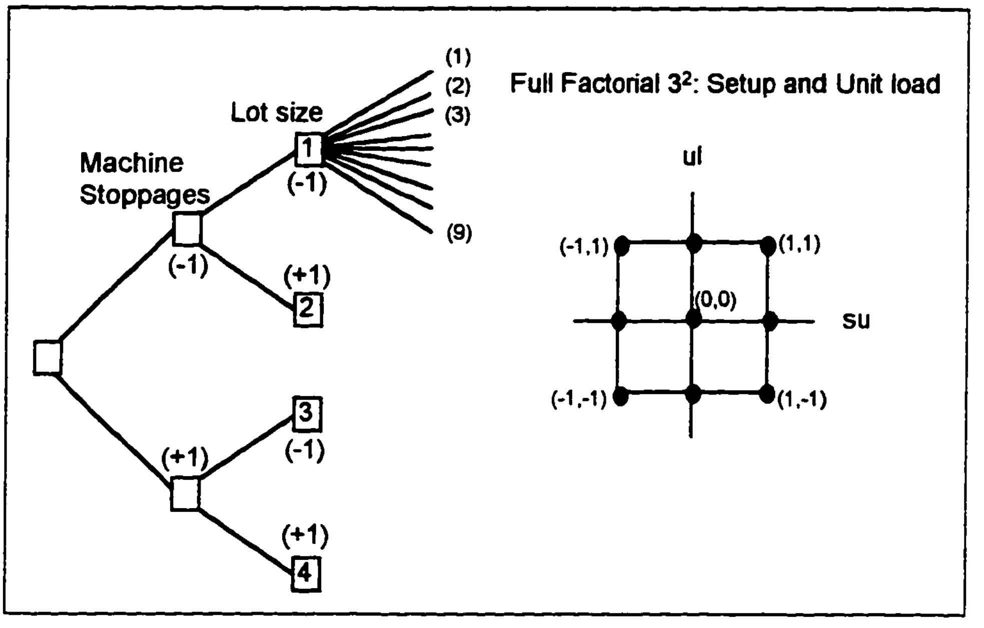

Figure 4.8 Layout of the macroexperiment

The macroexperiment consists of four 3^2 factorial experiments (branches 1 through 4 in Figure 4.8). Three independent simulation runs were performed at each design point of each 3^2 factorial design for a total of 27 runs, for a total of 108 independent simulation runs in the entire macroexperiment. A description of factor levels is presented in Table 4.6. As with the screening experiment, a factor level of (-1) represents the current cell operating policy.

Simulation results at each of the four branches were analyzed using SAS response surface regression (RSREG) procedure with a significance level α = 0.05 [SAS90]. The response surface was estimated using a second-order model. The optimum setting of the regressor variables, the stationary point, was found with a canonical analysis of the metamodel (estimated response surface). The results obtained are summarized in Table 4.7. Plots of the estimated response surface are presented in Figures 4.9 through 4.12.

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Table 4.6. Description of factor levels for the macroexperiment

Factor	Level 1 (-1)	Level 2 (0)	Level 3 (+1)
Setup	Long setup times	Quick changeovers (37.5% reduction)	Quick changeovers (75% reduction)
Unit load	Large (≈ 50% of lot size)	Medium (≈30% of lot size)	Small (≈ 10% of lot size)
Lot size	Large lots (groups of customer orders)		Small lots (individual customer orders)
Mach. stops	Small rolls of components		Bigger rolls of components

The residuals were analyzed using the SAS univariate (UNIVARIATE) procedure which includes moments, quantiles, stem and leaf plot, box plot, and normal probability plot [SAS90]. SAS output reports for each of the four experiments are included in Appendix D.

Table 4.7. Results from the statistical analysis of the macroexperiment

Experiment	Significant Regressors	Predicted Value at Stationary Point ($)	Residual Skewness and Excess Kurtosis	Std.Error of Estimate
1	UL,SU,UL^2, SU^2	1,954,912	-0.0071 , -1.0607	5,136
2	SU, SU^2	-1,425,522	0.6259 , 1.7765	82,588
3	UL,SU,UL^2, SU^2	1,967,606	0.0677 , -0.5288	5,396
4	SU, SU^2	-161,371	-0.6946 , 5.3033	2,290,592

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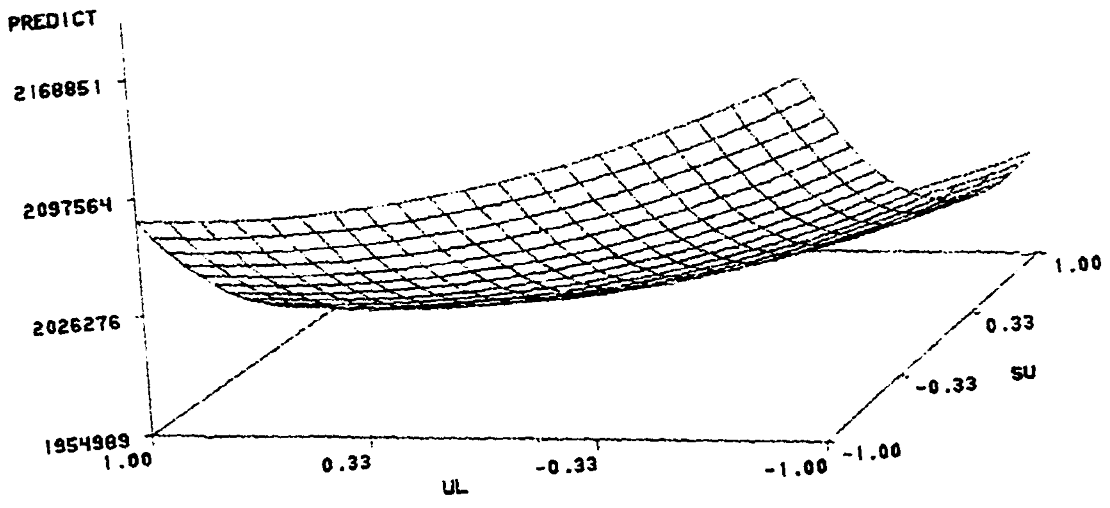

Figure 4.9 Estimated response surface for experiment 1

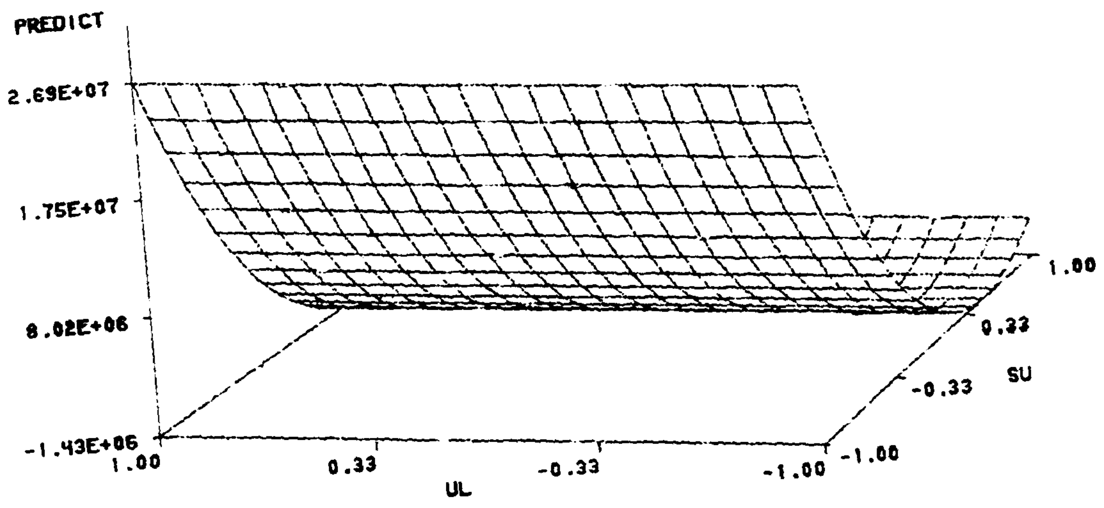

Figure 4.10 Estimated response surface for experiment 2

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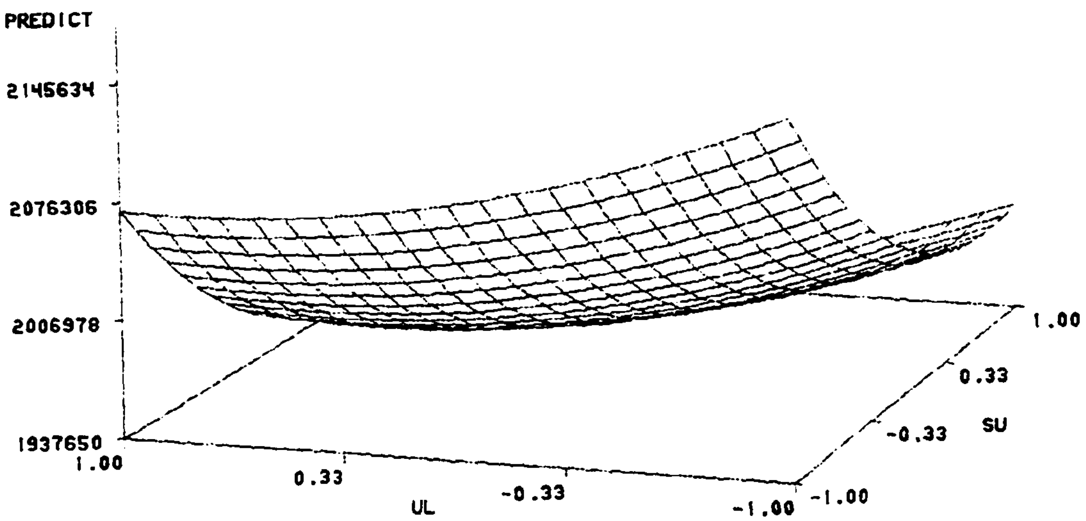

Figure 4.11 Estimated response surface for experiment 3

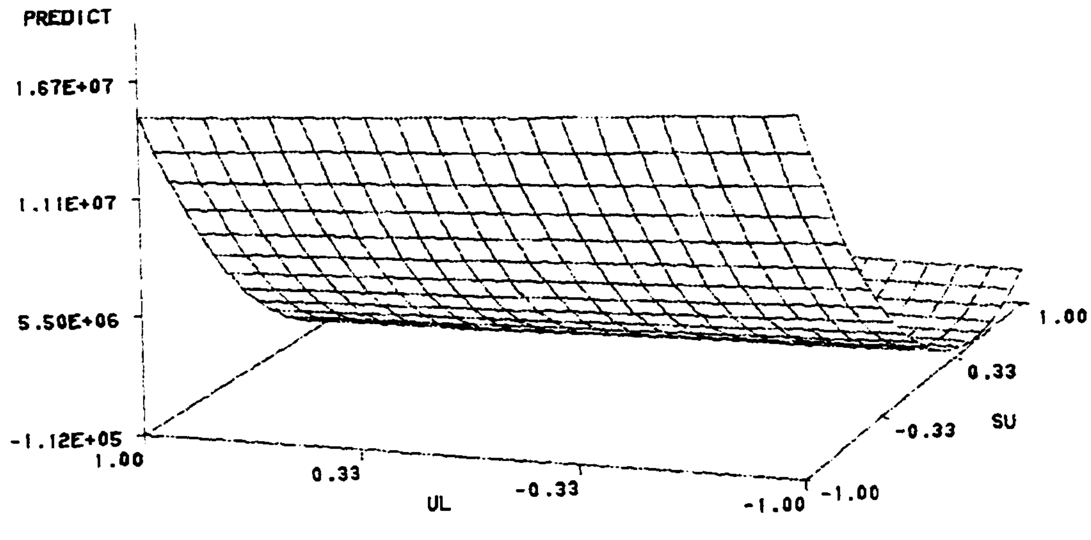

Figure 4.12 Estimated response surface for experiment 4

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Experiments 1 and 3 exhibit similar behavior in the shape of the estimated response surface. The predicted mean response at the stationary point is similar for both metamodels, and have the same significant regressor variables. The p-values for the lack of fit test were .9475 and .9643, respectively. The observed skewness and excess kurtosis of the estimated residuals show that the residuals follow an approximately normal distribution. The standard error of the estimated mean response at the stationary point is relatively small at both branches. Therefore, simulation results are well-behaved around the stationary point of the estimated response surface.

The metamodels developed for experiments 2 and 4 resulted in negative predictions (for total annual cost) at the stationary point and other regions of the estimated response surface. The skewness and excess kurtosis of the estimated residuals show these do not follow a normal distribution. The standard error of the estimates at the stationary point are significantly high. Therefore, the annualized costs obtained from the simulation are not well-behaved (in fact, meaningless) around the estimated response surface.

Several transformations of the response were studied in search for a metamodel with a better fit. Design points were added to the experiments to allow estimation of higher order models. The statistical analysis of transformations was performed using the general linear model (GLM) procedure which gives flexibility to test higher order models [SAS90]. The optimum setting for regressor variables was obtained by evaluating the metamodel at additional factor levels within the design region. SAS output reports for the response function with the best fit are presented in Appendix E. The predicted mean response at the stationary point and the standard error of the predicted mean response are presented in Table 4.8.

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Table 4.8. Results on transformations of the response for experiments 2 and 4

	Experiment 2	Experiment 4
Significant Regressors	UL,SU,UL^2, SU^2,UL^3,SU^3	SU,UL^2, SU^2,SU^3
Predicted Annual Cost $\hat{Y}(\hat{X}^{*})$ at the stationary point $(\hat{X}^{*})$	$1,647,899	$1,730,651
Residual Skewness and Excess Kurtosis	0.2690 , 1.4656	-0.0404 , 0.5606
Standard Error of the Estimate	26649	12453
Normalizing Transformation Z=f(Y)	Z = ln(Y)	Z = 1/Y

The logarithm transformation:

$$Z(X) = f\left[Y(X)\right] = \ln\left[Y(X)\right] \tag{4.11}$$

for every point X=(SU,UL) in the two dimensional region of interest for experiment 2 provided the best fit to the simulation responses in this experiment. The response surface was estimated by fitting a cubic model to the transformed data. The estimated response surface is presented in Figure 4.13.

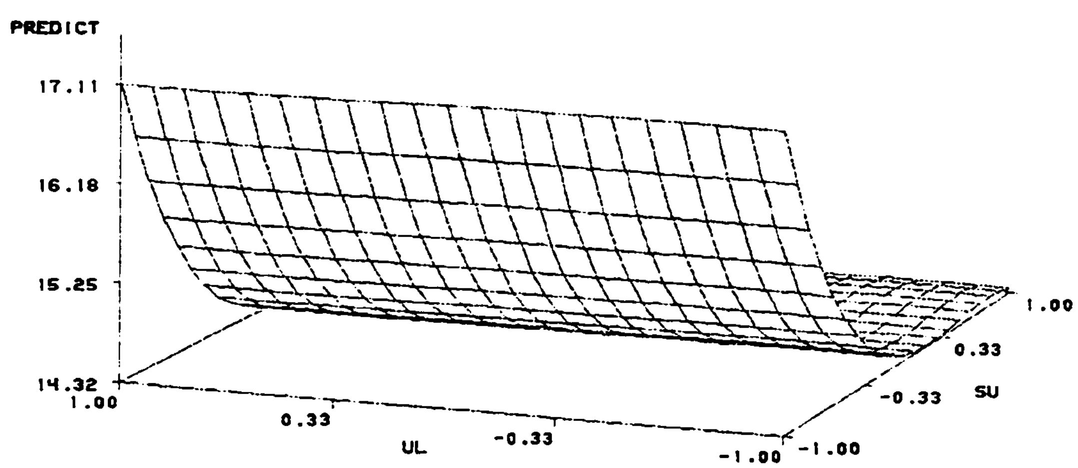

Figure 4.13 Estimated response surface for the logarithm transformation

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The standard error of the prediction at each design point X is estimated using the Delta method approximation [HUIT71], yielding

$$Var\left[\hat{Z}(X)\right] \cong \left\{f'\left[\hat{Y}(X)\right]\right\}^2 Var\left[\hat{Y}(X)\right]. \tag{4.12}$$

Now if D denotes the design matrix describing all of the design points in the experiment used to estimate the metamodel for the predicted transformed response $\hat{Z}(X)$, then we have predicted the standard regression result:

$$Var\left[\hat{Z}(X)\right] \cong \hat{\sigma}_Z X(D'D)^{-1} X' \tag{4.13}$$

where $\hat{\sigma}_Z$ is the standard error of the estimate for the regression involving the transformed responses. Combining (4.12) and (4.13) and inserting our final estimate $\hat{X}^*$ of the stationary point into the result, we obtain our final estimate of the predicted optimal untransformed response

$$\hat{Y}\left(\hat{X}^*\right) = f^{-1}\left[\hat{Z}\left(\hat{X}^*\right)\right] = \exp\left[\hat{Z}\left(\hat{X}^*\right)\right] \tag{4.14}$$

and the associated standard error

$$\begin{aligned} SE\left[\hat{Y}\left(\hat{X}^*\right)\right] &\cong \left|f'\left[\hat{Y}\left(\hat{X}^*\right)\right]\right|^{-1} \hat{\sigma}_Z \sqrt{\hat{X}^*(D'D)^{-1}(\hat{X}^*)'} \\ &= \exp\left[\hat{Z}\left(\hat{X}^*\right)\right] \hat{\sigma}_Z \sqrt{\hat{X}^*(D'D)^{-1}(\hat{X}^*)'}. \end{aligned} \tag{4.15}$$

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Predictions of the response function are all positive with a significant reduction in the standard error of the estimate. Residual skewness and kurtosis show these follow an approximately normal distribution.

The transformation that offered the best estimate of the response surface for experiment 4 was

$$Z(X) = f[Y(X)] = 10000/Y(X). \tag{4.16}$$

The response surface was estimated by fitting a cubic model to the transformed data. The estimated response surface is depicted in Figure 4.14. Proceeding along the lines of (4.14) and (4.15) for the transformation (4.16), we obtain for experiment 4

$$\hat{Y}\left(\hat{X}^{\bullet}\right) = 10000\Big/\hat{Z}\left(\hat{X}^{\bullet}\right) \tag{4.17}$$

and

$$SE\left[\hat{Y}\left(\hat{X}^{\bullet}\right)\right] \cong \left\{\left[\hat{Z}\left(\hat{X}^{\bullet}\right)\right]^2 \Big/ 10000\right\} \hat{\sigma}_Z \sqrt{\hat{X}^{\bullet}(D'D)^{-1}(\hat{X}^{\bullet})'}. \tag{4.18}$$

The skewness and kurtosis of the residuals for the transformation (4.17) show that these follow an approximately normal distribution. There was a significant reduction in the standard error of the estimate at the stationary point. Therefore, the annualized costs obtained from the simulation are well-behaved around the estimated response surface at the stationary point.

The metamodels developed to estimate the response surface of total cell annual cost are presented in equations 4.19 through 4.22.

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$$\hat{Y}_1 = 1986904 - 34686 * UL - 66788 * SU + 23320 * UL^2 + 49268 * SU^2 \quad (4.19)$$

$$\hat{Y}_2 = EXP(14.3672 - 0.0214 * UL - 0.4604 * SU + 2.89x10^{-4} * UL^2 + 1.3625 * SU^2 + 0.0245 * UL^3 - 0.9146 * SU^3) \quad (4.20)$$

$$\hat{Y}_3 = 1967606 - 31675 * UL - 66290 * SU + 22845 * UL^2 + 51536 * UL^3 \quad (4.21)$$

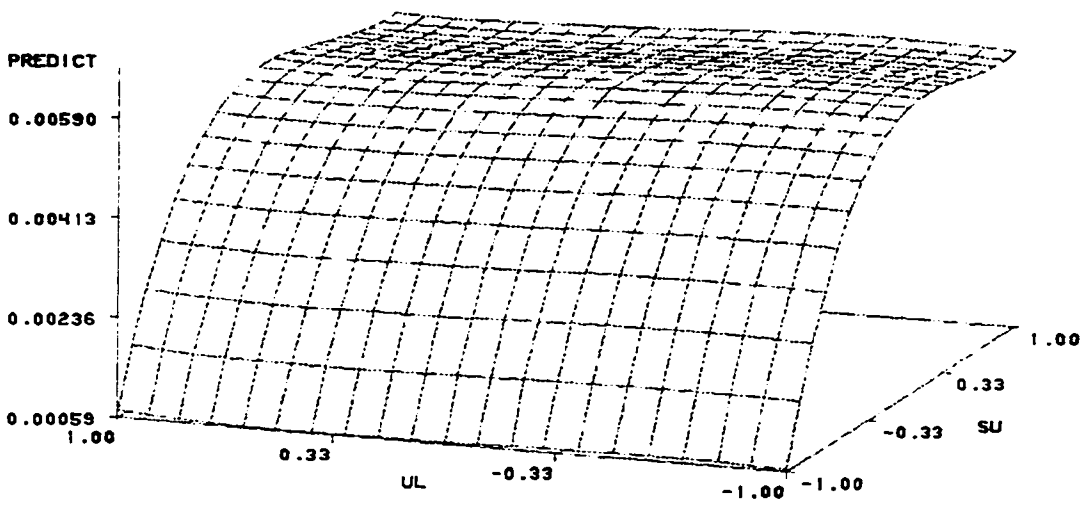

Figure 4.14 Estimated response surface for the inverse transformation

$$\hat{Y}_4 = \frac{10000}{\begin{bmatrix} 5.75X10^{-3} + 8.87X10^{-4} * SU + 3.20X10^{-6} * UL^2 - \\ 2.55X10^{-3} * SU^2 + 1.71X10^{-3} * SU^3 \end{bmatrix}} \quad (4.22)$$

where;

$\hat{Y}_i$ = predicted mean response at branch i,

UL = coded value of unit load size,

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SU = coded value of setup time.

Confidence intervals for the predicted mean response at the stationary point were obtained using equation 4.23. The results are presented in Table 4.9. The confidence intervals are mutually exclusive, showing no overlapping of predicted values.

$$\hat{Y}\left(\hat{X}^{*}\right) \pm t_{1-\alpha/2,\upsilon}\,\mathrm{SE}\left[\hat{Y}\left(\hat{X}^{*}\right)\right] \tag{4.23}$$

where;

$\hat{Y}\left(\hat{X}^{*}\right)$ = the predicted response at the stationary point,

$\hat{X}^{*}$ = estimated values of regressor variables at the stationary point,

$t_{1-\alpha/2,\upsilon}$ = value from the Student's t distribution for a significance level $\alpha=0.05$ and ν degrees of freedom,

α = 0.05,

ν = error degrees of freedom,

$\mathrm{SE}\left[\hat{Y}\left(\hat{X}^{*}\right)\right]$ = standard error of the predicted response at the stationary point.

$$= \begin{cases} \hat{\sigma}_Y \sqrt{\hat{X}^{*}(D'D)^{-1}(\hat{X}^{*})'} & \text{for experiments 1 and 3} \\ \left| f'\left[\hat{Y}\left(\hat{X}^{*}\right)\right]\right|^{-1} \hat{\sigma}_Z \sqrt{\hat{X}^{*}(D'D)^{-1}(\hat{X}^{*})'} & \text{for experiments 2 and 4} \end{cases}$$

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Table 4.9. Confidence intervals for the predicted optimal mean response

Experiment	$\hat{Y}\left(\hat{X}^{*}\right)$	95% Confidence Interval	$\hat{UL}^{*}$	$\hat{SU}^{*}$
1	1,954,905	1,944,837 , 1,964,972	0.6378	0.6268
2	1,647,899	1,594,601 , 1,701,197	0.5	0.2
3	1,967,606	1,957,029 , 1,978,183	0.6175	0.6091
4	1,730,652	1,706,242 , 1,755,061	0.7	0.2

UL^{*}= coded value of unit load size at the stationary point.
SU^{*}= coded value of setup time at the stationary point.

Predictions from the metamodels offer a clear distinction between the scenarios described by the four branches. Since there is no overlapping of the confidence intervals, it can be concluded that the predicted mean responses are significantly different from each other. The optimum setting for regressor variables, representing the minimum expected total annual cost, is found at experiment 2.

For experiment 2, the optimal unit load size and setup time coded values are 0.5 and 0.2, respectively, as shown in Table 4.8. The setup value suggests a 45 percent reduction in setup time. The unit load size value suggests seven units for products 1 through 7, and 3.5 units for products 8 through 13. Since the number of images per panel for products 1 through 7 is an even number, it is not practical to force a unit load size of 7. In this case 6 and 8 were evaluated. The factor settings implied by experiment 2 include the use of small rolls of components at the pick and place machine (machine stoppages = -1) and small lot sizes (lot size = +1). Factors that were decided from the screening experiment include traditional inspection (quality) and breakdown maintenance.

The metamodel was evaluated at the modified factor settings (i.e., unit loads of size 6 versus 8 for products 1 through 7, and unit loads of size 3 versus 4 for products 8 through 13) to understand the impact on the total annual cost

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prediction. The maximum difference observed ($286) is negligible when compared to the annual cost figures presented in Table 4.8. This sensitivity of the response to changes in unit load size at the vicinity of the stationary point shows there is a collection rather than one setting for unit load size that optimizes the response. Therefore, the company has flexibility in operating conditions to achieve optimum response.

The results from twenty independent replications of the simulation model at the feasible stationary point are presented in Table 4.10. The average annualized cost was $1,736,067 with a standard deviation of 14,091. These results were used to determine the number of observations needed to estimate the true mean response at the stationary point with a confidence level (1-α) of 95 percent and a maximum relative error (γ) of 5 percent. The number of observations needed are estimated using equation 4.24.

Table 4.10. Replications at the estimated stationary point

1726629	1747379	1747734	1738990	1726639
1738612	1723641	1731353	1733981	1742187
1761489	1705611	1714731	1739189	1727024
1758168	1752466	1739750	1723256	1742506
Average :	1736067			
Std. Dev.:	14091			

$$N = \left[\frac{t_{(1-\alpha/2),(n-1)} \bullet S_y}{\gamma \bullet \overline{Y}} \right]^2 \tag{4.24}$$

where;

N = number of observations needed,

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n = sample size,

(n-1) = degrees of freedom,

$t_{(1-\alpha/2),(n-1)}$ = value from the Student's t distribution for a significance level of α=.05 and a maximum relative error of γ=.05,

y = annualized cost from simulation runs,

S_y = sample standard deviation,

γ = maximum relative error (0.05),

$\overline{Y}$ = estimated average annualized cost.

The number of observations needed is n=.1154. Therefore, the actual relative error of the estimated response is γ=0.36%, determined by substituting n in equation 4.24 and solving for γ.

Validation of the metamodel is performed by determining the statistical and practical significance of the difference between the predicted mean response and the simulated mean response at the feasible stationary point. The statistical significance can be determined by building a confidence interval for the difference between means using equation 4.25 [SNED80]. The results obtained are summarized in Table 4.11.

$$\left[\hat{Y}\left(\hat{X}^{\bullet}\right)-\overline{Y}\left(\hat{X}^{\bullet}\right)\right] \pm t_{df,(1-\alpha/2)}\sqrt{SE^{2}\left[\hat{Y}\left(\hat{X}^{\bullet}\right)\right]+S^{2}{}_{\overline{Y}}} \tag{4.25}$$

where;

$\hat{Y}\left(\hat{X}^{\bullet}\right)$ = the predicted mean response at the estimated stationary point $\hat{X}^{\bullet}$,

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$\overline{Y}\left(\hat{X}^{\bullet}\right)$ = the simulation mean response at the estimated stationary point $\hat{X}^{\bullet}$,

$SE^2\left[\hat{Y}\left(\hat{X}^{\bullet}\right)\right]$ = variance of the predicted mean response,

$S^2_{\overline{Y}}$ = variance of the simulation mean response,

n = number of independent replications used to compute the simulation-based estimate $\overline{Y}\left(\hat{X}^{\bullet}\right)$,

df = approximate degrees of freedom

$$= \frac{\left(SE^2\left[\hat{Y}\left(\hat{X}^{\bullet}\right)\right] + S^2_{\overline{Y}}\right)^2}{\left[\frac{SE^4\left[\hat{Y}\left(\hat{X}^{\bullet}\right)\right]}{df_{error}} + \frac{S^4_{\overline{Y}}}{n-1}\right]},$$

df_{error} = standard error degrees of freedom.

Table 4.11. Confidence interval for the difference between means

$\overline{Y}$ = 1,736,060	$\hat{Y}$ = 1,649,538
$S_{\overline{Y}} = 14091/\sqrt{20} = 3151$	$S_{\hat{Y}}$ = 30492
n = 20	df_{error} = 31
df = 32	
α = .05	
$t_{df,(1-\alpha/2)} \cong 2.042$	
95% CI : $(1{,}736{,}060-1{,}649{,}538) \pm 2.042\sqrt{30492^2 + 3151^2}$	
: [23926 , 149118]	

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The confidence interval for the difference between the predicted mean response and the mean response from simulation runs does not contain zero. Therefore, it is concluded that there is a statistically significant difference between the two. This result leads to the conclusion that the metamodel does not give valid predictions of the simulation response. However, of greater importance is the practical significance of the difference between the two means. The practical significance is measured by calculating the percentage of deviation from the mean response of simulation runs. This is determined using equation 4.26.

$$\%\ \text{deviation} = \left[\hat{Y}\left(\hat{X}^{\bullet}\right) - \bar{Y}\left(\hat{X}^{\bullet}\right)\right] \Big/ \bar{Y}\left(\hat{X}^{\bullet}\right) \tag{4.26}$$

The developed metamodel is used to measure differences between cell scenarios during the cell design and evaluation process. In this environment, deviations of less than 10% from the simulated mean response are not of practical significance. The observed difference represents a 4.9% deviation from the mean response of simulation runs. Therefore, it is concluded that the metamodel provides reasonable estimates of the simulation response and can be used to evaluate cell performance under other scenarios within the region of experimentation.

The optimum setting of regressor variables identified through the evaluation of the metamodel includes: traditional inspections, breakdown machine maintenance, small rolls at the automatic insertion machines, small lot size, unit load sizes of 6 for products 1 through 7 and 4 for products 8 through 13, and a 45 percent reduction in machine setup times. The expected cell annual cost of this setting based on simulation runs is $1,736.060.

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The expected cell annual cost at the optimum setting of regressor variables can be used to estimate the expected savings of implementing the cell design and operation scenario identified by the methodology. The expected savings are determined by comparing the average annual cost of the current cell scenario with the estimated annual cost under the optimum scenario, both estimates from simulation runs (since simulation results at the feasible stationary point are available). The results are presented in Table 4.17. The expected savings from the implementation of the design and operation strategies identified by the methodology are within $426,890 and $452,945 per year.

Table 4.17 Expected savings at the optimum cell scenario

Optimum setting per simulation	Current cell scenario	
$\bar{Y}\left(\hat{X}^{\bullet}\right) = 1{,}736{,}060$	$\bar{Y}\left(X_C\right) = 2{,}175{,}927$	
$S = 14091/\sqrt{20} = 3153$	$S = 14634/\sqrt{8} = 5174$	
$n = 20$	$n = 8$	
approximate df = 13*		
$\alpha = .05$		
$t_{df,(1-\alpha/2)} \cong 2.16$		
95% CI: $(2{,}175{,}927 - 1{,}736{,}060) \pm 2.16\sqrt{3151^2 + 5174^2}$		1111111
: [426,890 , 452,945]		

* see equation 4.25

The methodology proposed herein provides users with a systematic and methodical tool for cell design. It facilitates the design process and the allocation of resources by focusing on those cell design and operation issues with a significant impact on cell performance as identified by a screening experiment. The methodology incorporates response surface analysis to identify the setting(s) of cell design and operational factors that optimize cell performance. The availability of simulation tools with capabilities similar to those included in

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the generic cell simulator should motivate more companies to combine simulation and optimization techniques for better results.

4.7 Conclusions

The generic cell simulator provides a means of evaluating cell performance under a wide variety of cell scenarios. Cell performance is measured with a comprehensive annualized cost function which addresses many aspects of cell design and operation issues simultaneously.

The metamodels provide a simple way of performing "what-if" analysis in the vicinity of the optimum. Canonical and ridge analyses of the estimated response surface determines if there exists a collection rather than one optimum setting for cell design and operation issues. This results in greater flexibility in operating conditions. Validation of a metamodel is based on the statistical and practical significance of the difference between the predicted mean response and the simulation mean response. Validation in this research work was based on the practical significance of the deviation.

The methodology proposed herein provides users with a systematic and methodical tool for cell design. It facilitates the design process and the allocation of resources by focusing on those cell design and operation issues with a significant impact on cell performance as identified by a screening experiment. The methodology incorporates response surface analysis to identify the setting(s) of cell design and operational factors that optimize cell performance. The availability of simulation tools with capabilities similar to those included in the generic cell simulator should motivate more companies to combine simulation and optimization techniques for better results.

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CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

5.1 Summary of Research Work

This research work expands the boundaries in cellular manufacturing by developing a comprehensive simulation-based methodology for the design of world class manufacturing cells. It entailed the development of a comprehensive performance measure and the design of a generic cell simulator for the evaluation of cell performance.

The performance measure proposed by the author is an annualized cost function that consolidates ten cost components. It has the capability of reflecting the expected benefits of manufacturing cells. The annualized cost function is used to evaluate the impact of implementing world class manufacturing practices and to compare alternative cell scenarios.

The development of a generic cell simulator required the identification of common machine types, product flow strategies, and world class manufacturing practices at cells. This was achieved through plant visits and interviews with users of cellular manufacturing. Four manufacturing cells were studied which includes a total of 85 machines. These cells represent a wide variety of product types, cell size (number of machines and operators), and product flow strategies.

The proposed methodology combines engineering economics, design of experiments, simulation, analysis of variance, regression analysis, and response

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surface methodology. Engineering economics was used in the development of the cost function to account for the time value of money. Investments and training costs are annualized over the period of the study. Screening experiments and analysis of variance are incorporated to identify relevant cell design and operation issues. Simulation is key in the evaluation of performance under alternative cell scenarios. Metamodels estimating the response surface are developed with regression analysis applied to results from simulation experiments. Optimization of cell performance is achieved with a canonical and ridge analysis of the response surface or evaluation of the metamodel at multiple factor levels within the region of experimentation.

5.2 Conclusions

The proposed annualized cost function, as demonstrated by the case study, is sensitive to changes in cell throughput, product quality, manufacturing lead time, work-in-process and finished goods inventory levels, machine reliability, lot sizing, unit load size, machine setup times, space requirements, and operator assignment strategies. This performance measure considers training and investment costs required for the implementation of design and operation strategies. The annualized cost function consolidates a series of widely used performance measures into one comprehensive measure of performance. It provides a highly effective means to evaluate and understand differences between cell scenarios.

Plant visits allowed the identification of four common machine types. Manufacturing cells consists of common machine types plus highly specialized equipment, used in a specific type of industry. Product flow at cells can be divided into three stages: arrival to machine, machine processing, departure

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from machine. Flexibility to reflect a variety of product flow strategies within a cell requires modeling the three stages of product flow at each machine.

The generic cell simulator developed in this research work provides a mechanism of evaluating the impact of implementing world class manufacturing practices such as: quality at the source, quick machine changeovers, multiskilled operators, small lot sizes, small unit load sizes, autonomous and preventive maintenance, and finite inventory buffers. Development of a fully generic cell simulator is not practical due to the development time requirements. The cell simulator is highly modular with flexibility to reflect a wide variety of cell scenarios. It can be adapted by incorporating new modules to reflect specific user needs.

The methodology proposed herein provides users of cellular manufacturing with a systematic and methodical tool for the design and evaluation of cells. It allows management to focus on the relevant design and operation issues as identified by the screening experiment. The methodology identifies the optimum cell design and operation strategies with response surface analysis. As demonstrated by the case study, companies can benefit from improved performance and better profit margins.

5.3 Recommendations for Future Research Work

The following recommendations for future research are provided.

1. Development of a database environment with a user friendly front-end to ensure data integrity. This improved data structure facilitates the eventual linking of the simulation tool to the plant's MRP-II database.
2. Integration of statistical tools to achieve the following tasks automatically:

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- Design of needed screening experiments,
- Design of needed response surface experiments,
- Analysis of screening experiment results,
- Evaluation of the response surface and identification of optimal factor settings.

3. Currently, the core of the simulation model is based on Slam II. A future project could involve the development of an object-oriented environment for event handling. This eliminates the dependency on a vendor-specific software system.
4. The lateness cost component was highly sensitive to some of the combinations of design and operation factor levels within a given experiment. The magnitude of this component at those combinations of factor levels was as much as ten times its magnitude at other combinations of factor levels. This behavior was responsible for increased variability in the response and error variance. It adds complexity to the process of estimating the response surface. The lateness cost should be studied further to determine the degree at which it complies to management expectations and reflects the reality of manufacturing operations.

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APPENDICES

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APPENDIX A SLAM II SIMULATION CODE

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```
      PROGRAM MAIN
      DIMENSION NSET(600000)
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
      COMMON QSET(600000)

      COMMON/UCOM79/NFACT,IEXP

      EQUIVALENCE(NSET(1),QSET(1))
      NNSET=600000
      NCRDR=5
      NPRNT=6
      NTAPE=7
c      OPEN(UNIT=10,FILE='dates/tput.dat',STATUS='NEW')
      OPEN(UNIT=11,FILE='dates/exp30.dat',STATUS='OLD')
      OPEN(UNIT=12,FILE='dates/trac30.dat',STATUS='NEW')
      OPEN(UNIT=13,FILE='dates/fact30.dat',STATUS='NEW')
      READ (11,*) NFACT
      IEXP=0
      CALL SLAM
c      CLOSE(10)
      CLOSE(11)
      CLOSE(12)
      CLOSE(13)
      STOP
      END
C
C ********************************************************************
C
      SUBROUTINE INTLC
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NAREC(50),
     1 NONPSC(50),NBUFF(50),NBUTYP(50),NHOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IOL(40),ISI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLRSC(50),NBLKNA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/NALERN,NAVNT,OPNDT,NOTNA,NALELD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHOP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTUCR(40,50),TOTQA,TQANUL,PUCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRONMD,TRMXP1,TRMXP2,TRMXP3
      COMMON/UCOM17/TRORJP(40),TRONWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNM,TSELNM
C
      COMMON/UCOM19/NSLDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSUNMD(50),SUNMP1(50),SUNMP2(50),SUNMP3(50)
      COMMON/UCOM21/NSENMD(50),SENMP1(50),SENMP2(50),SENMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
C
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      COMMON/UCOM26/NP3,NP4
      COMMON/UCOM27/NOP
      common/ucomd/iffl

      COMMON/UCOM28/SUSCP,SUSCF,SENMP,SUNMP
      COMMON/UCOM29/MINITR,MDESTR
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM31/NLONG(10),NUNITS(50)
c
      COMMON/UCOM32/EINSUP(50)
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
      COMMON/UCOM34/WOROP(50,16),WORNA(50,40),PERCOP(50,16)
     1,PERCNA(50,16)
C
```



```
      COMMON/UCOM35/IBLKSC(50),NNBLK(50),NBLK(50,50)
      COMMON/UCOM36/TRAIN,NCIN
      COMMON/UCOM37/TBPDIS(50),TBPP1(50),TBPP2(50),TBPP3(50),NBUKD(50)
      COMMON/UCOM38/TTRDIS(50),TTRP1(50),TTRP2(50),TTRP3(50),SCREN
      COMMON/UCOM39/TOTNT
      COMMON/UCOM40/REMPT(50)
      COMMON/UCOM41/NRENEW(50)
      COMMON/UCOM42/NTL(40,300),TL(40,300),NL(40,50),NTL(40,50)
      COMMON/UCOM43/NNXDSC,NXNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTH(50)
      COMMON/UCOM45/WAITTM(50)
      COMMON/UCOM46/NAUTOD(50),AUTOP1(50),AUTOP2(50),AUTOP3(50),TOTAUT
      COMMON/UCOM47/NEXAUT(50),DAYLTH
      COMMON/UCOM48/NAUTO
      COMMON/UCOM49/PGICC(40),CR
      COMMON/UCOM50/RA,CUSLT,NLO,DPCLO,NLENUM
      COMMON/UCOM51/SUMWIP(40,50),NOMWIP(40,50)
      COMMON/UCOM52/WIP(40,50)
      COMMON/UCOM54/NYRS,SUINV,PNINV,KEINV,QAINV,RELAY,PSPACE
      COMMON/UCOM55/WQ,OMO,NSUCRW,SUMO,NSUSC,SUTRAI,SUTWRK,NMEEKS,AIR
      COMMON/UCOM56/PNTRAI,PNCOST,SMO,PC(50),NPENP
      COMMON/UCOM57/TMWK(40,50),QAMO,NWKC(40,50),QATRAI
      COMMON/UCOM58/POINV(40),MAXPO(40),POCAP(40),POCC(40)
      COMMON/UCOM59/NCOPO(40)
      COMMON/UCOM60/IPNCD(50),IREP(50)
      COMMON/UCOM61/TBRDIS(50),TBRP1(50),TBRP2(50),TBRP3(50)
      COMMON/UCOM62/TTREP(50),TREP1(50),TREP2(50),TREP3(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM64/CAPAV(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM66/TWORK
      COMMON/UCOM67/NEXC(50)
      COMMON/UCOM68/ASKCO(50),RELCO(50)
      COMMON/UCOM69/ASKCA(50),RELCA(50)
      COMMON/UCOM70/TRIP1,TRIP2
      COMMON/UCOM71/TCFLAG
      COMMON/UCOM72/IPAN(40),CAP(50,40),REMCAP(50,40),NUMPAN,CYCLET(50)
      COMMON/UCOM73/LOADD(50),P1LD(50),P2LD(50),P3LD(50)
      COMMON/UCOM74/TRPUT
      COMMON/UCOM75/NUMUL(40,50)
      COMMON/UCOM76/NREL(40,500)
      COMMON/UCOM77/ULFLG(50)
      COMMON/UCOM78/TMPWK
      COMMON/UCOM79/NFACT,IEXP
      COMMON/UCOM80/NDMO
      COMMON/UCOM81/FACT(6)
      COMMON/UCOM82/MAXN
      COMMON/UCOM83/NWAIT(40)
      COMMON/UCOM84/NLEAVE
      COMMON/UCOM85/DELAY
      COMMON/UCOM86/NNN
      COMMON/UCOM87/SHIFT
      COMMON/UCOM88/EODFLG,IPNUMB
      COMMON/UCOM89/NRELPG
C
C     IPNUMB AND EODFLG ARE USED TO SIGNAL END OF DEMAND FILE. IF EODFLG
C     IS ONE IT MEANS THE END OF DEMAND FILE HAS BEEN REACHED. EODFLG CHANGES
C     TO ONE WHEN IPNUMB (THE PART NUMBER READ FROM THE DEMAND FILE)
C     IS ZERO.
C
      EODFLG=0
      IPNUMB=1
C
C     NRELPG IS A VARIABLE USED AT DEPART TO CONTROL THE RELEASE OF LOTS
C     AND UNIT LOADS. IF NRELPG=1 IT MEANS ALL UNIT LOADS OF GIVEN LOT
C     HAVE NOT BEEN RELEASED.
C
      NRELPG=1

      DPCLO=0
      TOTAUT=0
      NNN=0
      DELAY=0
      NLEAVE=0
      NDMO=0
      TMPWK=0
      TRPUT=0
      NUMPAN=0
      TWORK=0
      QAMO=0
      QATRAI=0
      NYRS=0
      SUINV=0
      PNINV=0
      KEINV=0
      QAINV=0
      RELAY=0
      PSPACE=0
      WQ=0
      OMO=0
      NSUCRW=0
      SUTRAI=0
```

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```
      SUTWRK=0
      NWEEKS=0
      AIR=0
      PNTRAI=0
      PNCOST=0
      BNO=0
      NPEMP=0

      DO 2 I=1,50
      IREP(I)=0
      IPMCD(I)=0
      LASTWA(I)=0
      TLASTP(I)=0
      LASLOT(I)=0
      NBLKSC(I)=0
      NBLKWA(I)=0
      XINBUF(I)=0
      ASKCO(I)=0
      ASKCA(I)=0
      RELCO(I)=0
      RELCA(I)=0
      FULLDQ(I)=0
      NRNEXT(I)=0
      NUNITS(I)=0
      CYCLET(I)=0
      ULFLG(I)=0
      COCOST(I)=0
      WAXCO(I)=0
2     CONTINUE

      DO 3 I=1,50
      DO 3 J=1,60
      CAP(I,J)=0
      REMCAP(I,J)=0
3     CONTINUE

      DO 4 I=1,60
      DO 4 J=1,50
      TOTSCR(I,J)=0
      TRWK(I,J)=0
      WIP(I,J)=0
      SUMWIP(I,J)=0
      NOSWIP(I,J)=0
      NWKC(I,J)=0
      NEWUL(I,J)=0
      ICOTYP(I,J)=0
      IDEPUL(I,J)=0
4     CONTINUE

      DO 5 I=1,10
5     NLONG(I)=0

      DO 6 I=1,60
      DO 6 J=1,500
      LSCRAP(I,J)=0
      NREL(I,J)=0
6     CONTINUE

      DO 7 I=1,60
      SCRAP(I)=0
      IPAN(I)=0
      NWAIT(I)=0
7     CONTINUE

      IEXP=IEXP+1
      READ (11,*) (FACT(J),J=1,NFACT)
      WRITE(6,8) IEXP,(FACT(J),J=1,NFACT)
8     FORMAT(1X,'IEXP=',I3,1X,6F10.5)
C
      IF (FACT(6).EQ.-1) THEN
         OPEN(UNIT=9,FILE='datos/dem01.dat',STATUS='OLD')
         REWIND(9)
         GO TO 10
      ENDIF

      IF (FACT(6).EQ.1) THEN
         OPEN(UNIT=9,FILE='datos/dem02.dat',STATUS='OLD')
         REWIND(9)
         GO TO 10
      ENDIF

      WRITE(6,9)
9     FORMAT(1X,'ERROR:DID NOT OPEN A DEMAND FILE')

C
C     MTYPE=  MACHINE TYPE (1-9)
C     NOPCD=0:NO OP. 1:NOT NEEDED WHILE MACHINE RUNS 2:NEEDED WHILE MACH. RUNS
C     NSUCD=0:DOES NOT NEEDED TO BE SETUP  1:NEEDS TO BE SETUP
C     NCAP -  NUMBER OF UNITS RUNNING SIMULTANEOUSLY
C     IPMCD=0:NO BREAKDOWNS AND PM   1:BREAKDOWNS AND PM
C     IREP =0:NO REPLENISHMENT  1:NEEDS TO BE REPLENISHED (MACHINE STOPS)
C     ASKCO=0:DO NOT REQUEST FOR CONTAINERS  1:REQUEST FOR CONTAINERS
```



```
C     RELCO=0:DO NOT RELEASE CONTAINERS  1:RELEASE CONTAINERS
C
10    IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/mach01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/mach02.dat',STATUS='OLD')
      ENDIF

      READ (8,*) NMACH,MAXN
      DO 11 I=1,NMACH
         READ (8,*) MNUM,MTYPE(MNUM),NOPCD(MNUM),NSUCD(MNUM),NCAP(MNUM),
     1   IREP(MNUM)
11    CONTINUE
      CLOSE(8)
C
      DO 13 I=1,MAXN
      NPARLL(I)=0
      DO 12 J=1,10
12    NRES(J,I)=0
13    CONTINUE

C      OPEN(UNIT=8,FILE='partes01.dat',STATUS='OLD')
C14    READ(8,*) MNUM
C      IF (MNUM.EQ.0) THEN
C         GO TO 18
C      ELSE
C         READ(8,*) NPARLL(MNUM),(NRES(I,MNUM),I=1,NPARLL(MNUM))
C         DO 16 I=1,NPARLL(MNUM)
C15       READ(8,*) IPN,MACHN,NPROCD(IPN,MACHN),PROP1(IPN,MACHN),
C    1              PROP2(IPN,MACHN),PROP3(IPN,MACHN)
C         IF (IPN.NE.0) THEN
C            GO TO 15
C         ELSE
C            GO TO 16
C         ENDIF
C16       CONTINUE
C         GO TO 14
C      ENDIF
C18    CLOSE(8)
C
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/mqcd01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/mqcd02.dat',STATUS='OLD')
      ENDIF

      DO 19 I=1,NMACH
         READ(8,*) MNUM,MQCD(MNUM)
19    CONTINUE
      CLOSE(8)
C
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/masc01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/masc02.dat',STATUS='OLD')
      ENDIF

      DO 20 I=1,NMACH
         READ(8,*) MNUM,MAXRSC(MNUM)
20    CONTINUE
      CLOSE(8)
C
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/cius01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/cius02.dat',STATUS='OLD')
      ENDIF

      DO 22 I=1,NMACH
         READ (8,*) MNUM,ASKCO(MNUM),RELCO(MNUM),ASKCA(MNUM),RELCA(MNUM)
22    CONTINUE
      CLOSE(8)
C
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/pmcd01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/pmcd02.dat',STATUS='OLD')
      ENDIF

      DO 24 I=1,MAXN
         READ (8,*) MNUM,IPMCD(MNUM)
24    CONTINUE
      CLOSE(8)
C
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/mdsc01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/mdsc02.dat',STATUS='OLD')
      ENDIF

      DO 25 I=1,NMACH
         READ(8,*) MNUM,MDEPSC(MNUM)
```

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```
25    CONTINUE
      CLOSE(8)
C
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/mbuf01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/mbuf02.dat',STATUS='OLD')
      ENDIF

      DO 30 I=1,NMACH
         READ(8,*) MNUM,MSUPP(MNUM)
30    CONTINUE
      CLOSE(8)
C
      IF (FACT(6).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/mout01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/mout02.dat',STATUS='OLD')
      ENDIF

      DO 35 I=1,NRAW
         READ(8,*) MNUM,MSOTYP(MNUM)
35    CONTINUE
      CLOSE(8)
C
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/lay01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/lay02.dat',STATUS='OLD')
      ENDIF

      READ(8,*) NELAY,FSPACE
40    READ(8,*) IFROM,ITO,D
      IF (IFROM .NE. 0) THEN
         DIST(IFROM,ITO)=D
         GO TO 40
      ENDIF
      CLOSE(8)
C
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/mhop01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/mhop02.dat',STATUS='OLD')
      ENDIF

      READ(8,*) NEINV,NDMO
50    READ(8,*) IFROM,ITO,NN
      IF (IFROM .NE. 0) THEN
         MHOP(IFROM,ITO)=NN
         GO TO 50
      ENDIF
      CLOSE(8)
C
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/conv01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/conv02.dat',STATUS='OLD')
      ENDIF

60    READ(8,*) IFROM,ITO,S,C
      IF (IFROM .NE. 0) THEN
         SPEED(IFROM,ITO)=S
         CLENGH(IFROM,ITO)=C
         GO TO 60
      ENDIF
      CLOSE(8)
C
      IF (FACT(4).EQ.1 .AND. FACT(5).EQ.1) THEN
         OPEN(UNIT=8,FILE='datos/cont01.dat',STATUS='OLD')
         GO TO 64
      ENDIF

      IF (FACT(4).EQ.1 .AND. FACT(5).EQ.0) THEN
         OPEN(UNIT=8,FILE='datos/cont05.dat',STATUS='OLD')
         GO TO 64
      ENDIF

      IF (FACT(4).EQ.1 .AND. FACT(5).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/cont02.dat',STATUS='OLD')
         GO TO 64
      ENDIF

      IF (FACT(4).EQ.1 .AND. FACT(5).EQ. -0.5710) THEN
         OPEN(UNIT=8,FILE='datos/cont02.dat',STATUS='OLD')
         GO TO 64
      ENDIF

      IF (FACT(4).EQ.1 .AND. FACT(5).EQ. 0.125) THEN
         OPEN(UNIT=8,FILE='datos/cont10.dat',STATUS='OLD')
         GO TO 64
      ENDIF
```



```
      IF (FACT(4).EQ.1 .AND. FACT(5).EQ. 0.5625) THEN
         OPEN(UNIT=8,FILE='datos/cont08.dat',STATUS='OLD')
         GO TO 64
      ENDIF

      IF (FACT(4).EQ.1 .AND. FACT(5).EQ. 0.6563) THEN
         OPEN(UNIT=8,FILE='datos/cont09.dat',STATUS='OLD')
         GO TO 64
      ENDIF

      IF (FACT(4).EQ.-1 .AND. FACT(5).EQ.1) THEN
         OPEN(UNIT=8,FILE='datos/cont03.dat',STATUS='OLD')
         GO TO 64
      ENDIF

      IF (FACT(4).EQ.-1 .AND. FACT(5).EQ.0) THEN
         OPEN(UNIT=8,FILE='datos/cont06.dat',STATUS='OLD')
         GO TO 64
      ENDIF

      IF (FACT(4).EQ.-1 .AND. FACT(5).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/cont04.dat',STATUS='OLD')
         GO TO 64
      ENDIF

      WRITE(6,63)
63    FORMAT(1X,'ERROR:DID NOT OPEN A CONTAINER FILE')
      STOP

64    READ(8,*) NCONT
65    READ(8,*) IPN,MACHN,ICOTYP(IPN,MACHN)
      IF (IPN.NE.0) THEN
         GO TO 65
      ENDIF
      CLOSE(8)
C
      OPEN(UNIT=8,FILE='datos/coco01.dat',STATUS='OLD')
70    READ(8,*) I,COCOST(I)
      IF (I.NE.0) THEN
         GO TO 70
      ENDIF
      CLOSE(8)
C
      OPEN(UNIT=8,FILE='datos/coca01.dat',STATUS='OLD')
75    READ(8,*) IPN,1,ICOCAP(IPN,1)
      IF (IPN.NE.0) THEN
         GO TO 75
      ENDIF
      CLOSE(8)
C
      OPEN(UNIT=8,FILE='datos/carte01.dat',STATUS='OLD')
      READ(8,*) CACOST
      CLOSE(8)
C
      OPEN(UNIT=8,FILE='datos/walk.dat',STATUS='OLD')
      READ(8,*) WALKLD
      READ(8,*) WALKEN
      CLOSE(8)
C
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/qine01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/qine02.dat',STATUS='OLD')
      ENDIF

80    READ(8,*) MNUM
      IF (MNUM .NE. 0) THEN
C
         READ(8,*) NSUDIS(MNUM),SUP1(MNUM),SUP2(MNUM),SUP3(MNUM)
         READ(8,*) NSLDIS(MNUM),SEP1(MNUM),SEP2(MNUM),SEP3(MNUM)
         READ(8,*) NSUNMD(MNUM),SUNMP1(MNUM),SUNMP2(MNUM),SUNMP3(MNUM)
         READ(8,*) NSENMD(MNUM),SENMP1(MNUM),SENMP2(MNUM),SENMP3(MNUM)
C
         GO TO 80
      ENDIF
      CLOSE(8)
C
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/qrte01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/qrte02.dat',STATUS='OLD')
      ENDIF

90    READ(8,*) IPN,MNUM,SC,RE
      IF (IPN .NE. 0) THEN
         SCRAPP(IPN,MNUM)=SC
         REWKP(IPN,MNUM)=RE
         GO TO 90
      ENDIF
      CLOSE(8)
C
      OPEN(UNIT=8,FILE='datos/qrtoen.dat',STATUS='OLD')
```


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```
      READ(8,*) RESCP
      READ(8,*) SUSCP
      READ(8,*) SENWP
      READ(8,*) SUNWP
      CLOSE(8)
c
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/opas01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/opas02.dat',STATUS='OLD')
      ENDIF

      READ(8,*) NOP
      DO 105 I=1,NOP
         NM(I)=0
         READ(8,*) (L(k), K=1,MAXM)
c             OPERATOR I ASSIGNED TO MACH k
c             MACH k IS THE NM(I)TH MACH ASSIGNED TO OP I
         DO 100 K=1,MAXM
            IF (L(K) .EQ. 1) THEN
               NM(I)=NM(I)+1
               IOP(K)=I
               MACH(NM(I),I)=K
            ENDIF
100      CONTINUE
105   CONTINUE
      CLOSE(8)
c
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/opcd01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/opcd02.dat',STATUS='OLD')
      ENDIF

      DO 110 I=1,NOP
         READ(8,*) IOPER, IOPCD(IOPER)
110   CONTINUE
      CLOSE(8)
c
      OPEN(UNIT=8,FILE='datos/mdr101.dat',STATUS='OLD')
      READ(8,*) MINITR,MDESTR
      CLOSE(8)

      OPEN(UNIT=8,FILE='datos/parts.dat',STATUS='OLD')
      READ(8,*) NPN,NUMFAM,NLOTS
      CLOSE(8)
c
      IF (FACT(6).EQ.-1) THEN
         GO TO 119
      ENDIF

      IF (FACT(6).EQ.0) THEN
         OPEN(UNIT=8,FILE='datos/exsu03.dat',STATUS='OLD')
         GO TO 114
      ENDIF

      IF (FACT(6).EQ.1) THEN
         OPEN(UNIT=8,FILE='datos/exsu02.dat',STATUS='OLD')
         GO TO 114
      ENDIF

      IF (FACT(6).EQ.0.5) THEN
         OPEN(UNIT=8,FILE='datos/exsu04.dat',STATUS='OLD')
         GO TO 114
      ENDIF

      IF (FACT(6).EQ.0.75) THEN
         OPEN(UNIT=8,FILE='datos/exsu05.dat',STATUS='OLD')
         GO TO 114
      ENDIF

      IF (FACT(6).EQ.0.6375) THEN
         OPEN(UNIT=8,FILE='datos/exsu10.dat',STATUS='OLD')
         GO TO 114
      ENDIF

      IF (FACT(6).EQ.0.25) THEN
         OPEN(UNIT=8,FILE='datos/exsu06.dat',STATUS='OLD')
         GO TO 114
      ENDIF

      IF (FACT(6).EQ.0.20) THEN
         OPEN(UNIT=8,FILE='datos/exsu07.dat',STATUS='OLD')
         GO TO 114
      ENDIF

      IF (FACT(6).EQ. -.2375) THEN
         OPEN(UNIT=8,FILE='datos/exsu11.dat',STATUS='OLD')
         GO TO 114
      ENDIF

112   WRITE(6,113)
```



```
113   FORMAT(1X,'ERROR:DID NOT OPEN AN EXSU FILE')
      STOP

114   READ(8,*) SUINV
115   READ(8,*) IPN,NMA
      IF (IPN.NE.0) THEN
         DO 116 I=1,NMA
         READ(8,*) MACHN,EXTDIS(IPN,MACHN),EXTP1(IPN,MACHN),
     1              EXTP2(IPN,MACHN),EXTP3(IPN,MACHN)
116      CONTINUE
         GO TO 115
      ENDIF
      CLOSE(8)
c
119   IF (FACT(6).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/ineu01.dat',STATUS='OLD')
         GO TO 120
      ENDIF

      IF (FACT(6).EQ.0) THEN
         OPEN(UNIT=8,FILE='datos/ineu03.dat',STATUS='OLD')
         GO TO 120
      ENDIF

      IF (FACT(6).EQ.1) THEN
         OPEN(UNIT=8,FILE='datos/ineu02.dat',STATUS='OLD')
         GO TO 120
      ENDIF

      IF (FACT(6).EQ.0.5) THEN
         OPEN(UNIT=8,FILE='datos/ineu04.dat',STATUS='OLD')
         GO TO 120
      ENDIF

      IF (FACT(6).EQ.0.75) THEN
         OPEN(UNIT=8,FILE='datos/ineu05.dat',STATUS='OLD')
         GO TO 120
      ENDIF

      IF (FACT(6).EQ.0.6375) THEN
         OPEN(UNIT=8,FILE='datos/ineu10.dat',STATUS='OLD')
         GO TO 120
      ENDIF

      IF (FACT(6).EQ.0.25) THEN
         OPEN(UNIT=8,FILE='datos/ineu06.dat',STATUS='OLD')
         GO TO 120
      ENDIF

      IF (FACT(6).EQ.0.20) THEN
         OPEN(UNIT=8,FILE='datos/ineu07.dat',STATUS='OLD')
         GO TO 120
      ENDIF

      IF (FACT(6).EQ. -.2375) THEN
         OPEN(UNIT=8,FILE='datos/ineu11.dat',STATUS='OLD')
         GO TO 120
      ENDIF

120   READ(8,*) IPN,NMA
      IF (IPN.NE.0) THEN
        DO 121 I=1,NMA
121     READ(8,*) MACHN,INDIS(IPN,MACHN),P1IN(IPN,MACHN),
     1              P2IN(IPN,MACHN),P3IN(IPN,MACHN)
        GO TO 120
      ENDIF
      CLOSE(8)

      OPEN(UNIT=8,FILE='datos/mtyp3.dat',STATUS='OLD')
125   READ(8,*) MNUM
      IF (MNUM.NE.0) THEN
         DO 126 I=1,NUMFAM
126      READ(8,*) IFAMLY,CAP(MNUM,IFAMLY)
         READ(8,*) LOADD(MNUM),P1LD(MNUM),P2LD(MNUM),P3LD(MNUM)
         READ(8,*) CYCLET(MNUM)
         GO TO 125
      ENDIF
      CLOSE(8)
c
      OPEN(UNIT=8,FILE='datos/mtyp2.dat',STATUS='OLD')
128   READ(8,*) IPN,NMA
      IF (IPN.NE.0) THEN
         DO 129 I=1,NMA
129      READ(8,*) MNUM,CAP(MNUM,IPN)
         GO TO 128
      ENDIF
      CLOSE(8)
c
      OPEN(UNIT=8,FILE='datos/family.dat',STATUS='OLD')
      DO 130 I=1,NPN
130   READ(8,*) IPN,IFAM(IPN)
      CLOSE(8)
```

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```
C
      IF (FACT(1).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/pnrt01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/pnrt02.dat',STATUS='OLD')
      ENDIF

135   READ(8,*) IPN,N
      IF (IPN .NE. 0) THEN
         MACHS(IPN)=N
         DO 136 I=1,MACHS(IPN)
         READ(8,*) MACHN,NPROCD(IPN,MACHN),PROP1(IPN,MACHN),
     1             PROP2(IPN,MACHN),PROP3(IPN,MACHN)
         NSEQ(I,IPN)=MACHN
         IF(NPROCD(IPN,NNUM).EQ.9) THEN
            READ(8,*) PROLOM(NNUM),PROOPP(NNUM)
         ENDIF
136      CONTINUE
         GO TO 135
      ENDIF
      CLOSE(8)
C
      IF (FACT(4).EQ.1 .AND. FACT(5).EQ.1) THEN
         OPEN(UNIT=8,FILE='datos/ul01.dat',STATUS='OLD')
         GO TO 140
      ENDIF

      IF (FACT(4).EQ.1 .AND. FACT(5).EQ.0) THEN
         OPEN(UNIT=8,FILE='datos/ul05.dat',STATUS='OLD')
         GO TO 140
      ENDIF

      IF (FACT(4).EQ.1 .AND. FACT(5).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/ul02.dat',STATUS='OLD')
         GO TO 140
      ENDIF

      IF (FACT(4).EQ.1 .AND. FACT(5).EQ.-.5710) THEN
         OPEN(UNIT=8,FILE='datos/ul07.dat',STATUS='OLD')
         GO TO 140
      ENDIF

      IF (FACT(4).EQ.1 .AND. FACT(5).EQ. 0.125) THEN
         OPEN(UNIT=8,FILE='datos/ul10.dat',STATUS='OLD')
         GO TO 140
      ENDIF

      IF (FACT(4).EQ.1 .AND. FACT(5).EQ. 0.5625) THEN
         OPEN(UNIT=8,FILE='datos/ul08.dat',STATUS='OLD')
         GO TO 140
      ENDIF

      IF (FACT(4).EQ.1 .AND. FACT(5).EQ. 0.6563) THEN
         OPEN(UNIT=8,FILE='datos/ul09.dat',STATUS='OLD')
         GO TO 140
      ENDIF

      IF (FACT(4).EQ.-1 .AND. FACT(5).EQ.1) THEN
         OPEN(UNIT=8,FILE='datos/ul03.dat',STATUS='OLD')
         GO TO 140
      ENDIF

      IF (FACT(4).EQ.-1 .AND. FACT(5).EQ.0) THEN
         OPEN(UNIT=8,FILE='datos/ul06.dat',STATUS='OLD')
         GO TO 140
      ENDIF

      IF (FACT(4).EQ.-1 .AND. FACT(5).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/ul04.dat',STATUS='OLD')
         GO TO 140
      ENDIF

      WRITE(6,139)
139   FORMAT(1X,'ERROR:DID NOT OPEN A UNIT LOAD FILE')
      STOP

140   READ(8,*) IPN,IU,IE
      IF (IPN .NE. 0) THEN
         IUL(IPN)=IU
         IEI(IPN)=IE
146      READ(8,*) MACHN,IDEP
         IF (MACHN.NE.0) THEN
            IDEPUL(IPN,MACHN)=IDEP
            NEWUL(IPN,MACHN)=IDEPUL(IPN,MACHN)
            GO TO 146
         ENDIF
         GO TO 140
      ENDIF
150   CLOSE(8)
C
      DO 152 J=1,MAXN
152   ISCHDP(J)=0
```



```
C
C      OPEN(UNIT=8,FILE='datos/schedp01.dat',STATUS='OLD')
C153   READ(8,*) MACHN,ISCHDP(MACHN)
C      IF (MACHN.NE.0) THEN
C         GO TO 153
C      ENDIF
C      CLOSE(8)
C
C     READ INFORMATION ON CONTAINERS TO STORE FINISHED GOODS
C
C      OPEN(UNIT=8,FILE='datos/fgco01.dat',STATUS='OLD')
C      DO 155 I=1,NPN
C      READ(8,*) PN,FGCAP(I),FGCC(I)
C155   CONTINUE
C      CLOSE(8)
C
C
C
c      OPEN(UNIT=8,FILE='datos/tradqa01.dat',STATUS='OLD')
c      READ(8,*) SAMPLP
c      READ(8,*) QAINSD,QAP1,QAP2,QAP3
c      DO 158,J=1,NPN
c      READ(8,*) IPN,TNORJP(IPN),TRDRMP(IPN)
c158   CONTINUE
c      READ(8,*) TRDRMD,TRMRP1,TRMRP2,TRMRP3
c      CLOSE(8)
C
      OPEN(UNIT=8,FILE='datos/pnco02.dat',STATUS='OLD')
159   READ(8,*) IPN,NN
      IF (IPN.NE.0) THEN
         NPG=NN+1
         DO 160 I=1,NPG
160      READ(8,*) MACHN,PNCOST(IPN,MACHN)
         GO TO 159
      ENDIF
      READ(8,*) CR
      CLOSE(8)
C
C     READ DATA ON BREAKDOWNS
C
      IF (FACT(2).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/brck01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/brck02.dat',STATUS='OLD')
      ENDIF

      READ (8,*)  BRKDSC
161   READ (8,*)  NNUM
      IF (NNUM.EQ.0) THEN
         GO TO 163
      ELSE
         READ(8,*) TBFDIS(NNUM),TBFP1(NNUM),TBFP2(NNUM),TBFP3(NNUM)
         GO TO 161
      ENDIF
163   CLOSE(8)
C
C     READ DATA ON REPAIR TIMES
C
      IF (FACT(2).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/rep01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/rep02.dat',STATUS='OLD')
      ENDIF

165   READ (8,*) NNUM
      IF (NNUM.EQ.0) THEN
         GO TO 170
      ELSE
         READ(8,*) TTRDIS(NNUM),TTRP1(NNUM),TTRP2(NNUM),TTRP3(NNUM)
         GO TO 165
      ENDIF
170   CLOSE(8)
C
C     READ DATA ON REPLENISHMENTS
C
      IF (FACT(3).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/mato01.dat',STATUS='OLD')
      ELSE
         OPEN(UNIT=8,FILE='datos/mato02.dat',STATUS='OLD')
      ENDIF

172   READ (8,*) NNUM
      IF (NNUM.EQ.0) THEN
         GO TO 175
      ELSE
         READ(8,*) TBRDIS(NNUM),TBRP1(NNUM),TBRP2(NNUM),TBRP3(NNUM)
         READ(8,*) TTREP(NNUM),TREP1(NNUM),TREP2(NNUM),TREP3(NNUM)
         GO TO 172
      ENDIF
175   CLOSE(8)

C     SCHEDULE THE FIRST MACHINE REPLENISHMENT.
```

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      DO 176 I=1,MAXM
      IF (IREP(I).EQ.1) THEN
         RT=0.0
         A(1)=0
         A(2)=0
         A(3)=0
         A(4)=0
         A(5)=0
         A(6)=0
         A(7)=I
         A(8)=0
         A(9)=0
         A(10)=0
         A(11)=0
         A(12)=0
         A(13)=0

         CALL NEXREP(I,RT)
         CALL SCHDL(22,RT,A)
      ENDIF
176   CONTINUE

C
C     SCHEDULE THE FIRST MACHINE BREAKDOWN AND REPLENISH. FOR EACH MACHINE

      IF (BRKDOC.EQ.1) THEN
C
C        BREAKDOWNS BASED ON CALENDAR TIME
C

         A(1)=0
         A(2)=0
         A(3)=0
         A(4)=0
         A(5)=0
         A(6)=0
         A(7)=0
         A(8)=0
         A(9)=0
         A(10)=0
         A(11)=0
         A(12)=0
         A(13)=0

         DO 177 I=1,MAXM
         IF (IPMCD(I).EQ.1) THEN
            BT=0.0
            A(7)=I
            CALL BREAKS(I,BT)
            CALL SCHDL(10,BT,A)
         ENDIF
177      CONTINUE
C
      ELSE
C
C        BREAKDOWNS BASED ON UP TIME
C
         DO 178 I=1,MAXM
         IF (IPMCD(I).EQ.1) THEN
            BT=0.0
            CALL BREAKS(I,BT)
            BKNEXT(I)=BT
         ENDIF
178      CONTINUE
C
      ENDIF
C
C     INITIALIZE THE NUMBER OF BREAKDOWNS AT EACH MACHINE.
C
      DO 179 I=1,MAXM
      NBRKM(I)=0
      NBRKD(I)=0
      REMPT(I)=0
      UPTIME(I)=0
      TOTUP(I)=0
      START(I)=0
      BLETH(I)=0
      WAITTM(I)=0
179   CONTINUE
C
C     INITIALIZE TOTAL REPAIR TIME
C
      TOTRT=0.0
C
C     DELAY REPRESENTS THE ADDITIONAL TIME NEEDED TO COMPLETE THE SCRAPPED
C     UNITS IN A GIVEN LOT SUCH THAT IT CAN BE SHIPPED COMPLETE.
C
      OPEN(UNIT=8,FILE='datos/cestf.dat',STATUS='OLD')
      READ(8,*) RA
      READ(8,*) CUSLT
      READ(8,*) RLENGH
      READ(8,*) TTCLR
      READ(8,*) NPEMP
```

```
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      READ(8,*) NWEEKS
      READ(8,*) THPWK
      READ(8,*) NYRS
      READ(8,*) AIR
      READ(8,*) DELAY
      READ(8,*) DAYLTH
      CLOSE(8)
C
C     SCHEDULE THE RELEASE OF THE FIRST LOT
C
      READ(9,*) IPNUMB,LOTNUM,LOTSIZ,IRELDA,IDUEDA
      WRITE(6,100) IPNUMB,LOTNUM,LOTSIZ,IRELDA,IDUEDA
100   FORMAT(1X,5I10)
C
      A(1)=IRELDA
      A(2)=IPNUMB
      A(3)=LOTNUM
      A(4)=IUL(IPNUMB)
      A(5)=IDUEDA
      A(6)=1
      A(7)=MSEQ(1,IPNUMB)
      A(8)=LOTSIZ
      A(9)=0
      A(10)=A(4)
      A(11)=1
      A(12)=A(7)
      A(13)=0
C
      CALL SCHDL (1,0.0,A)
C
C     INITILISE OPERATOR STATUS
C
      DO 185 I=1,NOP
         NOPSTA(I)=0
185   CONTINUE
C
C     INITIALISE MACHINE STATUS AND CAPACITY AVAILABLE
C
      DO 190 I=1,MAXM
         CAPAV(I)=MCAP(I)
         MSTATU(I)=0
190   CONTINUE
C
C     INITIALISE LAST PART NUMBER PROCESSED AT EACH MACHINE
C     INITIALISE ULFLAG TO BE USED AT D4M1 TO DETERMINE IDEPUL OF
C        LAST UNIT LOAD.
C
      DO 200 I=1,MAXM
         MSEC(I)=0
         LASTPN(I)=0
         ULFLG(I)=1
200   CONTINUE
C
C     INITIALISE FLAGS
C
      AFLAG=0
      FFLAG=0
      DFLAG=0
      QFLAG=0
C
C     INITIALISE NUL=NUMBER OF UNIT LOADS, NRELUL=NUMBER OF RELEASED
C     UNIT LOADS, AND END OF DEMAND FILE FLAG
C
      NUL=0
      NRELUL=0

C
C     INITIALISE THE NUMBER OF COMPLETED PARTS AND LOTS
C
      DO 210 J=1,NPN
210   NP(J)=0
C
C     1.NTL IS USED TO SAVE THE NUMBER OF LOADS TO COME OUT OF A LOT.
C     2.NL IS USED TO SAVE THE NUMBER OF LOADS COMPLETED OF A GIVEN PN AND
C        LOT NUMBER AT A GIVEN MACHINE.
C     3.NPL IS USED TO SAVE THE NUMBER OF PARTS COMPLETED OF A GIVEN  LOT
C        AT A GIVEN MACHINE.
C     4.TL IS USED TO DETERMINE IF THE LOT HAS BEEN COMPLETED.
C     5.TOTAL IS USED TO ACCUMULATE THE TOTAL NUMBER OF GOOD UNITS.
C     6.NREL IS USED TO DETERMINE ULS AT RELEASE OF UNIT LOAD.
C
      DO 215 J=1,NPN
      DO 215 K=1,MAXM
      NPL(J,K)=0
      NL(J,K)=0
215   CONTINUE

      DO 225 J=1,NPN
      DO 220 K=1,NLOTS
      NTL(J,K)=0
      NREL(J,K)=0
      TL(J,K)=0
```

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```
220   TOTAL(J,K)=0
225   CONTINUE
C
      NPARTS=0
      TOTLOT=0
C
C     INITIALISE THE NUMBER OF CARTS IN USE
C
      NUSECA=0
      NOBSCA=0
      MINCA=0
      MAXCA=0
      ICASUM=0
C
C     INITIALISE THE NUMBER OF CONTAINERS IN USE
C
      DO 230 I=1,NCONT
      NUSECO(I)=0
      NOBSCO(I)=0
      ICOSUM(I)=0
      MINCO(I)=0
      MAXCO(I)=0
230   CONTINUE
C
C     INTITIALISE THE NUMBER OF MATERIAL HANDLING HOURS SPENT BY
C     THE OPERATORS AND MATERIAL HANDLERS
C
      OPHOT=0
      MHTMA=0
C
C     INITIALISE TOTAL TIME SPENT ON INTERNAL AND EXTERNAL SETUP
C
      SUTEX=0
      SUTIN=0
      TRAIN=0
      MCIN=0
C
C     INITIALISE INSPECTION COUNTERS
C
      TSUCIN=0
      TSELIN=0
      TSUCMA=0
      TSELMA=0
      TOTQA=0
      TQARMK=0
C
C     INITIALISE COUNTERS FOR MACHINE AND OPERATOR STATUS STATISTICS
C
      DO 250 I=1,NOP
      DO 240 J=1,14
      NOBOP(I,J)=0
      PERCOP(I,J)=0
240   CONTINUE
250   CONTINUE

      DO 270 I=1,MAXM
      DO 260 J=1,14
      NOBMA(I,J)=0
      PERCMA(I,J)=0
260   CONTINUE
270   CONTINUE
C
C     SCHEDULE THE FIRST COLLECTION OF STATISTICS ON STATUS, CLEAR STA.
C     AND STATISTICS OF THROUGHPUT.
C
      ATRIB(1)=0
      ATRIB(2)=0
      ATRIB(3)=0
      ATRIB(4)=0
      ATRIB(5)=0
      ATRIB(6)=0
      ATRIB(7)=0
      ATRIB(8)=0
      ATRIB(9)=0
      ATRIB(10)=0
      ATRIB(11)=0
      ATRIB(12)=0
      ATRIB(13)=0

      CALL SCHDL(17,5.0,ATRIB)
      CALL SCHDL(20,TTCLR,ATRIB)
c      CALL SCHDL(27,DAYLTH,ATRIB)
C
C     INITIALISE VARIABLES AND COUNTERS NEEDED DURING UNBLOCKING
C
      DO 290 I=1,MAXM
      IBLKMC(I)=0
      NNABLK(I)=0
      DO 280 J=1,MAXM
      MBLK(J,I)=0
280   CONTINUE
290   CONTINUE
```



```
C
C     INTIALISE VARIABLES FOR AUTONOMOUS MAINTENANCE
C
      NAUTO=0
      SHIFT=0
      DO 300 I=1,MAXM
      NAUTOD(I)=0
300   NEXAUT(I)=0
C
C     READ INFORMATION ON AUTONOMOUS MAINTENANCE
C
      IF (FACT(2).EQ.1) THEN

        IF (FACT(4).EQ.-1) THEN
           OPEN(UNIT=8,FILE='datos/auto01.dat',STATUS='OLD')
        ELSE
           OPEN(UNIT=8,FILE='datos/auto02.dat',STATUS='OLD')
        ENDIF

        READ(8,*) NAUTO
        IF (NAUTO.EQ.0) THEN
           GO TO 310
        ELSE
           READ(8,*) SHIFT
305        READ(8,*) NNUM
           IF (NNUM.EQ.0) THEN
             GO TO 310
           ELSE
             READ(8,*) NAUTOD(NNUM),AUTOP1(NNUM),AUTOP2(NNUM)
     1              ,AUTOP3(NNUM)
             GO TO 305
           ENDIF
        ENDIF

310     CLOSE(8)

      ENDIF
C
C     IF THERE IS AUTONOMOUS MAINTENANCE, GENERATE THE FIRST OCCURENCE
C     FOR EACH MACHINE UNDER AUTONOMOUS MAINTENANCE.
C
      IF (NAUTO.EQ.1) THEN

         A(1)=0
         A(2)=0
         A(3)=0
         A(4)=0
         A(5)=0
         A(6)=0
         A(7)=0
         A(8)=0
         A(9)=0
         A(10)=0
         A(11)=0
         A(12)=0
         A(13)=0

         DO 320 I=1,MAXM
         IF (NAUTOD(I).GT.0) THEN
            A(7)=I
            CALL SCHDL(15,SHIFT,A)
         ENDIF
320      CONTINUE
      ENDIF
C
C     INITIALISE INVENTORY CARRYING COSTS
C
      DO 340 I=1,NPW
340   TOICC(I)=0
C
C     INITIALISE NUMBER OF LATE ORDERS AND PENALTY COST
C
      NLO=0
      DPCLO=0
C
C     READ DATA ON OPERATOR'S WAGES
C
      OPEN(UNIT=8,FILE='datos/opwage.dat',STATUS='OLD')
      READ(8,*) WG
      READ(8,*) OWG
      CLOSE(8)
C
C     READ DATA ON SETUP CREW
C
      IF (FACT(6).EQ.-1) THEN
         OPEN(UNIT=8,FILE='datos/sucr01.dat',STATUS='OLD')
         GO TO 345
      ENDIF

      IF (FACT(6).EQ.0) THEN
         OPEN(UNIT=8,FILE='datos/sucr00.dat',STATUS='OLD')
         GO TO 345
```

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      ENDIF

      IF (FACT(6).EQ.1) THEN
         OPEN(UNIT=8,FILE='datos/sucr02.dat',STATUS='OLD')
         GO TO 365
      ENDIF

      IF (FACT(6).EQ.0.5) THEN
         OPEN(UNIT=8,FILE='datos/sucr04.dat',STATUS='OLD')
         GO TO 365
      ENDIF

      IF (FACT(6).EQ.0.75) THEN
         OPEN(UNIT=8,FILE='datos/sucr05.dat',STATUS='OLD')
         GO TO 365
      ENDIF

      IF (FACT(6).EQ.0.25) THEN
         OPEN(UNIT=8,FILE='datos/sucr06.dat',STATUS='OLD')
         GO TO 365
      ENDIF

      IF (FACT(6).EQ.0.20) THEN
         OPEN(UNIT=8,FILE='datos/sucr07.dat',STATUS='OLD')
         GO TO 365
      ENDIF

      IF (FACT(6).EQ.0.6375) THEN
         OPEN(UNIT=8,FILE='datos/sucr10.dat',STATUS='OLD')
         GO TO 365
      ENDIF

      IF (FACT(6).EQ. -.2375) THEN
         OPEN(UNIT=8,FILE='datos/sucr11.dat',STATUS='OLD')
         GO TO 365
      ENDIF

365   READ(8,*) NSUCHM
      READ(8,*) SUMQ
      READ(8,*) NSUBC
      IF (NSUBC.EQ.1) THEN
         READ(8,*) TWORK
      ENDIF
      CLOSE(8)
C
C     READ DATA ON MAINTENANCE
C
      IF (FACT(2).EQ.1) THEN
         OPEN(UNIT=8,FILE='datos/pm02.dat',STATUS='OLD')
         READ(8,*) PMTRAI
         READ(8,*) PMCOST
         READ(8,*) PMINV
         CLOSE(8)
      ENDIF
C
      OPEN(UNIT=8,FILE='datos/ncrew.dat',STATUS='OLD')
      READ(8,*) NCREW
      READ(8,*) SWQ
      CLOSE(8)
C
      OPEN(UNIT=8,FILE='datos/propc.dat',STATUS='OLD')
      DO 350 I=1,NMACH
      READ(8,*) MNUM,PC(MNUM)
350   CONTINUE
      CLOSE(8)
C
      OPEN(UNIT=8,FILE='datos/qa.dat',STATUS='OLD')
      READ(8,*) QAWQ
      IF (FACT(1).EQ.1) THEN
         READ(8,*) QATRAI
         READ(8,*) QAINV
      ENDIF
      CLOSE(8)
C
      OPEN(UNIT=8,FILE='datos/prwhc.dat',STATUS='OLD')
360   READ(8,*) IPW,NMA
      IF (IPW.NE.0) THEN
         DO 362 I=1,NMA
         READ(8,*) MNUM,NWKC(IPW,MNUM)
362      CONTINUE
         GO TO 360
      ENDIF
      CLOSE(8)
C
C     INITIALISE MAXIMUM NUMBER OF UNITS OF FG IN INV.
C
      DO 365 J=1,NFW
      FGINV(I)=0
      MAXFG(I)=0
365   CONTINUE
c
C     READ INFORMATION ON CONTAINERS FOR FINISHED GOODS
```

```
mdirizar@c50030-201ps.i          cell6.f          10/17/96  13:43   16/220
C
C      OPEN(UNIT=8,FILE='datos/fgce01.dat',STATUS='OLD')
C      DO 370 I=1,NFW
C      READ(8,*) IPW,FGCAP(IPW),FOCC(IPW)
C370   CONTINUE
C      CLOSE(8)
C
C     READ TRAVELLING TIMES FOR THE TRANSFER CAR
C
      OPEN(UNIT=8,FILE='datos/transf.dat',STATUS='OLD')
      READ(8,*) TRIP1,TRIP2
      CLOSE(8)
C
C     INITIALISE TCFLAG USED TO DETERMINE IF THE TRANSFER CAR IS LOADED OR
C     UNLOADED. TCFLAG=0 MEANS UNLOADED
C
      TCFLAG=0
C
C     INITIALISE WEEKLY THROUGHPUT
C
      TRPUT=0.0
C
C     NLEAVE IS A VARIALBE USED TO GIVE A DISTINCT NUMBER TO EACH
C     ENTITY LEAVING SCENARIO 0.
C
      NLEAVE=0
C
      RETURN
      END
C
C *************************************************************
C
      SUBROUTINE EVENT(I)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MBUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IRI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTFN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPW,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/MSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNOT,NDTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWEP1,TRWEP2,TRWEP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNM,TSELNM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      COMMON/UCOM32/XINBUF(50)
      common/ucomd/iffl

      ia7=atrib(7)
      ia2=atrib(2)
c      if (i.ne.9 .and. tnow.lt.50) then

c      if (ia7.eq.1 .or. ia7.eq.2) then
c      write(6,1) i,ia7,mstatu(ia7),mopsta(iop(ia7)),lastma(iop(ia7))
c     1,mstatu(lastma(iop(ia7))),tnow
c1     format(1x,'i=',i2,1x,'ia7=',i2,1x,'mstatu=',i2,1x,'mopsta=',i2,1x,
c     1'lastma=',i2,1x,'sta(last)=',i2,1x,'tnow=',f8.2)
c      write(6,2) xinbuf(ia7)
c2     format(1x,'xinbuf=',f8.2)
c      endif
```

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```
c
c       else
c
c       ial2=atrib(12)
c       if (iop(ial2).eq.2 .and.tnow.gt.353.0) then
c       write(6,3) i,ial2,mstatu(ial2),mopsta(iop(ial2)),lastma(iop(ial2))
c      1,mstatu(lastma(iop(ial2))),tnow
c3      format(1x,'i=',i3,1x,'ial2=',i2,1x,'mstatu=',i2,1x,'mopsta=',i2,1x,
c      1'lastma=',i2,1x,'sta(last)=',i2,1x,'tnow=',f8.2)
c       write(6,4)
c4      format()
c       endif
c
c       endif
C
      GO TO (1191,1192,1193,1194,1195,1196,1197,1198,1199,2000,2001
     1,2002,2003,2004,2005,2006,2007,2008,2009,2010,2011,2012,2013
     2,2014,2015,2016,2017),I
C
C     RELEASE OF A LOT FOR PRODUCTION
1191  CALL LARRVL
      GO TO 2030
C     COMPLETION OF SUCCESSIVE INSPECTION
1192  CALL CSUCIN
      GO TO 2030
C
C     COMPLETION OF SUCCESSIVE INSPECTION REWORK
1193  CALL CSUCIR
      GO TO 2030
C
C     COMPLETION OF MACHINE PROCESSING: UNIT OR UNIT LOAD
1194  CALL DEPART
      GO TO 2030
C
C     COMPLETION OF SELF INSPECTION
1195  CALL CSELIN
      GO TO 2030
C
C     COMPLETION OF SELF INSPECTION REWORK
1196  CALL CSELIR
      GO TO 2030
C
C     ARRIVAL OF A UNIT LOAD TO THE NEXT MACHINE ON ITS ROUTER
1197  CALL ULARRL
      GO TO 2030
C
C     COMPLETION OF POKA YOKE MACHINE IMPROVEMENTS
1198  GO TO 2030
c      CALL CPYIMP
C
C     COMPLETION OF MATERIAL HANDLING BY CELL OPERATOR
1199  CALL CMHOP
      GO TO 2030
C
C     ARRIVAL OF HAND TRUCK TO HAND TRUCK PARKING LOCATION
2000   GO TO 2030
c      CALL HTARRL
C
C     COMPLETION OF TRADITIONAL SETUP
2001  CALL CTRASU
      GO TO 2030
C
C     COMPLETION OF WORLD CLASS SETUP
2002  CALL CWCSU
      GO TO 2030
C
C     COMPLETION OF Q.A. INSPECTION
2003  CALL CQAINS
      GO TO 2030
C
C     COMPLETION OF REWORK BY EXTERNAL RESOURCES UNDER THE
C     TRADITIONAL NO SOURCE INSPECTION QUALITY SCENARIO
2004  CALL CTRARW
      GO TO 2030
C
C     AUTONOMOUS MAINTENANCE BY CELL OPERATOR
```



```
2005  CALL AUTOMT
      GO TO 2030
C
C     COMPLETION OF AUTONOMOUS MAINTENANCE BY CELL OPERATOR
2006  CALL CAUTOM
      GO TO 2030
C     COLLECT STATISTICS ON STATUS
C
2007  CALL GATHER
      GO TO 2030
C
2008  CALL BREAKD
      GO TO 2030
C
2009  CALL CREPAI
      GO TO 2030
C
C     CLEAR STATISTICS AND COUNTERS
C
2010  CALL CLRSTA
      GO TO 2030
C
C     COMPLETION OF SCRAPPED PARTS
C
2011  CALL CSCRAP
      GO TO 2030
C
C     MINOR STOPPAGES SUCH AS MATERIAL REPLENISHMENTS
C
2012  CALL MINSTP
      GO TO 2030
C     COMPLETION OF MINOR STOPPAGE (SAME AS CAUTOM)
C
2013  CALL CAUTOM
      GO TO 2030
C
C     RETURN OF THE TRANSFER CAR
C
2014  CALL TCRET
      GO TO 2030
C
2015  CALL CLOAD
      GO TO 2030
C
2016  CALL CULOAD
      GO TO 2030
C
2017  CALL THRUPT
      GO TO 2030
C
2030  RETURN
      END
C
C ***********************************************************
C
      SUBROUTINE LARRVL
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MSCXV)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MANRSC(50),
     1 MDEPSC(50),MSUPP(50),MSUTYP(50),MMOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NNELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/MSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKRN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
```

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```
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMEP1,TRMEP2,TRMEP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRM,TSELRM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM42/NTL(40,500),TL(40,500),ML(40,50),MPL(40,50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM76/NREL(40,500)
      COMMON/UCOM82/MAXN
      COMMON/UCOM89/NRELPG
      common/ucomd/iffl
C
      IA2=ATRIB(2)
      IA3=ATRIB(3)
      RELT(IA2,IA3)=TNOW
C
C     ADD LOT TO QUEUE OF RELEASED LOTS (ACTUAL ORDERS)
C
      LOTQ=MAXN*3+3
      CALL FILEM(LOTQ,ATRIB)
      NRELPG=1
C
C     DETERMINE THE NUMBER OF UNIT LOADS IN THE LOT. THE LOT SIZE MUST
C     BE IN MULTIPLES OF THE UNIT LOAD SIZE.
C
      IA8=ATRIB(8)
      IA4=ATRIB(4)
      NUL=INT((ATRIB(8)/ATRIB(4))+.99)
C
C     NTL SAVES THE NUMBER OF UNIT LOADS TO COME OUT OF THE LOT.
C
      NTL(IA2,IA3)=NUL
C
C     SCHEDULE THE ARRIVAL, TO MACHINE 01, OF THE FIRST TWO UNIT LOADS
C
      IF (NUL.GE.2) THEN
         IF (IA4*2.GT.IA8) THEN
            I7=ATRIB(7)
            XINBUF(I7)=XINBUF(I7)+ATRIB(4)
            NREL(IA2,IA3)=NREL(IA2,IA3)+1
            CALL SCHDL (7,0.0,ATRIB)
            I4=IA8-IA4
            ATRIB(4)=I4
            ATRIB(10)=I4
            CALL SCHDL (7,0.0,ATRIB)
            XINBUF(I7)=XINBUF(I7)+ATRIB(4)
            NREL(IA2,IA3)=NREL(IA2,IA3)+1
         ELSE
            DO 2035 I=1,2
            I7=ATRIB(7)
            XINBUF(I7)=XINBUF(I7)+ATRIB(4)
            NREL(IA2,IA3)=NREL(IA2,IA3)+1
2035        CALL SCHDL (7,0.0,ATRIB)
         ENDIF
C         NRELUL=2
      ELSE
         I7=ATRIB(7)
         IF (IA4.EQ.IA8) THEN
            XINBUF(I7)=XINBUF(I7)+ATRIB(4)
            CALL SCHDL (7,0.0,ATRIB)
            NREL(IA2,IA3)=NREL(IA2,IA3)+1
         ELSE
            ATRIB(4)=IA8
            ATRIB(10)=IA8
            CALL SCHDL (7,0.0,ATRIB)
            NREL(IA2,IA3)=NREL(IA2,IA3)+1
         ENDIF
C         NRELUL=1
      ENDIF
C
      RETURN
      END
C
C *******************************************************************
C
      SUBROUTINE ULABEL
C
      INCLUDE '/mcsu/jwilson_rse/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
```



```
     2 CLEDGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACNS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLESC(50),MBLEMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNOT,HDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMEP1,TRMEP2,TRMEP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRM,TSELRM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM71/TCFLAG
C
      IA7=ATRIB(7)
C
      IPN=ATRIB(3)
      EXPECT=0
      CALL EXPEC(IPN,IA7,EXPECT)
      ATRIB(9)=ATRIB(10)*EXPECT
C
C     IF THE ARRIVAL IS FROM A TRANSFER CAR, RESET TFLAG TO ZERO
C
      IA12=ATRIB(12)
      IF (MTYPE(IA12).EQ.7) THEN
         TCFLAG=0
      ENDIF
C
      IF (MARRSC(IA7).EQ.1) THEN
         CALL ARRSC1(IA7)
         RETURN
      ENDIF
C
      IF (MARRSC(IA7).EQ.5) THEN
         CALL ARRSC5(IA7)
         RETURN
      ENDIF
C
      IF (MARRSC(IA7).EQ.6) THEN
         CALL ARRSC6(IA7)
         RETURN
      ENDIF
C
      IF (MARRSC(IA7).EQ.7) THEN
         CALL ARRSC7(IA7)
         RETURN
      ENDIF
C
      IF (MARRSC(IA7).EQ.8) THEN
         CALL ARRSC8(IA7)
         RETURN
      ENDIF
C
      END
C
C *******************************************************************
C
      SUBROUTINE ARRSC1(IA7)
C
      INCLUDE '/mcsu/jwilson_rse/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLEDGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
```

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```
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IRI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKIN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNL,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRORWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRORJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
c
      IF (MTYPE(IA7) .EQ. 1) THEN
         CALL A15M1(IA7)
         RETURN
      ENDIF
c
      IF (MTYPE(IA7) .EQ. 5) THEN
         CALL A1M5(IA7)
         RETURN
      ENDIF
c
      IF (MTYPE(IA7) .EQ. 7) THEN
         CALL A1M7(IA7)
         RETURN
      ENDIF
c
      IF (MTYPE(IA7) .EQ. 9) THEN
         CALL A1M9(IA7)
         RETURN
      ENDIF
c
      END
c
c **********************************************************************
c
      SUBROUTINE A15M1(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON QSET(400000)
c
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),MAXBSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IRI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKIN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
```



```
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNL,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRORWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRORJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
c
      COMMON/UCOM32/KINBUF(50)
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
      COMMON/UCOM43/BRKDSC,BRNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTM(50)
      COMMON/UCOM45/WAITTM(50)
      COMMON/UCOM49/NAUTO
      COMMON/UCOM60/IPMCD(50),IREP(50)
      COMMON/UCOM63/PULLDQ(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM75/NEMUL(40,50)
      COMMON/UCOM82/MAXN
c
      IA2=ATRIB(2)
      IA4=ATRIB(4)
      IA10=ATRIB(10)
c
      IF (MSTATU(IA7).EQ.10 .AND. IA2.EQ.LASTPN(IA7)) THEN
c
c         IF THE MACHINE IS WAITING FOR THIS PART NUMBER DO NOT
c         CHECK QUEUE STATUS. GIVE PRIORITY TO THIS PART.
c
          CALL FILEM(IA7,ATRIB)
c
          IF (NNQ(IA7).GT.1) THEN
             DO 2040 I=1,NNQ(IA7)-1
             CALL RMOVE(1,IA7,ATRIB)
             CALL FILEM(IA7,ATRIB)
2040         CONTINUE
          ENDIF
c
c         SAVE UPTIME AND DETERMINE IF IT IS TIME TO SCHEDULE THE NEXT BRKDWN.
c
          TTBLK=TNOW-WAITTM(IA7)
          UPTIME(IA7)=UPTIME(IA7)+TTBLK
          TOTUP(IA7)=TOTUP(IA7)+TTBLK
          WAITTM(IA7)=0
c
          IF (BRKDSC.EQ.2) THEN
             IF (UPTIME(IA7).GT.BRNEXT(IA7)) THEN
                CALL UPBRKD(IA7)
             ENDIF
          ENDIF
c
c         CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE
c         ARE, THEN GIVE PRIORITY TO THOSE.
c
          PFLAG=0
          MSTATU(IA7)=0
c
          CALL BRKCK(IA7,PFLAG)
          IF (PFLAG.EQ.0) THEN
             GO TO 2070
          ENDIF
c
c         CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED.
c         IF THERE ARE,GIVE PRIORITY TO THOSE.
c
          PFLAG=0
          CALL AUTOCK(IA7,PFLAG)
          IF (PFLAG.EQ.0) THEN
             GO TO 2070
          ENDIF
c
c         CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
c         IF THERE ARE,GIVE PRIORITY TO THOSE.
c
          IF (IREP(IA7).EQ.1) THEN
             PFLAG=0
             CALL RPTCK(IA7,PFLAG)
             IF (PFLAG.EQ.0) THEN
                GO TO 2070
             ENDIF
          ENDIF
c
```

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```
            IF (IA10.GT.0) THEN
C              CALL PQC SINCE THE PART MIGHT HAVE TO BE INSPECTED.
               GO TO 2056
            ELSE
C
C              IF AN OPERATOR IS NEEDED AND AVAILABLE THEN CALL MACHINE
C
               IF (NOPCD(IA7).EQ.2) THEN
                  IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                     NOPSTA(IOP(IA7))=1
                     LASTMA(IOP(IA7))=IA7
                     GO TO 2057
                  ELSE
                     GO TO 2070
                  ENDIF
               ELSE
                  GO TO 2057
               ENDIF
            ENDIF
C
      ENDIF
C
      IF (NNQ(IA7) .GT. 0) THEN
         CALL FILEM(IA7,ATRIB)
      RETURN
      ENDIF
C
      IF (NSTATU(IA7) .NE. 0) THEN
         CALL FILEM(IA7,ATRIB)
      RETURN
      ENDIF
C
C     DETERMINE IF THE UNIT REQUIRES A MACHINE SETUP
C
      IF (IA2 .NE. LASTPN(IA7)) THEN
C
         IF (MSUCD(IA7) .EQ. 1) THEN
            NSUPN=IA2
C              PUT THE ENTITY IN QUEUE SUCH THAT AT TRADSU OR MCSU THE QUEUE
C              IS SEARCHED FOR THE ATTRIBUTES OF THE ENTITY THAT ARRIVED
C              OR THE ONE THAT WAS ALREADY IN QUEUE
            CALL FILEM(IA7,ATRIB)
            CALL MSETUP(NSUPN,IA7)
C
            RETURN
         ENDIF
      ENDIF
C
C     DETERMINE IF THE UNIT CAN BE PROCESSED OR WILL BE INSPECTED.
C     AFLAG=1 AND DFLAG=0 MEANS PQC IS BEING CALLED FROM AN ARRIVAL
C     SUBROUTINE
C
C     PUT THE UNIT LOAD IN QUEUE. IT WILL BE REMOVED AT PQC IF THE
C     OUTCOME IS SUCCESSIVE INSPECTION.
C
      CALL FILEM(IA7,ATRIB)
C
2056  AFLAG=1
      DFLAG=0
      FFLAG=0
C
      IF (IA10.EQ.0.0) THEN
C
C        IF ALL PARTS IN THE UNIT LOAD ARE BAD, DO NOT CALL FOR A SETUP
C        OR PQC. PUT THE UNIT LOAD IN THE DUMMY INPUT QUEUE AND SCHEDULE
C        A MACHINE DEPARTURE W/PROCESS TIME OF ZERO.
C
C        HOWEVER, SINCE THE
C        PART HAS BEEN ADDED TO XINBUP, IF IT WILL BE PROCESSED IT HAS TO
C        BE REMOVED FROM XINBUP (THERE WILL BE NO 'RMOVE' SINCE IT NEVER
C        WENT THROUGH THE MAIN QUEUE.
C
         IF (NOPCD(IA7).EQ.2) THEN
            IF (NOPSTA(IOP(IA7)).EQ.0) THEN
               LASTMA(IOP(IA7))=IA7
               NOPSTA(IOP(IA7))=1
               GO TO 2058
            ELSE
               GO TO 2070
            ENDIF
         ELSE
            GO TO 2058
         ENDIF
      ENDIF

      CALL PQC(AFLAG,DFLAG,FFLAG,IA7)
      IF (FFLAG .EQ.0) THEN
C
C           THE MCANINE MIGHT BE DOING INSPECTION, THEREFORE, A UNIT LOAD
C           MIGHT HAVE BEEN REMOVED FROM QUEUE.
C
            IF (NSTATU(IA7).EQ.6) THEN
```



```
               GO TO 2069
            ELSE
               GO TO 2070
            ENDIF
      ENDIF
C
C     IF FFLAG IS ONE, THEN IT MEANS THE UNIT LOAD CAN BE PROCESSED.
C
2057  CALL RMOVE(1,IA7,ATRIB)
2058  FULLDQ(IA7)=ATRIB(6)
      XINBUP(IA7)=XINBUP(IA7)-FULLDQ(IA7)
      LASTPN(IA7)=ATRIB(2)
C
C     THE UNIT LOAD GOES TO THE DUMMY INPUT BUFFER IF FFLAG=1,
C     EVEN IF THE UNIT LOAD SIZE IS EQUAL TO 1. THIS IS DONE SINCE
C     AT 'M1' (THE MACHINE SUB CALLED TO GET CARTS AND/OR CONTAINERS AND
C     SCHEDULE PART DEPARTURE) PARTS ARE LOOKED FOR AT THE DUMMY INPUT
C     QUEUE OR AT THE MAIN QUEUE. REMEMBER 'M1' SUB IS CALLED FROM MANY
C     DIFFERENT ARRIVAL AND DEPARTURE SCENARIOS.
C
C     THUS, PUT UNIT IN DUMMY INPUT BUFFER AND CALL 'M1' SUB.
C
C     IF THE ARRIVAL SCENARIO IS ONE, THEN ONLY ONE UNIT GOES TO THE
C     DUMMY INPUT BUFFER. IF THE ARRIVAL SCENARIO IS FIVE, THEN THE NUMBER
C     OF UNITS TO PUT IN THE DUMMY INPUT BUFFER WILL BE THE UNIT LOAD SIZE.
C
      IF (MARRSC(IA7).EQ.1) THEN
C
C        UNITS ARRIVE ONE BY ONE. ATRIB(10) AND ATRIB(11) DESCRIBE
C        THE QUALITY CHARACTERISTICS OF THE ONLY UNIT IN THE UNIT LOAD.
C
         NIDQ=IA7+MAXN
         CALL FILEM(NIDQ,ATRIB)

         IF (MDEPSC(IA7).EQ.0) THEN
            IA2=ATRIB(2)
            IF ((NNQ(NIDQ)*IBI(IA2)).LT.NBMUL(IA2,IA7)) THEN
               NBMUL(IA2,IA7)=NNQ(NIDQ)*IBI(IA2)
            ENDIF
         ENDIF

         CALL MACHIN(IA7,NIDQ)

         GO TO 2069
      ENDIF
C
      IF (MARRSC(IA7).EQ.5) THEN
C
C        UNITS ARRIVE IN A BATCH. QUALITY OF EACH UNIT IN THE UNIT LOAD
C        NEEDS TO BE DEFINED BEFORE PLACING THE UNIT IN THE DUMMY INPUT QUEUE.
C
         NIDQ=IA7+MAXN
C
         IF (IA10.EQ.0) THEN
C
C           ALL UNITS IN THE UNIT LOAD ARE BAD.
C
            DO 2060 J=1,IA4
            ATRIB(11)=0
2060        CALL FILEM(NIDQ,ATRIB)
C
C           IF THE UNITS IN NIDQ ARE NOT ENOUGH TO COMPLY WITH THE DEPARTING
C           UNIT LOAD SIZE THEN CHANGE IDEFUL TO WHAT CAN BE BATCHED.
C
            IF (MDEPSC(IA7).EQ.0) THEN
               IA2=ATRIB(2)
               IF ((NNQ(NIDQ)*IBI(IA2)).LT.NBMUL(IA2,IA7)) THEN
                  NBMUL(IA2,IA7)=NNQ(NIDQ)*IBI(IA2)
               ENDIF
            ENDIF

            CALL MACHIN(IA7,NIDQ)
            GO TO 2069
         ENDIF
C
         IF (IA10.EQ.IA4) THEN
C
C           ALL UNITS IN THE UNIT LOAD ARE GOOD.
C
            DO 2063 J=1,IA4
            ATRIB(11)=1
2063        CALL FILEM(NIDQ,ATRIB)

C           IF THE UNITS IN NIDQ ARE NOT ENOUGH TO COMPLY WITH THE DEPARTING
C           UNIT LOAD SIZE THEN CHANGE IDEFUL TO WHAT CAN BE BATCHED.
C
            IF (MDEPSC(IA7).EQ.0) THEN
               IA2=ATRIB(2)
               IF ((NNQ(NIDQ)*IBI(IA2)).LT.NBMUL(IA2,IA7)) THEN
                  NBMUL(IA2,IA7)=NNQ(NIDQ)*IBI(IA2)
               ENDIF
            ENDIF
```


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            CALL MACHIN(IA7,NIDQ)
            GO TO 2069
         ENDIF
C
         IF (IA10.LT.IA4) THEN
C
C           THE UNIT LOAD HAS A COMBINATION OF GOOD AND BAD UNITS.
C
            DO 2065 J=1,IA10
            ATRIB(11)=1
2065        CALL FILEM(NIDQ,ATRIB)
            N=IA4-IA10
            DO 2060 J=1,N
            ATRIB(11)=0
2060        CALL FILEM(NIDQ,ATRIB)
C
C           IF THE UNITS IN NIDQ ARE NOT ENOUGH TO COMPLY WITH THE DEPARTING
C           UNIT LOAD SIZE THEN CHANGE IDEPUL TO WHAT CAN BE BATCHED.
C
            IF (NDEPSC(IA7).EQ.0) THEN
               IA2=ATRIB(2)
               IF ((NNQ(NIDQ)*ISI(IA2)).LT.NEWUL(IA2,IA7)) THEN
                  NEWUL(IA2,IA7)=NNQ(NIDQ)*ISI(IA2)
               ENDIF
            ENDIF

            CALL MACHIN(IA7,NIDQ)
         ENDIF

      ENDIF
C
2069  IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND. XINBUF(IA7)
     1.LT.NBUFF(IA7)) THEN
         CALL CKBLK(IA7)
      ENDIF
C
2070  RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE M1(IA7,NIDQ)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKNA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKSN,NAVNT,OPNDT,NOTNA,WALKLD
      COMMON/UCOM8/SUTSX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUN(50),ICASUN,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHOP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDNWD,TNWKP1,TNWKP2,TNWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/ifl1
      COMMON/UCOM30/TLASTP(50)
C
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      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM40/REMPT(50)
      COMMON/UCOM43/BRKDSC,NRNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM75/NEWUL(40,50)
      COMMON/UCOM82/MAXN
C
C     FIND IF THE UNIT TO BE PROCESSED IS FROM A NEW OR PARTIALLY
C     PROCESSED UNIT LOAD. IF IT IS FROM A NEW UNIT LOAD CALL CONTAI
C     TO DETERMINE IF CONTAINERS OR CARTS ARE NEEDED.
C
C     IF NNQ(NIDQ) IS GT 0, THEN THE UNIT TO BE PROCESSED COMES FROM
C     THE DUMMY INPUT BUFFER.
C
C     THE FIRST PORTION OF THE IF APPLIES WHEN THE SUB IS CALLED FROM
C     AN ARRIVAL OR A DEPARTURE, THE ELSE APPLIES ONLY WHEN THE SUB IS
C     CALLED FROM A DEPARTURE SCENARIO.
C
      NODQ=IA7+MAXN*2
      CCKBLK=0
C
      IF (NNQ(NIDQ).GT.0) THEN
         NTRY=MMFE(NIDQ)
         IA2=QSET(NTRY+2)
         IA4=QSET(NTRY+4)
         IA6=QSET(NTRY+6)
C
C        CALL CKCONT TO DETERMINE THE NEED FOR CARTS OR CONTAINERS.
C        THE NEED FOR CONTAINERS OCCUR AT THE START OF A UNIT LOAD ON
C        SOME SCENARIOS. HOWEVER, ON OTHERS LIKE DEPARTURE SCENARIO 4
C        WHERE PARTS ARRIVE ONE BY ONE AND ARE ACCUMULATED, THE NEED
C        FOR CONTAINERS OR CARTS IS CHARACTERISED BY AN EMPTY DUMMY
C        OUTPUT BUFFER.
C              ANOTHER SITUATION OCCURRS WHEN AN ENTITY IS REMOVED
C        FROM THE EVENT CALENDAR TO INITIATE MACHINE REPAIR. THE ENTITY
C        IS PLACED IN THE DUMMY INPUT QUEUE. IF THE ENTITY REPRESENTS THE
C        WHOLE UNIT LOAD, THE MODEL MIGHT THINK IT IS A NEW UNIT LOAD
C        AND ASK FOR CONTAINERS WHEN THAT WAS ALREADY DONE. UNITS REMOVED
C        FROM THE EVENTS CALENDAR HAVE REMPT(IA7)=0.
C
C
         IF (NNQ(NIDQ).EQ.IA4.AND.NNQ(NODQ).EQ.0.AND.IA7.NE.
     1NSEQ(MACHS(IA2),IA2).AND.REMPT(IA7).EQ.0) THEN
            CALL CKCONT(IA2,IA4,IA6,IA7)
C
         ENDIF
         CALL RMOVE(1,NIDQ,ATRIB)
      ELSE
C
C        WHEN A UNIT LOAD IS REMOVED FROM QUEUE IT GOES TO THE DUMMY INPUT
C        BUFFER ONLY IF THE UNIT LOAD SIZE IS GREATER THAN ONE.
C
         CALL RMOVE(1,IA7,ATRIB)
         IA4=ATRIB(4)
         IA2=ATRIB(2)
         IA6=ATRIB(6)
         IA10=ATRIB(10)
C
         FULLDQ(IA7)=ATRIB(4)
         XINBUF(IA7)=XINBUF(IA7)-FULLDQ(IA7)
C
         IF (IA4.EQ.1) THEN
C
C           IF THE UNITS IN NIDQ ARE NOT ENOUGH TO COMPLY WITH THE DEPARTING
C           UNIT LOAD SIZE THEN CHANGE IDEPUL TO WHAT CAN BE BATCHED.
C
            IF (NDEPSC(IA7).EQ.0) THEN
               IA2=ATRIB(2)
               IF ((IA4*ISI(IA2)).LT.NEWUL(IA2,IA7)) THEN
                  NEWUL(IA2,IA7)=IA4*ISI(IA2)
               ENDIF
            ENDIF

            GO TO 2095
C
         ELSE
C
C           QUALITY OF EACH UNIT IS THE UNIT LOAD NEEDS TO BE DEFINED
C           BEFORE PLACING THE UNIT IN THE DUMMY INPUT QUEUE.
C
            NIDQ=IA7+MAXN
C
            IF (IA10.EQ.0) THEN
C
C              ALL UNITS IN THE UNIT LOAD ARE BAD.
C
               DO 2080 J=1,IA4
               ATRIB(11)=0
2080           CALL FILEM(NIDQ,ATRIB)
C
               IF THE UNITS IN NIDQ ARE NOT ENOUGH TO COMPLY WITH THE
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C         DEPARTING UNIT LOAD SIZE THEN CHANGE IDEPUL TO WHAT CAN BE
C         MATCHED.
C
          IF (MDEPSC(IA7).EQ.0) THEN
             IA2=ATRIB(2)
             IF ((NNQ(NIDQ)*IBI(IA2)).LT.NEWUL(IA2,IA7)) THEN
                NEWUL(IA2,IA7)=NNQ(NIDQ)*IBI(IA2)
             ENDIF
          ENDIF

          CALL RMOVE(1,NIDQ,ATRIB)
          GO TO 2095
       ENDIF
C
       IF (IA10.EQ.IA4) THEN
C
C         ALL UNITS IN THE UNIT LOAD ARE GOOD.
C
          DO 2090 J=1,IA4
          ATRIB(11)=1
2090      CALL FILEM(NIDQ,ATRIB)

C         IF THE UNITS IN NIDQ ARE NOT ENOUGH TO COMPLY WITH THE
C         DEPARTING UNIT LOAD SIZE THEN CHANGE IDEPUL TO WHAT CAN BE
C         MATCHED.
C
          IF (MDEPSC(IA7).EQ.0) THEN
             IA2=ATRIB(2)
             IF ((NNQ(NIDQ)*IBI(IA2)).LT.NEWUL(IA2,IA7)) THEN
                NEWUL(IA2,IA7)=NNQ(NIDQ)*IBI(IA2)
             ENDIF
          ENDIF

          CALL RMOVE(1,NIDQ,ATRIB)
          GO TO 2095
       ENDIF
C
       IF (IA10.LT.IA4) THEN
C
C         THE UNIT LOAD HAS A COMBINATION OF GOOD AND BAD UNITS.
C
          DO 2092 J=1,IA10
          ATRIB(11)=1
2092      CALL FILEM(NIDQ,ATRIB)
          N=IA4-IA10
          DO 2094 J=1,N
          ATRIB(11)=0
2094      CALL FILEM(NIDQ,ATRIB)

C         IF THE UNITS IN NIDQ ARE NOT ENOUGH TO COMPLY WITH THE
C         DEPARTING UNIT LOAD SIZE THEN CHANGE IDEPUL TO WHAT CAN BE
C         MATCHED.
C
          IF (MDEPSC(IA7).EQ.0) THEN
             IA2=ATRIB(2)
             IF ((NNQ(NIDQ)*IBI(IA2)).LT.NEWUL(IA2,IA7)) THEN
                NEWUL(IA2,IA7)=NNQ(NIDQ)*IBI(IA2)
             ENDIF
          ENDIF

          CALL RMOVE(1,NIDQ,ATRIB)
       ENDIF

    ENDIF
C
2095 IF (NNQ(NODQ).EQ.0.AND.IA7.NE.NSEQ(MACHS(IA2),IA2)) THEN
       CALL CKCONT(IA2,IA6,IA6,IA7)
    ENDIF
C
  ENDIF
C
  LASLOT(IA7)=ATRIB(3)
  LASTPN(IA7)=ATRIB(2)
  IPN=ATRIB(2)
  DEP=0
C
C CALL FOR A PROCESSING TIME ONLY IF THE PART IS GOOD AND THE PART
C WAS NOT ONE WITH REMAINING PROCESSING TIME.
C
  IF (REMPT(IA7).GT.0) THEN
    DEP=ATRIB(13)
    ATRIB(13)=0
    REMPT(IA7)=0
  ELSE
    IF (ATRIB(11).EQ.1) THEN
      CALL PROCES(IPN,IA7,DEP)
    ENDIF
  ENDIF
C
  CALL SCHDL (4,DEP,ATRIB)
  NSTATU(IA7)=1
  TLASTP(IA7)=TNOW+DEP
```



```
      START(IA7)=TNOW
C
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE FQC(AFLAG,DFLAG,PFLAG,IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),MQCD(50),MASRSC(50),
     1 MDEPSC(50),MSUPP(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),MBLKSC(50),NBLKNA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,WAVNT,OPNDP,NOTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NOSBCO(50),NOSBCA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNE,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TNWKP1,TNWKP2,TNWKP3
      COMMON/UCOM17/TRDRJP(40),TRDSMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCSW,TSELSW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
C
C     THERE COULD BE FOUR CATEGORIES:
C
C     MQCD=1  TRADITIONAL NO SOURCE INSPECTION
C     MQCD=2  SOURCE INSPECTION W/SAS INSP.
C     MQCD=3  SOURCE INSPECTION W/POKA-YOKE
C     MQCD=4  SOURCE INSPECTION W/SELF INSP. ONLY
C
      GO TO (2105,2110,2105,2105) MQCD(IA7)
C
2105  CALL NOINSP(AFLAG,DFLAG,PFLAG,IA7)
      GO TO 2115
C
2110  IF (IA7.EQ.1) THEN
          GO TO 2105
      ELSE
          CALL SCRINS(AFLAG,DFLAG,PFLAG,IA7)
      ENDIF
C
2115  RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE NOINSP(AFLAG,DFLAG,PFLAG,IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),MQCD(50),MASRSC(50),
     1 MDEPSC(50),MSUPP(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),MBLKSC(50),NBLKNA(50),
     6 RELT(40,500)
C
```


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```
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPW,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANMX,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMEP1,TRMEP2,TRMEP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
C
C
C     IT IS IMPORTANT FIRST TO CHECK FOR THE NEED OF AN OPERATOR
C     TO PROCESS PARTS.
C
      IF (NOPCD(IA7).EQ.2) THEN
C
C        CALLED FROM A MACHINE IN WHICH AN OPERATOR IS NEEDED.
C        THE OPERATOR MIGHT BE IDLE OR HE MIGHT HAVE STATUS OF 1 WAITING
C        FOR PARTS TO COMPLETE A UNIT LOAD.
C
         IF (NOPSTA(IOP(IA7)).EQ.0 .OR.(NOPSTA(IOP(IA7)).EQ.1 .AND.
     1   LASTMA(IOP(IA7)).EQ.IA7)) THEN
            LASTMA(IOP(IA7))=IA7
            NOPSTA(IOP(IA7))=1
            PFLAG=1
         ELSE
            PFLAG=0
            NSTATU(IA7)=0
         ENDIF
C
      ELSE
C
C        CALLED FROM AN SCENARIO IN WHICH AN OPERATOR IS NOT NEEDED.
C
         PFLAG=1
C
      ENDIF
C
      RETURN
      END
C
C ******************************************************************
C
      SUBROUTINE SCRINE(AFLAG,DFLAG,PFLAG,IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),MANRSC(50),
     1 MDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPW,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
```



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C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANMX,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMEP1,TRMEP2,TRMEP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
C
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM63/FULLDQ(50)
C
C     IN THIS SCENARIO, WE KNOW AN OPERATOR IS NEEDED, THEREFORE WE
C     CHECK FOR OPERATOR AVAILABILITY REGARDLESS OF NOPCD.
C
      CCKBLK=0
C
      IF (NOPSTA(IOP(IA7)).EQ.0 .OR.(NOPSTA(IOP(IA7)).EQ.1 .AND.
     1LASTMA(IOP(IA7)).EQ.IA7)) THEN
         LASTMA(IOP(IA7))=IA7
         NOPSTA(IOP(IA7))=6
         NSTATU(IA7)=6
         TOTINS=0
         CALL RMOVE(1,IA7,ATRIB)
C
         IA4=ATRIB(4)
         FULLDQ(IA7)=ATRIB(4)
         XINBUF(IA7)=XINBUF(IA7)-FULLDQ(IA7)
C
         IA10=ATRIB(10)
C
         CALL SUCINS(IA10,IA7,TOTINS)
         TSUCIN=TSUCIN+TOTINS
C
         CALL SCHDL (2,TOTINS,ATRIB)
         UPTIME(IA7)=UPTIME(IA7)+TOTINS
         TOTUP(IA7)=TOTUP(IA7)+TOTINS
         PFLAG=0
      ELSE
         PFLAG=0
         NSTATU(IA7)=0
      ENDIF
C
      RETURN
      END
C
C ******************************************************************
C
      SUBROUTINE DEPART
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),MANRSC(50),
     1 MDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPW,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
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mdirizar@c50030-201ps.1          cell6.f          10/17/96 13:43   31/220
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNE,PHCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDSMD,TRMEP1,TRMEP2,TRMEP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCSM,TSELSM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSUNMD(50),SUNMP1(50),SUNMP2(50),SUNMP3(50)
      COMMON/UCOM21/NSENMD(50),SENMP1(50),SENMP2(50),SENMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      COMMON/UCOM32/XINBUF(50)
      common/ucomd/iffl
C
      COMMON/UCOM42/NTL(40,500),TL(40,500),ML(40,50),MPL(40,50)
      COMMON/UCOM43/BUSLOSC,BRNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM50/NA,CUSLT,NLO,DPCLO,RLENGH
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM76/NREL(40,500)
      COMMON/UCOM79/NFACT,IEXP
      COMMON/UCOM80/NDMG
      COMMON/UCOM81/FACT(6)
      COMMON/UCOM82/MAXN
      COMMON/UCOM88/BODFLG,IPNUMB
      COMMON/UCOM89/NRELFG
C
      IA2=ATRIB(2)
      IA3=ATRIB(3)
      IA7=ATRIB(7)
      NIDQ=IA7+MAXN
C
C     RELEASE THE NEXT UNIT LOAD OR LOT FOR PRODUCTION
C
C     IF THE DEPARTURE OCCURED AT THE FIRST MACHINE IN THE CELL, AND THERE
C     ARE NO PARTS WAITING AT THE DUMMY INPUT QUEUE, THEN RELEASE EITHER
C     ANOTHER UNIT LOAD OF THE CURRENT LOT OR A NEW LOT FOR PRODUCTION.
C
      IF (IA7.EQ.NSEQ(1,IA2).and.NNQ(IA7).GT.0) THEN

         NTRY=MMLE(IA7)
         I2=QSET(NTRY+2)
         I3=QSET(NTRY+3)
         IF (NREL(I2,I3).EQ.NTL(I2,I3)) THEN
C
           IF (NRELFG.NE.0) THEN

            IF (BODFLG.EQ.1) THEN
               GO TO 2330
            ENDIF
C
C           RELEASE NEW LOT
C
            READ(9,*) IPNUMB,LOTNUM,LOTSIZ,IRELDA,IDUEDA
C
            IF (IPNUMB.EQ.0) THEN
               BODFLG=1
               NRELFG=0
               GO TO 2330
            ENDIF
C
            A(1)=IRELDA
            A(2)=IPNUMB
            A(3)=LOTNUM
            A(4)=IUL(IPNUMB)
            A(5)=IDUEDA
            A(6)=1
            A(7)=NSEQ(1,IPNUMB)
            A(8)=LOTSIZ
            A(9)=0
            A(10)=A(4)
            A(11)=1
            A(12)=0
            A(13)=0
C
            IF (IRELDA.GT.TNOW) THEN
               TREL=IRELDA-TNOW
               NRELFG=0
C
C           REDEFINING 'NRELFG' TO ZERO WHEN 'NREL' REACHES 'NUL' STOPS
C           THE RELEASE OF UNIT LOADS FROM THE COMPLETED LOT, AND
C           GARANTEES THAT THE NEXT LOT FOR PRODUCTION IS READ ONLY ONCE.
C
C           ****NRELFG WILL REMAIN AS ZERO UNTIL ARRIVAL OF THE NEXT LOT****
C
               CALL SCHDL (1,TREL,A)
            ELSE
               NRELFG=0
               TREL=0.01
```

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mdirizar@c50030-201ps.1          cell6.f          10/17/96 13:43   32/220
               CALL SCHDL (1,TREL,A)
            ENDIF

           ENDIF

         ELSE
C           RELEASE ANOTHER UNIT LOAD OF THE CURRENT LOT OR OF THE NEXT LOT
C           FOR PRODUCTION IF THE DEPARTING UNIT IS THE LAST ONE OF THE
C           CURRENT LOT.
C
C            NRELUL=NRELUL+1

            CALL COPY(NNQ(IA7),IA7,A)

            I2=A(2)
            I3=A(3)

C           THIS IS A SET OF INSTRUCTIONS VALID FOR CASES WHERE IUL>1
C
C            I4=A(4)
C            I8=A(8)
C
C            IF (I8-NREL(I2,I3).LT.I4) THEN
C               A(4)=I8-NREL(I2,I3)
C               A(10)=A(4)
C            ENDIF

            NREL(I2,I3)=NREL(I2,I3)+1
            XINBUF(IA7)=XINBUF(IA7)+A(4)
            CALL SCHDL (7,0.0,A)
         ENDIF
      ENDIF

C
2330  IF (NDEPSC(IA7).EQ.1) THEN
         CALL DESC1(IA7)
         RETURN
      ENDIF
C
      IF (NDEPSC(IA7).EQ.2) THEN
         CALL DESC2(IA7)
         RETURN
      ENDIF
C
      IF (NDEPSC(IA7).EQ.3) THEN
         CALL DESC3(IA7)
         RETURN
      ENDIF
C
      IF (NDEPSC(IA7).EQ.4) THEN
         CALL DESC4(IA7)
         RETURN
      ENDIF

      IF (NDEPSC(IA7).EQ.6) THEN
         CALL DESC6(IA7)
         RETURN
      ENDIF

      IF (NDEPSC(IA7).EQ.8) THEN
         CALL DESC8(IA7)
         RETURN
      ENDIF

      IF (NDEPSC(IA7).EQ.10) THEN
         CALL DESC10(IA7)
         RETURN
      ENDIF

      END
C
C *****************************************************************
C
      SUBROUTINE DESC1(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MSCZV)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NNOCD(50),NQCD(50),NABRSC(50),
     1 NDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLJOB(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
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c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEM,NAVNT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANME,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINED,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRONMD,TNMKP1,TNMKP2,TNMKP3
      COMMON/UCOM17/TRONJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCSM,TSELSM
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
c
      IF (MTYPE(IA7).EQ.1) THEN
         CALL DIN1(IA7)
         RETURN
      ENDIF
c
      IF (MTYPE(IA7).EQ.5) THEN
         CALL DIN5(IA7)
         RETURN
      ENDIF
c
c      IF (MTYPE(IA7).EQ.6) THEN
c         CALL DIN6(IA7)
c         RETURN
c      ENDIF
c
      END
c
c ***********************************************************************
c
      SUBROUTINE DIN1(IA7)
c
      INCLUDE '/ncsu/jwilson_run/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON QSET(600000)
c
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),MANRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENON(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLESC(50),NBLAMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEM,NAVNT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANME,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINED,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRONMD,TNMKP1,TNMKP2,TNMKP3
      COMMON/UCOM17/TRONJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCSM,TSELSM
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
```



```
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM29/MINITR,NDESTR
      COMMON/UCOM32/KINDUP(50)
      COMMON/UCOM43/BRKDSC,BRMEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM60/IPMCD(50),IREP(50)
      COMMON/UCOM63/PULLDQ(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM82/MAXN
c
      QFLAG=0
      NQFLAG=0
c
c     NQFLAG=1 IS USED AT THE PYQ SUBROUTINE TO POINT OUT THAT THE
c     THE POKA YOKE SUB IS BEING CALLED FROM A DEPARTURE SCENARIO
c     IN WHICH THE DEPARTING UNIT SHOULD BE ALLOWED TO MOVE TO THE
c     NEXT MACHINE IN THE PART'S ROUTING.
c
      NQFLAG=1
      NIDQ=IA7+MAXN
      IF (NOPCD(IA7).EQ.2) THEN
         NOPSTA(IOP(IA7))=0
      ENDIF
c
      MSTATU(IA7)=0
c
      UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
      TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
      START(IA7)=900000

      IF (BRKDSC.EQ.2) THEN
         IF (UPTIME(IA7).GT.BRMEXT(IA7)) THEN
            CALL UPBRKD(IA7)
         ENDIF
      ENDIF

      ATRIB(12)=IA7
      CALL DQC(IA7,QFLAG,NQFLAG)
c
c     QFLAG=1 MEANS THE QUEUE OR DUMMY INPUT BUFFER OF MACHINE IA7
c     SHOULD BE CHECKED FOR PARTS WAITING TO BE PROCESSED.
c
      IF (QFLAG.NE.1) THEN

         IF (NOPCD(IA7).EQ.2) THEN

c          IF HIS STATUS IS STILL ZERO IT MEANS HE WAS NOT INVOLVED IN
c          MATERIAL HANDLING ACTIVITIES

           IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7)).EQ.2) THEN
              CALL DESTIN(IA7)
           ENDIF

         ENDIF

         RETURN
      ENDIF
c
c     DO NOT FREE CONTAINERS IN THIS SUBROUTINE SINCE HERE PARTS ARRIVE
c     AND LEAVE IN UNIT LOAD SIZE OF ONE.
c
c     THE ABOVE IF (QFLAG.NE.1) DOES NOT CONTEMPLATE THE FOLLOWING
c     CASE: QFLAG=1, NOPCD=2 (I.E. OPERATOR NEEDED
c     AT ALL TIMES, HOWEVER MATERIAL HANDLING IS MANUAL. CHECK IF THE
c     OPERATOR IS HANDLING THE PROCESSED PART. IF THAT IS THE CASE,
c     THEN SET MACHINE STATUS TO 0.
c
      IF (NOPCD(IA7).EQ.2) THEN
         IF (NOPSTA(IOP(IA7)).EQ.3 .AND. LASTMA(IOP(IA7)).EQ.IA7) THEN
            RETURN
         ENDIF
      ENDIF
c
c     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
c     GIVE PRIORITY TO THOSE.
c
      FFLAG=0
      CALL BRKCK(IA7,FFLAG)
      IF (FFLAG.EQ.0) THEN
         IF (NOPCD(IA7).EQ.2) THEN
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               CALL DESTIN(IA7)
            ENDIF
         ENDIF
         GO TO 2390
      ENDIF
c
c     CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
c     GIVE PRIORITY TO THOSE.
c
```

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```
      IF (MAUTO.EQ.1) THEN
         FFLAG=0
         CALL AUTOCK(IA7,FFLAG)
         IF (FFLAG.EQ.0) THEN
            GO TO 2390
         ENDIF
      ENDIF
C
C     CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C     IF THERE ARE,GIVE PRIORITY TO THOSE.
C
      IF (IREP(IA7).EQ.1) THEN
         FFLAG=0
         CALL NSTCK(IA7,FFLAG)
         IF (FFLAG.EQ.0) THEN
            GO TO 2390
         ENDIF
      ENDIF
C
C     THE FOLLOWING 'IF' COVERS FIRST THE CASE IN WHICH THE MACHINE
C     REQUIRES AN OPERATOR TO PROCESS THE PART (I.E. MOPCD=2). THE
C     'ELSE' COVERS THE CASE IN WHICH AN OPERATOR IS NOT NEEDED TO
C     PROCESS A PART.
C
      QFLAG=0
      SFLAG=0
C
      IF (MOPCD(IA7).EQ.2) THEN
C
         CALL QFULL(IA7,QFLAG,SFLAG)
C
         IF (QFLAG.EQ.0) THEN
C
C           SEND OPERATOR TO ANOTHER MACHINE IF HE IS A SHARED OPERATOR
C           OR FREE HIM IF HE IS A DEDICATED OPERATOR. MACHINE STATUS
C           CHANGES TO ZERO AT MIQFUL.
C
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               CALL DESTIN(IA7)
            ENDIF
            RETURN
C
         ELSE
C
C           VERIFY IF THE OPERATOR WILL STAY AT THAT MACHINE OR NEEDS
C           TO MOVE TO ANOTHER MACHINE
C
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               MOVE=0
               CALL MOVEMT(IA7,MOVE)
               IF (MOVE.EQ.1) THEN
                  RETURN
               ENDIF
            ENDIF
C
            IF (SFLAG.EQ.1 .AND. ISCHOP(IA7).NE.0) THEN
C
C              PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C              CHOSEN BY THE USER.
C
               CALL SCHEDP(IA7)
C
            ENDIF
C
C           DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C           TO BE PROCESSED.
C
            NTRY=MMPE(IA7)
            IA2=QSET(NTRY+2)
            IA10=QSET(NTRY+10)
C
C           VERIFY IF A SETUP IS NEEDED
C
            IF (MSUCD(IA7).EQ.1) THEN
C
               IF (IA2.NE.LASTPN(IA7)) THEN
                 MSUPN=IA2
                 CALL MSETUP(MSUPN,IA7)
C
C                AN OPERATOR MIGHT HAVE BEEN PROCESSING PARTS AND NOW IS
C                AVAILABLE. ITS STATUS WAS CHANGED TO ZERO AT THE BEGINNING
C                OF THIS SUB. THEREFORE, AT MSETUP, IF HE IS NOT NEEDED THAT
C                SUB WILL NOT CALL DESTIN BEACUSE HIS STATUS IS ZERO.
C
                 IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7)).EQ.2)
     1           THEN
                    CALL DESTIN(IA7)
                 ENDIF
                 RETURN
               ENDIF
            ENDIF
```



```
            IF (IA10.EQ.0) THEN
               GO TO 2373
            ENDIF
C
C           DFLAG=1 WITH AFLAG=0 TELLS THE FQC SUBROUTINE THAT THE
C           CALLING SUBROUTINE IS A DEPARTURE.
C
            DFLAG=1
            AFLAG=0
            FFLAG=0
C
C           IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C           PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C           THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C           CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C           THE REMOVAL.
C
            CALL FQC(AFLAG,DFLAG,FFLAG,IA7)

            IF (FFLAG.EQ.0) THEN
               IF (NOPSTA(IOP(IA7)).NE.6) THEN
                  WRITE(6,2370)
2370              FORMAT(1X,'ERROR:AT MID1 W/MOPCD=2, FFLAG WILL BE
     1                 ZERO ONLY IF HE IS DOING INSPECTION')
               CALL MESSAGE(IA7)
               ENDIF
C
               IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1         XINBUF(IA7).LT.MBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
C
            ELSE
2373           MIDQ=IA7+MAXM
               NOPSTA(IOP(IA7))=1
               CALL MACHIN(IA7,MIDQ)
C
               IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1         XINBUF(IA7).LT.MBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
C
               RETURN
            ENDIF
C
         ENDIF
C
      ELSE
C
C        VERIFY IF PARTS ARE WAITING IN QUEUE AND IF THERE IS MORE
C        THAN ONE UNIT LOAD IN QUEUE (I.E. SFLAG=1)
C
         CALL QFULL(IA7,QFLAG,SFLAG)
C
         IF (QFLAG.EQ.0) THEN
            RETURN
         ENDIF

         IF (SFLAG.EQ.1  .AND. ISCHOP(IA7).NE.0) THEN
C
C           PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C           CHOSEN BY THE USER.
C
            CALL SCHEDP(IA7)
C
         ENDIF
C
C        DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C        TO BE PROCESSED.
C
         NTRY=MMPE(IA7)
         IA2=QSET(NTRY+2)
         IA10=QSET(NTRY+10)
C
C
C        VERIFY IF A SETUP IS NEEDED
C
         IF (MSUCD(IA7).EQ.1) THEN
C
             IF (IA2.NE.LASTPN(IA7)) THEN
                 MSUPN=IA2
                 CALL MSETUP(MSUPN,IA7)
                 RETURN
             ENDIF
          ENDIF
C
         IF (IA10.EQ.0) THEN
            GO TO 2380
         ENDIF
C
C        DFLAG=1 WITH AFLAG=0 TELLS THE FQC SUBROUTINE THAT THE
C        CALLING SUBROUTINE IS A DEPARTURE.
```

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c
      DFLAG=1
      AFLAG=0
      PFLAG=0
c
c     IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
c     PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
c     THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
c     CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
c     THE REMOVAL.
c
      CALL PQC(AFLAG,DFLAG,PFLAG,IA7)
c
      IF (PFLAG.EQ.0) THEN
c
         IF (MSTATU(IA7).EQ.6) THEN
            IF ((XINBUF(IA7)+PULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1      XINBUF(IA7).LT.MBUFF(IA7)) THEN
               CALL CEBLK(IA7)
            ENDIF
         ENDIF
c
         RETURN
      ELSE
2380     NIDQ=IA7+MAXN
         CALL MACHIN(IA7,NIDQ)
c
         IF ((XINBUF(IA7)+PULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1   XINBUF(IA7).LT.MBUFF(IA7)) THEN
             CALL CEBLK(IA7)
         ENDIF
c
      ENDIF
c
      ENDIF
c
2390  RETURN
      END
c
c ******************************************************************
c
      SUBROUTINE DIN1(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MSCRV)
c
      COMMON QSET(600000)
c
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MBUFTP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWRP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MNEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,MRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKSN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDSMD,TNMLP1,TNMLP2,TNMLP3
      COMMON/UCOM17/TRDRJP(40),TRDSMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNM,TSELNM
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSUNMD(50),SUNMP1(50),SUNMP2(50),SUNMP3(50)
      COMMON/UCOM21/NSENMD(50),SENMP1(50),SENMP2(50),SENMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
c
      COMMON/UCOM26/NP3,NP4
      common/ucomd/iffl
      COMMON/UCOM29/MINITR,MDESTR
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      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM48/MAUTO
      COMMON/UCOM60/IPNCD(50),IREP(50)
      COMMON/UCOM61/PULLDQ(50)
      COMMON/UCOM63/BRKDSC,BRNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM68/ASKCO(50),RELCO(50)
      COMMON/UCOM69/ASKCA(50),RELCA(50)
      COMMON/UCOM82/MAXN
c
      QFLAG=0
      NQFLAG=0
c
      IF (NOPCD(IA7).EQ.2) THEN
         NOPSTA(IOP(IA7))=0
      ENDIF
c
      MSTATU(IA7)=0
c
c     MKFLAG=1 IS USED AT THE PYQ SUBROUTINE TO POINT OUT THAT THE
c     THE POKA YOKE SUB IS BEING CALLED FROM A DEPARTURE SCENARIO
c     IN WHICH THE DEPARTING UNIT SHOULD BE ALLOWED TO MOVE TO THE
c     NEXT MACHINE IN THE PART'S ROUTING.
c
      MKFLAG=1
c
      IA2=ATRIB(2)
c
c     IN THIS SCENARIO PARTS ARRIVE IN BATCHES AND LEAVE ONE BY ONE.
c     THUS VERIFY IF THE PREVIOUS BATCH WAS COMPLETED AND FREE CONTAINERS.
c
      NIDQ=IA7+MAXN
      IF (IA7.GE.2.AND.RELCO(IA7).EQ.1.AND.NNQ(NIDQ).EQ.0) THEN
c
         CALL FREECO(IA2,IA7)
      ENDIF
c
      IF (IA7.GE.2 .AND. NNQ(NIDQ).EQ.0 .AND.RELCA(IA7).EQ.1) THEN
          CALL FREECA(IA2,IA7)
      ENDIF
c
c     CHANGE UNIT LOAD SIZE TO 1.
c
      ATRIB(4)=1.0
c
      IF (ATRIB(11).EQ.1) THEN
         ATRIB(10)=1
      ELSE
         ATRIB(10)=0
      ENDIF
c
      UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
      TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
      START(IA7)=900000

      IF (BRKDSC.EQ.2) THEN
         IF (UPTIME(IA7).GT.BRNEXT(IA7)) THEN
            CALL UPBRKD(IA7)
         ENDIF
      ENDIF

      ATRIB(12)=IA7
      CALL DQC(IA7,QFLAG,NQFLAG)
c
c     QFLAG=1 MEANS THE QUEUE OR DUMMY INPUT BUFFER OF MACHINE IA7
c     SHOULD BE CHECKED FOR PARTS WAITING TO BE PROCESSED.
c
      IF (QFLAG.NE.1) THEN

         IF (NOPCD(IA7).EQ.3) THEN
c
c          IF HIS STATUS IS STILL ZERO IT MEANS HE WAS NOT INVOLVED IN
c          MATERIAL HANDLING ACTIVITIES
c
           IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7)).EQ.2) THEN
              CALL DESTIN(IA7)
           ENDIF

         ENDIF

         RETURN
      ENDIF
c
c     CHECK IF THE NEXT PART TO BE PROCESSED BELONGS TO A PARTIALLY
c     PROCESSED UNIT LOAD. NIDQ REPRESENTS THE DUMMY INPUT BUFFER OF IA7
c
      IF (NNQ(NIDQ).GT.0) THEN
         IF (NOPCD(IOP(IA7)).EQ.2) THEN
            NOPSTA(IOP(IA7))=1
         ENDIF
         CALL MACHIN(IA7,NIDQ)
         RETURN
```

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      ENDIF
C
C     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
C     GIVE PRIORITY TO THOSE.
C
      FFLAG=0
      CALL BRKCK(IA7,FFLAG)
      IF (FFLAG.EQ.0) THEN
         IF (MOPCD(IA7).EQ.2) THEN
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               CALL DESTIN(IA7)
            ENDIF
         ENDIF
         GO TO 2437
      ENDIF
C
C     CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
C     GIVE PRIORITY TO THOSE.
C
      IF (MAUTO.EQ.1) THEN
         FFLAG=0
         CALL AUTOCK(IA7,FFLAG)
         IF (FFLAG.EQ.0) THEN
            GO TO 2437
         ENDIF
      ENDIF
C
C     CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C     IF THERE ARE,GIVE PRIORITY TO THOSE.
C
      IF (IREP(IA7).EQ.1) THEN
         FFLAG=0
         CALL RPTCK(IA7,FFLAG)
         IF (FFLAG.EQ.0) THEN
            GO TO 2437
         ENDIF
      ENDIF
C
C     THE FOLLOWING 'IF' COVERS FIRST THE CASE IN WHICH THE MACHINE
C     REQUIRES AN OPERATOR TO PROCESS THE PART (I.E. MOPCD=2). THE
C     'ELSE' COVERS THE CASE IN WHICH AN OPERATOR IS NOT NEEDED TO
C     PROCESS A PART.
C
      QFLAG=0
      SFLAG=0
C
      IF (MOPCD(IA7).EQ.2) THEN
C
         CALL QFULL(IA7,QFLAG,SFLAG)
C
         IF (QFLAG.EQ.0) THEN
C
C           SEND OPERATOR TO ANOTHER MACHINE IF HE IS A SHARED OPERATOR
C           OR FREE HIM IF HE IS A DEDICATED OPERATOR. MACHINE STATUS
C           CHANGES TO ZERO AT RIQFUL.
C
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               CALL DESTIN(IA7)
            ENDIF
            RETURN
C
         ELSE
C
C           VERIFY IF THE OPERATOR WILL STAY AT THAT MACHINE OR NEEDS
C           TO MOVE TO ANOTHER MACHINE
C
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               MOVE=0
               CALL MOVENT(IA7,MOVE)
               IF (MOVE.EQ.1) THEN
                  RETURN
               ENDIF
            ENDIF
C
            IF (SFLAG.EQ.1  .AND. ISCHDP(IA7).NE.0) THEN
C
C              PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C              CHOSEN BY THE USER.
C
               CALL SCHEDP(IA7)
C
            ENDIF
C
C           DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C           TO BE PROCESSED.
C
            NTRY=MNFE(IA7)
            IA2=QSET(NTRY+2)
            IA10=QSET(NTRY+10)
C
C
C           VERIFY IF A SETUP IS NEEDED
```

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```
C
            IF (MSUCD(IA7).EQ.1) THEN

               IF (IA2.NE.LASTPN(IA7)) THEN
                 MSUPN=IA2
                 CALL MSETUP(MSUPN,IA7)
                 IF (MOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7)).EQ.2)
     1           THEN
                     CALL DESTIN(IA7)
                 ENDIF
C
                 RETURN
               ENDIF
            ENDIF

            IF (IA10.EQ.0) THEN
               GO TO 2424
            ENDIF
C
C           DFLAG=1 WITH AFLAG=0 TELLS THE FQC SUBROUTINE THAT THE
C           CALLING SUBROUTINE IS A DEPARTURE.
C
            DFLAG=1
            AFLAG=0
            FFLAG=0
C
C           IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C           PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C           THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C           CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C           THE REMOVAL.
C
            CALL FQC(AFLAG,DFLAG,FFLAG,IA7)

            IF (FFLAG.EQ.0) THEN
               IF (MOPSTA(IOP(IA7)).NE.6) THEN
                  WRITE(6,2420)
2420              FORMAT(1X,'ERROR:AT DIML W/MOPCD=3, FFLAG WILL BE
     1                    ZERO ONLY IF HE IS DOING INSPECTION')
               CALL MESSAGE(IA7)
               ENDIF
C
               IF ((KINBUF(IA7)+ FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1         KINBUF(IA7).LT.MBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
C
            ELSE
2424           NIDQ=IA7+MAXM

               CALL MACHIN(IA7,NIDQ)
               MOPSTA(IOP(IA7))=1
C
               IF ((KINBUF(IA7)+ FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1         KINBUF(IA7).LT.MBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
C
            ENDIF
C
         ENDIF
C
      ELSE
C
C     VERIFY IF PARTS ARE WAITING IN QUEUE AND IF THERE IS MORE
C     THAN ONE UNIT LOAD IN QUEUE (I.E. SFLAG=1)
C
         CALL QFULL(IA7,QFLAG,SFLAG)
C
         IF (QFLAG.EQ.0) THEN
            RETURN
         ENDIF
         IF (SFLAG.EQ.1  .AND. ISCHDP(IA7).NE.0) THEN
C
C            PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C            CHOSEN BY THE USER.
C
            CALL SCHEDP(IA7)
         ENDIF
C
C        DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C        TO BE PROCESSED.
C
         NTRY=MNFE(IA7)
         IA2=QSET(NTRY+2)
         IA10=QSET(NTRY+10)
C
C        VERIFY IF A SETUP IS NEEDED
C
         IF (MSUCD(IA7).EQ.1) THEN

             IF (IA2.NE.LASTPN(IA7)) THEN
```

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```
                  NSUPN=IA2
                  CALL NSETUP(NSUPN,IA7)
                  RETURN
               ENDIF
            ENDIF

         IF (IA10.EQ.0) THEN
            GO TO 2435
         ENDIF
C
C     DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
C     CALLING SUBROUTINE IS A DEPARTURE.
C
         DFLAG=1
         AFLAG=0
         PFLAG=0
C
C        IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C        PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C        THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C        CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C        THE REMOVAL.
C
         CALL PQC(AFLAG,DFLAG,PFLAG,IA7)

         IF (PFLAG.EQ.0) THEN
C
            IF (MSTATU(IA7).EQ.6) THEN
               IF ((XINBUF(IA7)+ FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1         XINBUF(IA7).LT.MBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
            ENDIF
C
         ELSE
2435        NIDQ=IA7+MAXM
            CALL MACHIN(IA7,NIDQ)
C
            IF ((XINBUF(IA7)+ FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1      XINBUF(IA7).LT.MBUFF(IA7)) THEN
               CALL CKBLK(IA7)
            ENDIF
C
         ENDIF
C
      ENDIF
C
2437  RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE DQC(IA7,QFLAG,NQFLAG)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDSND,TRNKP1,TRNKP2,TRNKP3
      COMMON/UCOM17/TRDRJP(40),TRDSNP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSUNMD(50),SUNMP1(50),SUNMP2(50),SUNMP3(50)
```



```
      COMMON/UCOM21/NSENMD(50),SENMP1(50),SENMP2(50),SENMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      COMMON/UCOM82/MAXM
      common/ucomd/iffl
C
      IF (NQFLAG.EQ.1) THEN
         NODQ=IA7+MAXM*2
         IF (MDEPSC(IA7).NE.0) THEN
            IA10=NUMQ(11,NODQ)
         ELSE
            IA10=NUMQ(10,NODQ)
         ENDIF
      ELSE
         IA10=ATRIB(10)
      ENDIF
C
      IF (IA10.EQ.0) THEN
C
C        IF ALL PARTS IN THE UNIT LOAD ARE BAD THEN
C        DO NOT ALLOW INSPECTIONS TO BE PERFORMED.
C
         GO TO 2440
      ENDIF
C
      GO TO (2440,2441,2440,2441),MQCD(IA7)
C
2440  CALL TRADQ(IA7,QFLAG,NQFLAG)
      RETURN
C
2441  CALL SELFIQ(IA7,QFLAG,NQFLAG)
      RETURN
C
C2440  CALL FYQ(IA7,QFLAG,NQFLAG)
C      RETURN
C
      END
C
C ********************************************************************
C
      SUBROUTINE TRADQ(IA7,QFLAG,NQFLAG)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDSND,TRNKP1,TRNKP2,TRNKP3
      COMMON/UCOM17/TRDRJP(40),TRDSNP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSUNMD(50),SUNMP1(50),SUNMP2(50),SUNMP3(50)
      COMMON/UCOM21/NSENMD(50),SENMP1(50),SENMP2(50),SENMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM33/NPARLL(50),NNRS(10,50)
      COMMON/UCOM46/BLKTM(50)
```

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```
      COMMON/UCOM32/MAXM
C
C     DETERMINE IF THIS IS THE LAST MACHINE IN THE PART ROUTING
C
      IF (NQFLAG.EQ.1) THEN
         NODQ=IA7+MAXM*2
         NTRY=NNPE(NODQ)
         IA2=QSET(NTRY+2)
         IA6=QSET(NTRY+6)
      ELSE
         IA2=ATRIB(2)
         IA4=ATRIB(4)
         IA6=ATRIB(6)
      ENDIF

      IF (IA6.GT.IA7) THEN
         WRITE(6,2443) IA2,IA7,IA6,IA7
2443     FORMAT(1X,'ERROR W/IA2=',I3,1X,'IA7=',I3,1X,'IA6=',I3,'>',
     1   'IA7')
      ENDIF

      IF (IA6.EQ.MACNS(IA2)) THEN
         IF (MTYPE(IA7).EQ.5) THEN

            IF (NQFLAG.EQ.1) THEN
               DO 2444 I=1,NNQ(NODQ)
               CALL REMDOQ(IA7)
               CALL FINGDS(IA7)
2444           CONTINUE
            ELSE
               CALL FINGDS(IA7)
            ENDIF

         ELSE

            IF (NQFLAG.EQ.1) THEN
               CALL REMDOQ(IA7)
            ENDIF
            CALL FINGDS(IA7)

         ENDIF

         QFLAG=1
         GO TO 2448
      ENDIF
C
C     IF THIS IS NOT THE LAST MACHINE, DETERMINE IF THERE IS SPACE ON
C     THE NEXT MACHINE'S BUFFER
C
      BFLAG=0
C
      IA6=IA6+1
      NEXTM=NSEQ(IA6,IA2)
      IF (NPARLL(NEXTM).EQ.0) THEN
         CALL BUFFCK(BFLAG,NEXTM)
C
C        IF THERE IS NOT ENOUGH BUFFER SPACE THEN BLOCK THIS MACHINE.
C        OTHERWISE, CALL THE MATERIAL HANDLING SUBROUTINE.
C
C        WHEN CALLED FROM CSELIN, IF BFLAG=0 THEN THE MACHINE STATUS CHANGES
C        FROM 7 TO 2.
C
C        **** THE BURN IN OVEN IS A VERY SPECIAL CASE IN WHICH THE OPERATOR
C             IS PERFORMING INSPECTION WHILE THE MACHINE IS RUNNING PARTS.
C             THEREFFORE, THE MACHINE SHOULD NOT BE BLOCKED. *****
C
         IF (BFLAG.EQ.0) THEN
C
            IF (MTYPE(IA7).EQ.3) THEN
               WRITE(6,2445)
2445           FORMAT(1X,'ERROR AT TRADQ BLOCKING MTYPE=3')
               CALL MESSAGE(IA7)
            ENDIF
C
            MSTATU(IA7)=2
            BLKTM(IA7)=TNOW
            MBLKSC(IA7)=1
            MBLKMA(IA7)=NEXTM
            IF (NQFLAG.EQ.0) THEN
               CALL PUTDOQ(IA7)
            ENDIF
            QFLAG=0
         ELSE
            CALL MATHAN(IA7,QFLAG,NEXTM,NQFLAG)
         ENDIF
C
      ELSE

         NEXTM=0
         CALL SELRES(IA7,NEXTM)
         CALL BUFFCK(BFLAG,NEXTM)
         IF (BFLAG.EQ.0) THEN
```



```
            IF (MTYPE(IA7).EQ.3) THEN
               WRITE(6,2446)
2446           FORMAT(1X,'ERROR AT TRADQ BLOCKING MTYPE=3')
               CALL MESSAGE(IA7)
            ENDIF

            MSTATU(IA7)=2
            BLKTM(IA7)=TNOW
            MBLKSC(IA7)=1
            MBLKMA(IA7)=NEXTM
            IF (NQFLAG.EQ.0) THEN
               CALL PUTDOQ(IA7)
            ENDIF
            QFLAG=0
         ELSE
            CALL MATHAN(IA7,QFLAG,NEXTM,NQFLAG)
         ENDIF
      ENDIF
C
2448  RETURN
      END
C
C ******************************************************************
C
      SUBROUTINE BUFFCK(BFLAG,NEXTM)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MMUCD(50),MQCD(50),MAXREC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWRP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACNS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),NSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPW,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/MSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/MALKEN,NAVNT,OPNDT,NDTMA,MALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
C
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM33/FULLDQ(50)
C
C     DETERMINE THE NUMBER OF UNITS WAITING IN QUEUE AT THE NEXT
C     MACHINE IN THE PART'S ROUTING. IF THE NUMBER OF UNITS WAITING
C     IN QUEUE EQUALS OR EXCEED QUEUE CAPACITY, THEN SET BFLAG=0.
C
C      IF A MACHINE  IS WAITING FOR A GIVEN PART NUMBER IT SHOULD BE
C      ALLOW TO FLOW EVEN IF THE BUFFER IS FULL.
C
       IA2=ATRIB(2)
C
       IF (MSTATU(NEXTM).EQ.10 .AND. IA2.EQ.LASTPN(NEXTM))THEN
          BFLAG=1
          GO TO 2450
       ENDIF
C
       IF (XINBUF(NEXTM).LT.MBUFF(NEXTM)) THEN
```

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```
            BFLAG=1
         ELSE
            BFLAG=0
         ENDIF
C
2450  RETURN
      END
C
C ***************************************************************
C
      SUBROUTINE MATHAN(IA7,QFLAG,NEXTM,NQFLAG)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NEQT),DDL(NEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(NEQT),
     2SSL(NEQT),TNEXT,TNOW,XX(NGXIV)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NAMRSC(50),
     1 NOEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLESC(50),NBLEMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEM,WAVWT,OPNDT,NOTWA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBECO(50),NOBECA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRORWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
C
      GO TO (2460,2460,2460,2461,2461,2461,2461,2461), NMOP(IA7,NEXTM)
C
2460  CALL CONV(IA7,QFLAG,NEXTM,NQFLAG)
      RETURN
C
2461  CALL MANMAN(IA7,QFLAG,NEXTM,NQFLAG)
      RETURN
C
      END
C
C ***************************************************************
C
      SUBROUTINE CONV(IA7,QFLAG,NEXTM,NQFLAG)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NEQT),DDL(NEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(NEQT),
     2SSL(NEQT),TNEXT,TNOW,XX(NGXIV)
C
      COMMON QSET(600000)

      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NAMRSC(50),
     1 NOEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLESC(50),NBLEMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
```



```
C
      COMMON/UCOM7/WALKEM,WAVWT,OPNDT,NOTWA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBECO(50),NOBECA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRORWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM63/PULLDQ(50)
      COMMON/UCOM82/MAXN
      common/ucomd/iff1
C
      IF (MTYPE(IA7).EQ.5 .AND. NQFLAG.EQ.1) THEN

         NODQ=IA7+MAXN*2

         DO 2460 I=1,NNQ(NODQ)-1
         NTRY=LOCAT(I,NODQ)
         I2=QSET(NTRY+2)
         I3=QSET(NTRY+3)
         NTRY=LOCAT(I+1,NODQ)
         I12=QSET(NTRY+2)
         IF (I2.NE.I12) THEN
            WRITE(6,2455) I2,I3
2455        FORMAT(1X,'ERROR AT CONV FOR  MTYPE=5 PN=',I3,1X,'LOT=',I4)
            WRITE(6,2456)
2456        FORMAT(1X,'DIFFERENT PART NUMBERS IN THE OUTPUT BUFFER')
            CALL MESSAGE(IA7)
         ENDIF
2460     CONTINUE

         DO 2470 I=1,NNQ(NODQ)
         CALL REMDOQ(IA7)
         ATRIB(6)=ATRIB(6)+1
         ATRIB(7)=NEXTM

         IF (ATRIB(6).GT.ATRIB(7).AND.ATRIB(7).LE.19) THEN
            WRITE(6,2475) ATRIB(2),ATRIB(7),ATRIB(6)
2475        FORMAT(1X,'ERROR W/IA2=',F4.0,1X,'IA7=',F4.0,1X,
     1      'IA6=',F4.0,'>','IA7')
         ENDIF

         TARR=CLENGN(IA7,NEXTM)/SPEED(IA7,NEXTM)
C
         CALL SCHDL (7,TARR,ATRIB)
         XINBUF(NEXTM)=XINBUF(NEXTM)+ATRIB(4)
2470     CONTINUE

         QFLAG=1

      ELSE

         IF (NQFLAG.EQ.1) THEN
            CALL REMDOQ(IA7)
         ENDIF

         ATRIB(6)=ATRIB(6)+1
         ATRIB(7)=NEXTM

         IF (ATRIB(6).GT.ATRIB(7).AND.ATRIB(7).LE.19) THEN
            WRITE(6,2480) ATRIB(2),ATRIB(7),ATRIB(6)
2480        FORMAT(1X,'ERROR W/IA2=',F4.0,1X,'IA7=',F4.0,1X,
     1      'IA6=',F4.0,'>','IA7')
         ENDIF

         TARR=CLENGN(IA7,NEXTM)/SPEED(IA7,NEXTM)
C
         CALL SCHDL (7,TARR,ATRIB)
         XINBUF(NEXTM)=XINBUF(NEXTM)+ATRIB(4)
         QFLAG=1

      ENDIF

2490  RETURN
      END
```

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```
mdirlsar@c50030-201ps.i          cell6.f          10/17/96  13:46   47/220
c
c *******************************************************************
c
      SUBROUTINE QPULL(IA7,QFLAG,SFLAG)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MMOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKIN,NAVMT,OPNOT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANML,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
c

      IF (MTYPE(IA7).EQ.1 .OR. MTYPE(IA7).EQ.9) THEN
         CALL M1QPU1(IA7,QFLAG,SFLAG)
         RETURN
      ENDIF

      IF (MTYPE(IA7).EQ.2 .and. MDEPSC(IA7).EQ.6) THEN
         CALL M1QPU1(IA7,QFLAG,SFLAG)
         RETURN
      ENDIF

      IF (MTYPE(IA7).EQ.3) THEN
         CALL M3QPU1(IA7,QFLAG,SFLAG)
         RETURN
      ENDIF

      IF (MTYPE(IA7).EQ.5) THEN
         CALL M5QPU1(IA7,QFLAG,SFLAG)
         RETURN
      ENDIF

      END
c
c *******************************************************************
c
      SUBROUTINE M1QPU1(IA7,QFLAG,SFLAG)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MMOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
```

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mdirlsar@c50030-201ps.i          cell6.f          10/17/96  13:46   48/220
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKIN,NAVMT,OPNOT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANML,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
c
c     WHEN THERE ARE NO UNITS WAITING IN QUEUE, QFLAG REMAINS AS ZERO,
c     AND THE MACHINE STATUS CHANGES TO ZERO.
c
      IF (NNQ(IA7).EQ.0) THEN
         MSTATU(IA7)=0
         RETURN
      ENDIF
      QFLAG=1
c
c     IF THERE IS MORE THAN ONE UNIT LOAD WAITING IN QUEUE, SFLAG ASSUMES
c     A VALUE OF ONE.
c
      IF (NNQ(IA7).GT.1) THEN
         SFLAG=1
      ENDIF
c
      RETURN
      END
c
c *******************************************************************
c
      SUBROUTINE M3QPU1(IA7,QFLAG,SFLAG)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MMOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKIN,NAVMT,OPNOT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANML,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
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      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      COMMON/UCOM64/CAPAV(50)
      common/ucomd/iffl
C
C     WHEN THERE ARE NO UNITS WAITING IN QUEUE, QFLAG REMAINS AS ZERO.
C
      IF (NNQ(IA7).EQ.0) THEN
         RETURN
      ENDIF
      QFLAG=1
C
C     IF THERE IS MORE THAN ONE UNIT LOAD WAITING IN QUEUE, SFLAG ASSUMES
C     A VALUE OF ONE.
C
      IF (NNQ(IA7).GT.1) THEN
         SFLAG=1
      ENDIF
C
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE CKCONT(IA2,IA4,IA6,IA7)
C
      INCLUDE '/ncsu/jwilson_ree/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),MARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKNA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,SLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKIN,NAVNT,OPNDT,NDTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      COMMON/UCOM68/ASECO(50),RELCO(50)
      COMMON/UCOM69/ASECA(50),RELCA(50)
      common/ucomd/iffl
C
      M=IA7
      J=IA6+1
      NEXTM=NSEQ(J,IA2)
C
      IF (ASECO(M).EQ.1 .OR. ASECA(M).EQ.1) THEN
          CALL CONTAI(IA2,IA4,M,NEXTM)
      ENDIF
C
      RETURN
C
      END
C
C ********************************************************************
C
      SUBROUTINE CONTAI(IA2,IA4,M,NEXTM)
C
      INCLUDE '/ncsu/jwilson_ree/PARAM.INC'
```



```
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),MARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKNA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,SLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKIN,NAVNT,OPNDT,NDTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      COMMON/UCOM68/ASECO(50),RELCO(50)
      COMMON/UCOM69/ASECA(50),RELCA(50)
      common/ucomd/iffl
C
      IF(ASECO(M).EQ.1) THEN
C
         IF (IDEPUL(IA2,M).GT.0) THEN
C
            IF (NDEPSC(M).EQ.0) THEN
               NULS=INT(ATRIB(4)*IBI(IA2)/IDEPUL(IA2,M)+.99)
            ELSE
               NULS=INT(ATRIB(4)/IDEPUL(IA2,M)+.99)
            ENDIF
C
            U=IDEPUL(IA2,M)
            NEED=INT(U/ICOCAP(IA2,ICOTYP(IA2,NEXTM))+.99)
     1            *NULS
C
         ELSE
            NEED=INT(ATRIB(4)/ICOCAP(IA2,ICOTYP(IA2,NEXTM))+.99)
         ENDIF
C
         NUSECO(ICOTYP(IA2,NEXTM))=NUSECO(ICOTYP(IA2,NEXTM))+NEED
C
         IF (NUSECO(ICOTYP(IA2,NEXTM)).GT.MAXCO(ICOTYP(IA2,NEXTM)))
     1THEN
             MAXCO(ICOTYP(IA2,NEXTM))=NUSECO(ICOTYP(IA2,NEXTM))
         ENDIF
C
         IF (NUSECO(ICOTYP(IA2,NEXTM)).LT.MINCO(ICOTYP(IA2,NEXTM)))
     1THEN
             MINCO(ICOTYP(IA2,NEXTM))=NUSECO(ICOTYP(IA2,NEXTM))
         ENDIF
C
         ICOSUM(ICOTYP(IA2,NEXTM))=ICOSUM(ICOTYP(IA2,NEXTM))+
     1           NUSECO(ICOTYP(IA2,NEXTM))
         NOBSCO(ICOTYP(IA2,NEXTM))=NOBSCO(ICOTYP(IA2,NEXTM))+1
C
      ENDIF
C
      IF (ASECA(M).EQ.1) THEN
C
          IF (IDEPUL(IA2,M).GT.0) THEN
C
             IF (NDEPSC(M).EQ.0) THEN
                NULS=INT(ATRIB(4)*IBI(IA2)/IDEPUL(IA2,M)+.99)
             ELSE
                NULS=INT(ATRIB(4)/IDEPUL(IA2,M)+.99)
```

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          ENDIF

        ELSE

          NULS=1

        ENDIF

        NUSECA=NUSECA+NULS
        ICASUM=ICASUM+NUSECA
        NOBSCA=NOBSCA+1
c
       IF (NUSECA.GT.MAXCA) THEN
          MAXCA=NUSECA
       ENDIF
c
       IF (NUSECA.LT.MINCA) THEN
          MINCA=NUSECA
       ENDIF
c
      ENDIF
c
      RETURN
      END
c
c ***************************************************************
c
      SUBROUTINE PREBOP(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NEQT),DDL(NEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(NEQT),
     2SSL(NEQT),TNEXT,TNOW,XX(NNXXV)
c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTFM(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
c
      IF (IOPCD(IOP(IA7)).EQ.3) THEN
         CALL DESTIN(IA7)
      ELSE
         NOPSTA(IOP(IA7))=0
      ENDIF
c
      RETURN
      END
c
c ***************************************************************
c
      SUBROUTINE SCHEDP(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NEQT),DDL(NEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(NEQT),
     2SSL(NEQT),TNEXT,TNOW,XX(NNXXV)
c
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      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTFM(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
c
      GO TO (2501,2502,2503) ISCHDP(IA7)
c
2501  CALL FISCHD(IA7)
      RETURN
c
2502  CALL SPSCHD(IA7)
      RETURN
c
2503  CALL EDSCHD(IA7)
      RETURN
c
      END
c
c ***************************************************************
c
      SUBROUTINE FINODS(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NEQT),DDL(NEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(NEQT),
     2SSL(NEQT),TNEXT,TNOW,XX(NNXXV)
c
      COMMON QSET(600000)
c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTFM(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
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c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
c
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      COMMON/UCOM42/NTL(40,500),TL(40,500),NL(40,50),NPL(40,50)
      COMMON/UCOM49/PGICC(40),CR
      COMMON/UCOM50/RA,CUSLT,NLO,DPCLO,RLENGH
      common/ucomd/iffl
      COMMON/UCOM58/PGINV(40),MAXPG(40),PGCAP(40),PGCC(40)
      COMMON/UCOM74/TRPUT
      COMMON/UCOM82/MAXN
      COMMON/UCOM85/DELAY
      COMMON/UCOM79/NFACT,ISEP
c
      IA2=ATRIB(2)
      IA3=ATRIB(3)
      IA6=ATRIB(6)
      IA8=ATRIB(8)
      IA10=ATRIB(10)
c
      IPG=MAXN+1
      NPARTS=NPARTS+IA10
      NP(IA2)=NP(IA2)+IA10
      TOTAL(IA2,IA3)=TOTAL(IA2,IA3)+IA10
      TL(IA2,IA3)=TL(IA2,IA3)+IA6
      TRPUT=TRPUT+IA10
c
c     EVALUATE MAXIMUM UNITS OF PG IN INV
c
      PGINV(IA2)=PGINV(IA2)+IA10
      IF (PGINV(IA2).GT.MAXPG(IA2)) THEN
          MAXPG(IA2)=PGINV(IA2)
      ENDIF
c
      IF (TL(IA2,IA3).EQ.IA8) THEN
         IF (LSCRAP(IA2,IA3).EQ.0) THEN
            PLEADT=TNOW-ATRIB(1)
            CALL COLCT(PLEADT,1)
            TOTLOT=TOTLOT+1
            IF (ATRIB(5).GT.TNOW) THEN
c
c              THE LOT WILL STAY IN INVENTORY FOR A WHILE. THEREFORE,
c              CALCULATE CARRYING COST.
c
               PGICC(IA2)=PGICC(IA2)+(ATRIB(5)-TNOW)*PNCOST(IA2,IPG)*
     1                    IA8*CR
c
            ELSE
c
c              THE LOT IS LATE, CALCULATE LATENESS COST.
c
               NLO=NLO+1
               TLATE=TNOW-ATRIB(5)
               RATE=EXP((.6931/RA)*(TLATE/CUSLT))-1
               IF (RATE.GT.1) THEN
                  RATE=1
               ENDIF
               DPCLO=DPCLO+RATE*PNCOST(IA2,IPG)*IA8
c
            ENDIF
c
c           REDUCE PGINV BY LOT SIZE
c
            PGINV(IA2)=PGINV(IA2)-IA8
c
c           REMOVE LOT FROM QUEUE OF RELEASED ORDERS IN PROCESS.
c
            LOTQ=MAXN*3+3
            N=1
            A2=IA2
2530        NRANK=NFIND(N,LOTQ,2,0,A2,0.0)
            NTRY=LOCAT(NRANK,LOTQ)
            IPN=QSET(NTRY+2)
            ILOT=QSET(NTRY+3)
            IF (IPN.EQ.IA2 .AND. ILOT.EQ.IA3) THEN
               CALL RMOVE(NRANK,LOTQ,ATRIB)
            ELSE
               N=N+1
               GO TO 2530
            ENDIF
c
         ELSE
c
c           ASSUME PARTS NEEDED TO COMPLETE THE LOT WILL BE MADE DURING
c           OVERTIME. DETERMINE WHEN THE LOT WILL BE COMPLETED . THE TIME
c           NEEDED TO COMPLETE THE SCRAPPED PARTS IS INPUT BY THE USER
c           IN THE VARIABLE 'DELAY'.
c
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            PROCT=DELAY
c
c           THE LOT WILL STAY IN INVENTORY FOR A WHILE. THEREFORE,
c           CALCULATE CARRYING COST.
c
            IPG=MAXN+1
            PGICC(IA2)=PGICC(IA2)+(PROCT)*PNCOST(IA2,IPG)*
     1                 TOTAL(IA2,IA3)*CR
            CALL SCHDL(21,PROCT,ATRIB)
         ENDIF
c
      ENDIF
c
      RETURN
      END
c
c ********************************************************************
c
      SUBROUTINE ARRSC3(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MNUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MNUPP(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTWA(50),MBLKSC(50),MBLKDM(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTWA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
c
c
      IF (MTYPE(IA7) .EQ. 1) THEN
        CALL A1SM1(IA7)
        RETURN
      ENDIF
c
c      IF (MTYPE(IA7) .EQ. 6) THEN
c        CALL A5M6(IA7)
c        RETURN
c      ENDIF
c
      END
c
c ********************************************************************
c
      SUBROUTINE DESC2(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MNUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MNUPP(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTWA(50),MBLKSC(50),MBLKDM(50),
     6 RELT(40,500)
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c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,NAVHT,OPNDT,NDTWA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PHCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
c
      IF (NTYPE(IA7).EQ.1) THEN
         CALL D1M1(IA7)
         RETURN
      ENDIF
c
c       IF (NTYPE(IA7).EQ.6) THEN
c          CALL D1M6(IA7)
c          RETURN
c       ENDIF
c
      END
c
c ************************************************************
c
      SUBROUTINE DESC3(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKNA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,NAVHT,OPNDT,NDTWA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PHCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
c
      IF (NTYPE(IA7).EQ.1) THEN
         CALL D1M1(IA7)
```



```
         RETURN
      ENDIF
c
c      IF (NTYPE(IA7).EQ.6) THEN
c         CALL D1M6(IA7)
c         RETURN
c      ENDIF
c
      END
c
c ************************************************************
c
      SUBROUTINE D1M1(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON QSET(600000)
c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKNA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,NAVHT,OPNDT,NDTWA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PHCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM29/NINITR,NDESTR
      COMMON/UCOM32/XINBUP(50)
      COMMON/UCOM40/NAUTO
      COMMON/UCOM60/IPNCD(50),IREP(50)
      COMMON/UCOM63/PULLDQ(50)
      COMMON/UCOM43/BREDSC,BRNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM68/ABLCO(50),BBLCO(50)
      COMMON/UCOM69/ABKCA(50),BELCA(50)
      COMMON/UCOM83/MAXN
c
      QFLAG=0
      NQFLAG=1
      NIDQ=IA7+MAXN
      NODQ=IA7+MAXN*2
      IA4=ATRIB(4)
c
c     NUFLAG=0 IS USED AT THE PYQ SUBROUTINE TO POINT OUT THAT THE
c     THE POKA YOKE SUB IS BEING CALLED FROM A DEPARTURE SCENARIO
c     IN WHICH THE DEPARTING UNIT SHOULD NOT BE ALLOWED TO MOVE TO THE
c     NEXT MACHINE IN THE PART'S ROUTING.
c
      NUFLAG=0
c
      IF (NQCD(IA7).EQ.3) THEN
c
c     PENDING !!!!!!!!
c
      ELSE
c
c         PUT UNIT IN OUTPUT DUMMY BUFFER, VERIFY IF THE DESIRED QTY (BASED
c         ON ATRIB(4) UNDER THIS SCENARIO) HAS BEEN REACHED. IF NOT THEN
c         PULL FROM INPUT DUMMY BUFFER. IF YES, THEN REMOVE UNITS FROM OUTPUT
c         DUMMY BUFFER AND CALL DOC TO SCHEDULE NEXT OPERATION ON DEPARTING
```


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```
c         UNITS.
c
          CALL FILEM(NODQ,ATRIB)

          UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
          TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
          START(IA7)=900000

          IF (BRKDOC.EQ.2) THEN
             IF (UPTIME(IA7).GT.BKNEXT(IA7)) THEN
                CALL UPBRKD(IA7)
             ENDIF
          ENDIF

          IF (NNQ(NODQ).LT.IA4) THEN
c
             IF (NNQ(NIDQ).GT.0) THEN
                  CALL MACHIN(IA7,NIDQ)
                  RETURN
             ELSE
                  WRITE(6,3060)
3060              FORMAT(1X,'ERROR: D3M1 SHOULD HAVE NNQ(NIDQ)=0 IF THE
     1DESIRED QUANTITY
     2HAS NOT BEEN REACHED')
                  CALL MESSAGE(IA7)
             ENDIF

          ELSE
c
             IA2=ATRIB(2)
c
c            THIS IS A SCENARIO IN WHICH PARTS ARRIVE IN BATCHES AND LEAVE
c            IN BATCHES. THUS, CALL FREECO TO FREE CONTAINERS.
c
             NIDQ=IA7+MAXN
             IF (IA7.GE.2.AND.RELCO(IA7).EQ.1.AND.NNQ(NIDQ)
     1.EQ.0) THEN
                  CALL FREECO(IA2,IA7)
             ENDIF
c
             IF (IA7.GE.2 .AND. NNQ(NIDQ).EQ.0 .AND.RELCA(IA7).EQ.1)
     1THEN
                  CALL FREECA(IA2,IA7)
             ENDIF
c
             IF (NOPCD(IA7).EQ.2) THEN
                NOPSTA(IOP(IA7))=0
             ENDIF
c
             MSTATU(IA7)=0
c
             CALL DQC(IA7,QFLAG,NQFLAG)

          ENDIF
c
c         QFLAG=1 MEANS THE QUEUE OR DUMMY INPUT BUFFER OF MACHINE IA7
c         SHOULD BE CHECKED FOR PARTS WAITING TO BE PROCESSED.
c
          IF (QFLAG.NE.1) THEN

             IF (NOPCD(IA7).EQ.2) THEN
c
c            IF HIS STATUS IS STILL ZERO IT MEANS HE WAS NOT INVOLVED IN
c             MATERIAL HANDLING ACTIVITIES
c
                IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7)).EQ.2)
     1          THEN
                   CALL DESTIN(IA7)
                ENDIF

             ENDIF

             RETURN
          ENDIF

c
c         THE ABOVE IF (QFLAG.NE.1) DOES NOT CONTEMPLATE THE FOLLOWING
c         CASE: QFLAG=1, NOPCD=2 (I.E. OPERATOR NEEDED
c         AT ALL TIMES, HOWEVER MATERIAL HANDLING IS MANUAL. CHECK IF THE
c         OPERATOR IS HANDLING THE PROCESSED PART. IF THAT IS THE CASE,
c         THEN SET MACHINE STATUS TO 0.
c
          IF (NOPCD(IA7).EQ.2) THEN
             IF (NOPSTA(IOP(IA7)).EQ.3 .AND. LASTMA(IOP(IA7)).EQ.IA7)
     1       THEN
                  RETURN
             ENDIF
          ENDIF
c
c         CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
c         GIVE PRIORITY TO THOSE.
c
```



```
          PFLAG=0
          CALL BRKCK(IA7,PFLAG)
          IF (PFLAG.EQ.0) THEN
             IF (NOPCD(IA7).EQ.2) THEN
                IF (IOPCD(IOP(IA7)).EQ.2) THEN
                   CALL DESTIN(IA7)
                ENDIF
             ENDIF
             GO TO 3079
          ENDIF
c
c         CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
c         GIVE PRIORITY TO THOSE.
c
          IF (MAUTO.EQ.1) THEN
             PFLAG=0
             CALL AUTOCK(IA7,PFLAG)
             IF (PFLAG.EQ.0) THEN
                GO TO 3079
             ENDIF
          ENDIF
c
c          CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
c          IF THERE ARE,GIVE PRIORITY TO THOSE.
c
          IF (IREP(IA7).EQ.1) THEN
             PFLAG=0
             CALL RSTCK(IA7,PFLAG)
             IF (PFLAG.EQ.0) THEN
                GO TO 3079
             ENDIF
          ENDIF

c        THE FOLLOWING 'IF' COVERS FIRST THE CASE IN WHICH THE MACHINE
c        REQUIRES AN OPERATOR TO PROCESS THE PART (I.E. NOPCD=2). THE
c        'ELSE' COVERS THE CASE IN WHICH AN OPERATOR IS NOT NEEDED TO
c        PROCESS A PART.
c
         QFLAG=0
         SFLAG=0
c
         IF (NOPCD(IA7).EQ.2) THEN
c
            CALL QFULL(IA7,QFLAG,SFLAG)
c
            IF (QFLAG.EQ.0) THEN
c
c              SEND OPERATOR TO ANOTHER MACHINE IF HE IS A SHARED OPERATOR
c              OR FREE HIM IF HE IS A DEDICATED OPERATOR.
c
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  CALL DESTIN(IA7)
               ENDIF
               RETURN
c
            ELSE
c
c              VERIFY IF THE OPERATOR WILL STAY AT THAT MACHINE OR NEEDS
c              TO MOVE TO ANOTHER MACHINE
c
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  MOVE=0
                  CALL MOVEMT(IA7,MOVE)
                  IF (MOVE.EQ.1) THEN
                     RETURN
                  ENDIF
               ENDIF
c
              IF (SFLAG.EQ.1  .AND. ISCHDP(IA7).NE.0) THEN
c
c                 PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
c                 CHOSEN BY THE USER.
c
                CALL SCHEDP(IA7)
c
              ENDIF
c
c             DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
c             TO BE PROCESSED.
c
              NTRY=MMFE(IA7)
              IA2=QSET(NTRY+2)
              IA10=QSET(NTRY+10)
c
c              VERIFY IF A SETUP IS NEEDED
c
               IF (MSUCD(IA7).EQ.1) THEN

                  IF (IA2.NE.LASTPN(IA7)) THEN
                     NSUPN=IA2
                     CALL MSETUP(NSUPN,IA7)
                     IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7))
```

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```
     1             .EQ.2) THEN
                      CALL DESTIN(IA7)
                   ENDIF
                   RETURN
                ENDIF
             ENDIF

             IF (IA10.EQ.0) THEN
               GO TO 3075
             ENDIF
C
C            DFLAG=1 WITH AFLAG=0 TELLS THE FQC SUBROUTINE THAT THE
C            CALLING SUBROUTINE IS A DEPARTURE.
C
             DFLAG=1
             AFLAG=0
             FFLAG=0
C
C            IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C            PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C            THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C            CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C            THE REMOVAL.
C
             CALL FQC(AFLAG,DFLAG,FFLAG,IA7)

              IF (FFLAG.EQ.0) THEN
                 IF (NOPSTA(IOP(IA7)).NE.6) THEN
                    WRITE(6,3074)
3074                FORMAT(1X,'ERROR:AT DIM1 W/NOPCD=2, FFLAG WILL BE
     1              ZERO ONLY IF NE IS DOING INSPECTION')
                 CALL MESSAGE(IA7)
                 ENDIF
C
                 IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1           XINBUF(IA7).LT.MBUFF(IA7)) THEN
                    CALL CKBLK(IA7)
                 ENDIF
C
              ELSE
3075             NIDQ=IA7+MAXM

                 NOPSTA(IOP(IA7))=1
                 CALL MACHIN(IA7,NIDQ)
C
                 IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1           XINBUF(IA7).LT.MBUFF(IA7)) THEN
                    CALL CKBLK(IA7)
                 ENDIF
C
              ENDIF
C
           ENDIF
C
C
        ELSE
C
C          VERIFY IF PARTS ARE WAITING IN QUEUE AND IF THERE IS MORE
C          THAN ONE UNIT LOAD IN QUEUE (I.E. SFLAG=1)
C
           CALL QFULL(IA7,QFLAG,SFLAG)
C
           IF (QFLAG.EQ.0) THEN
              RETURN
           ENDIF
           IF (SFLAG.EQ.1  .AND. ISCHDP(IA7).NE.0) THEN
C
C          PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C          CHOSEN BY THE USER.
C
              CALL SCHEDP(IA7)
           ENDIF
C
C          DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C          TO BE PROCESSED.
C
           NTRY=NMPE(IA7)
           IA2=QSET(NTRY+2)
           IA10=QSET(NTRY+10)
C
C          VERIFY IF A SETUP IS NEEDED
C
           IF (MSUCD(IA7).EQ.1) THEN

              IF (IA2.NE.LASTPN(IA7)) THEN
                 NSUPN=IA2
                 CALL MSETUP(NSUPN,IA7)
                 RETURN
              ENDIF
           ENDIF

           IF (IA10.EQ.0) THEN
```



```
              GO TO 3078
           ENDIF
C
C          DFLAG=1 WITH AFLAG=0 TELLS THE FQC SUBROUTINE THAT THE
C          CALLING SUBROUTINE IS A DEPARTURE.
C
           DFLAG=1
           AFLAG=0
           FFLAG=0
C
C          IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C          PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C          THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C          CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C          THE REMOVAL.
C
           CALL FQC(AFLAG,DFLAG,FFLAG,IA7)
           IF (FFLAG.EQ.0) THEN
C
              IF (MSTATU(IA7).EQ.6) THEN
                 IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1           XINBUF(IA7).LT.MBUFF(IA7)) THEN
                    CALL CKBLK(IA7)
                 ENDIF
              ENDIF
C
              RETURN
           ELSE
3078          NIDQ=IA7+MAXM
              CALL MACHIN(IA7,NIDQ)
C
              IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1        XINBUF(IA7).LT.MBUFF(IA7)) THEN
                 CALL CKBLK(IA7)
              ENDIF
C
           ENDIF
C
        ENDIF
C
      ENDIF
C
3079  RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE DESC4(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MBUFTP(50),MMOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),III(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),MBLKSC(50),MBLKMR(50),
     6 XELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/MSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/NALKER,NAVNT,OPNDT,NOTNA,NALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     1MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNL,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINND,QAP1,QAP2,QAP3
      COMMON/UCOM16/TMDRND,TMMEP1,TMMEP2,TMMEP3
      COMMON/UCOM17/TMDRJP(40),TMDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/MSURND(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/MSERND(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
C
```

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```
      IF (MTYPE(IA7).EQ.1) THEN
         CALL D4N1(IA7)
         RETURN
      ENDIF
C
      END
C
C ******************************************************************
C
      SUBROUTINE D4N1(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MAXRSC(50),
     1 NOEPMC(50),MDUPP(50),MSUTYP(50),MMOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),MRLRSC(50),MRLEMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/MSUD10(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/MALAEN,MAVNT,OPNDT,NDTMA,MALELD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANMX,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMLP1,TRMLP2,TRMLP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM19/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/MSUTMD(50),SUTMP1(50),SUTMP2(50),SUTMP3(50)
      COMMON/UCOM21/MSEMMD(50),SEMMP1(50),SEMMP2(50),SEMMP3(50)
      COMMON/UCOM26/MPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM35/MINITR,MDESTR
      COMMON/UCOM32/XINBUP(50)
      COMMON/UCOM62/NTL(40,500),TL(40,500),NL(40,50),NPL(40,50)
      COMMON/UCOM63/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM65/WAITTM(50)

      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM40/NAUTO
      COMMON/UCOM60/IPNCD(50),IREP(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM73/NEWUL(40,50)
      COMMON/UCOM77/ULFLG(50)
      COMMON/UCOM82/MAXN
C
      QFLAG=0
      NQFLAG=1
C
C     MNFLAG=0 IS USED AT THE FTQ SUBROUTINE TO POINT OUT THAT THE
C     THE FOKA YOKE SUB IS BEING CALLED FROM A DEPARTURE SCENARIO
C     IN WHICH THE DEPARTING UNIT SHOULD NOT BE ALLOWED TO MOVE TO THE
C     NEXT MACHINE IN THE PART'S ROUTING.
C
      MNFLAG=0
      NODQ=IA7+MAXN*2
      NIDQ=IA7+MAXN
      IA2=ATRIB(2)
C
      IF (MQCD(IA7).EQ.3) THEN
C
C     PENDING !!!!!!!!
C
      ELSE
C
C         PUT UNIT IN OUTPUT DUMMY BUFFER, VERIFY IF THE DESIRED QTY (BASED
C         ON IDEFUL(IA2,IA7) UNDER THIS SCENARIO) HAS BEEN REACHED. IF NOT THEN
C         PULL FROM MAIN QUEUE. IF YES, THEN REMOVE UNITS FROM OUTPUT
C         DUMMY BUFFER AND CALL DQC TO SCHEDULE NEXT OPERATION ON DEPARTING
```



```
C         UNITS.
C         IF THERE ARE NO UNITS WAITING IN QUEUE, CHANGE MACHINE STATUS TO
C         ZERO. IF AN OPERATOR IS AT THE MACHINE, LEAVE HIS STATUS AS ONE TO
C         PREVENT MOVEMENT TO ANOTHER MACHINE BEFORE THE DESIRED QUANTITY
C         HAS BEEN ACCUMULATED.
C
          CALL FILEM(NODQ,ATRIB)

          IA2=ATRIB(2)
          IA3=ATRIB(3)
          IA8=ATRIB(8)

          UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
          TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
          START(IA7)=900000
C
          IF (IA8.LT.NEWUL(IA2,IA7) .and. ULFLG(IA7).EQ.1) THEN
             NEWUL(IA2,IA7)=IA8
             ULFLG(IA7)=0
          ENDIF
C
          NUM=INT(ATRIB(8)/IDEFUL(IA2,IA7)+.99)

          IF ((NUM-NL(IA2,IA7)).EQ.1.AND.ULFLG(IA7).EQ.1) THEN
             NREM=IA8-NPL(IA2,IA7)
             NEWUL(IA2,IA7)=NREM
             ULFLG(IA7)=0
          ENDIF
C
C         SAVE THE NUMBER OF PARTS COMPLETED OF THAT PN AT THIS MACH.
C
          NPL(IA2,IA7)=NPL(IA2,IA7)+ATRIB(4)

          IF (BRKDSC.EQ.2) THEN
             IF (UPTIME(IA7).GT.BKNEXT(IA7)) THEN
                CALL UPBRKD(IA7)
             ENDIF
          ENDIF

          IF (NNQ(NODQ).LT.NEWUL(IA2,IA7)) THEN
C
C            IN THIS DEPARTURE SCENARIO PARTS LEAVE AS A BATCH BUT ARRIVE
C            ONE BY ONE. VERIFY IF THE PART NUMBER WAITING IN QUEUE IS THE
C            SAME AS THE ONE IN THE DUMMY OUTPUT QUEUE.
C
             IF (NNQ(IA7).GT.0) THEN
                K=1
3082            NTRY=LOCAT(K,IA7)
                NIA2=QSET(NTRY+2)
                NIA3=QSET(NTRY+3)
                NIA10=QSET(NTRY+10)
                IF (NIA2.EQ.LASTPN(IA7).AND.NIA3.EQ.LASLOT(IA7)) THEN
C
C                  IF IT IS THE SAME PART NUMBER, CALL PQC ONLY IF THERE
C                  ARE GOOD PARTS TO BE INSPECTED. OTHERWISE, CALL MACHINE.
C
                   DFLAG=1
                   AFLAG=0
                   PFLAG=0
                   IF (NIA10.GT.0) THEN

                      IF (K.GT.1) THEN
                         IF (K.NE.NNQ(IA7)) THEN
                            CALL RMOVE(K,IA7,ATRIB)
                            CALL FILEM(IA7,ATRIB)
                         ENDIF
                         DO 3083 I=1,NNQ(IA7)-1
                         CALL RMOVE(1,IA7,ATRIB)
                         CALL FILEM(IA7,ATRIB)
3083                     CONTINUE

                         NTRY=MMFE(IA7)
                         NIA2=QSET(NTRY+2)
                         NIA3=QSET(NTRY+3)
                         IF (NIA2.NE.LASTPN(IA7).OR.NIA3.NE.
     1                   LASLOT(IA7)) THEN
                            WRITE(6,3091)
3091                        FORMAT(1X,'ERROR AT D4N1: PN PLACED
     1 FIRST IN LINE DIFF. FROM LASTPN')
                            CALL MESSAGE(IA7)
                         ENDIF

                      ENDIF

                      CALL PQC(AFLAG,DFLAG,PFLAG,IA7)
                      IF (PFLAG.EQ.1) THEN
                         CALL MACHIN(IA7,NIDQ)
C
                         IF ((XINBUP(IA7)+FULLDQ(IA7)).GE.MDUPP(IA7)
     1                   .AND.XINBUP(IA7).LT.MDUPP(IA7)) THEN
                            CALL CKBLK(IA7)
                         ENDIF
```


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```
c
                    RETURN
                 ELSE
c
                    IF (MSTATU(IA7).EQ.6) THEN
                       IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(
     1                 IA7).AND.XINBUF(IA7).LT.NBUFF(IA7)) THEN
                          CALL CKBLK(IA7)
                       ENDIF
                    ENDIF
c
                    RETURN
                 ENDIF
              ELSE

                 IF (K.GT.1) THEN
                    IF (K.NE.NNQ(IA7)) THEN
                       CALL RMOVE(K,IA7,ATRIB)
                       CALL FILEM(IA7,ATRIB)
                    ENDIF
                    DO 3084 I=1,NNQ(IA7)-1
                    CALL RMOVE(1,IA7,ATRIB)
                    CALL FILEM(IA7,ATRIB)
3084                CONTINUE

                    NTRY=NMPS(IA7)
                    NIA2=QSET(NTRY+2)
                    NIA3=QSET(NTRY+3)
                    IF (NIA2.NE.LASTPN(IA7).OR.NIA3.NE.
     1              LASLOT(IA7)) THEN
                        WRITE(6,3092)
3092                    FORMAT(1X,'ERROR AT D4M1: PN PLACED
     1 FIRST IN LINE DIFF. FROM LASTPN')
                        CALL MESSAGE(IA7)
                    ENDIF

                 ENDIF

                 CALL MACHIN(IA7,NIDQ)
c
                 IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7)
     1           .AND.XINBUF(IA7).LT.NBUFF(IA7)) THEN
                    CALL CKBLK(IA7)
                 ENDIF
                 RETURN
c
               ENDIF
            ELSE
              K=K+1
              IF (NNQ(IA7).GE.K) THEN
               GO TO 3082
              ELSE
               WRITE(6,3085)TNOW
3085           FORMAT(1X,'WARNING: AT TNOW=',F10.2,1X,'THE NEXT')
               WRITE(6,3086)
3086           FORMAT(1X,'PART NUMBER IN QUEUE IS NOT THE SAME')
               WRITE(6,3087) IA7
3087           FORMAT(1X,'AS THE ONE WAITING IN NODQ OF MACHINE'
     1         ,I4)
               WRITE(6,3088)
3088           FORMAT()
C
               MSTATU(IA7)=10
               WAITTM(IA7)=TNOW

               IF (MOPCD(IA7).EQ.2) THEN
                  IF (IOPCD(IOP(IA7)).EQ.2) THEN
                     CALL DESTIN(IA7)
                  ELSE
                     MOPSTA(IOP(IA7))=0
                  ENDIF
               ENDIF

               RETURN
              ENDIF
            ENDIF
         ELSE
            MSTATU(IA7)=10
            WAITTM(IA7)=TNOW
            IF (MOPCD(IA7).EQ.2) THEN
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  CALL DESTIN(IA7)
               ELSE
                  MOPSTA(IOP(IA7))=0
               ENDIF
               RETURN
            ENDIF
         ENDIF
C
       ELSE
C
         IF (MOPCD(IA7).EQ.2) THEN
```

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```
               MOPSTA(IOP(IA7))=0
            ENDIF
C
            MSTATU(IA7)=0

C           NL(IA2,IA7) IS USED TO STORE THE NUMBER OF UNIT LOADS COMPLETED

            NL(IA2,IA7)=NL(IA2,IA7)+1

            IF (NL(IA2,IA7).EQ.NNU) THEN
               NPL(IA2,IA7)=0
               ULFLG(IA7)=1
               NL(IA2,IA7)=0
            ENDIF
C
            CALL DQC(IA7,QFLAG,NQFLAG)
         ENDIF
C
C        QFLAG=1 MEANS THE QUEUE OR DUMMY INPUT BUFFER OF MACHINE IA7
C        SHOULD BE CHECKED FOR PARTS WAITING TO BE PROCESSED.
C
         IF (QFLAG.NE.1) THEN

           IF (MOPCD(IA7).EQ.2) THEN
C
C             IF HIS STATUS IS STILL ZERO IT MEANS HE WAS NOT INVOLVED IN
C             MATERIAL HANDLING ACTIVITIES
C
              IF (MOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7)).EQ.2)
     1        THEN
                 CALL DESTIN(IA7)
              ENDIF

           ENDIF

           RETURN
         ENDIF
C
C         THIS IS A SCENARIO IN WHICH PARTS ARRIVE AS ONE AND LEAVE IN
C         IN BATCHES. THUS, THERE IS NO NEED TO CALL PREECO.
C
C         THE ABOVE IF (QFLAG.NE.1) DOES NOT CONTEMPLATE THE FOLLOWING
C         CASE: QFLAG=1, MOPCD=2 (I.E. OPERATOR NEEDED
C         AT ALL TIMES, HOWEVER MATERIAL HANDLING IS MANUAL. CHECK IF THE
C         OPERATOR IS HANDLING THE PROCESSED PART. IF THAT IS THE CASE,
C         THEN SET MACHINE STATUS TO 0.
C
          IF (MOPCD(IA7).EQ.2) THEN
             IF (MOPSTA(IOP(IA7)).EQ.3 .AND. LASTMA(IOP(IA7)).EQ.IA7)
     1       THEN
                RETURN
             ENDIF
          ENDIF
C
C         CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
C         GIVE PRIORITY TO THOSE.
C
          PFLAG=0
          CALL BRKCK(IA7,PFLAG)
          IF (PFLAG.EQ.0) THEN
             IF (MOPCD(IA7).EQ.2) THEN
                IF (IOPCD(IOP(IA7)).EQ.2) THEN
                   CALL DESTIN(IA7)
                ENDIF
             ENDIF
             GO TO 3094
          ENDIF
C
C         CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
C         GIVE PRIORITY TO THOSE.
C
          IF (MAUTO.EQ.1) THEN
             PFLAG=0
             CALL AUTOCK(IA7,PFLAG)
             IF (PFLAG.EQ.0) THEN
                GO TO 3094
             ENDIF
          ENDIF
C
C         CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C         IF THERE ARE,GIVE PRIORITY TO THOSE.
C
          IF (IREP(IA7).EQ.1) THEN
             PFLAG=0
             CALL NSTCK(IA7,PFLAG)
             IF (PFLAG.EQ.0) THEN
                GO TO 3094
             ENDIF
          ENDIF
C
C        THE FOLLOWING 'IF' COVERS FIRST THE CASE IN WHICH THE MACHINE
C        REQUIRES AN OPERATOR TO PROCESS THE PART (I.E. MOPCD=2). THE
```


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C        'ELSE' COVERS THE CASE IN WHICH AN OPERATOR IS NOT NEEDED TO
C        PROCESS A PART.
C
         QFLAG=0
         SFLAG=0
C
         IF (NOPCD(IA7).EQ.2) THEN
C
            CALL QPULL(IA7,QFLAG,SFLAG)
C
            IF (QFLAG.EQ.0) THEN
C
C              SEND OPERATOR TO ANOTHER MACHINE IF HE IS A SHARED OPERATOR
C              OR FREE HIM IF HE IS A DEDICATED OPERATOR.
C
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  CALL DESTIN(IA7)
               ENDIF
               RETURN
C
            ELSE
C
C              VERIFY IF THE OPERATOR WILL STAY AT THAT MACHINE OR NEEDS
C              TO MOVE TO ANOTHER MACHINE
C
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  MOVE=0
                  CALL MOVENT(IA7,MOVE)
                  IF (MOVE.EQ.1) THEN
                     RETURN
                  ENDIF
               ENDIF
C
               IF (SFLAG.EQ.1  .AND. ISCHDP(IA7).NE.0) THEN
C
C                 PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C                 CHOSEN BY THE USER.
C
                  CALL SCHEDP(IA7)
C
               ENDIF
C
C              DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C              TO BE PROCESSED.
C
               NTRY=MMFE(IA7)
               IA2=QSET(NTRY+2)
               IA10=QSET(NTRY+10)
C
C              VERIFY IF A SETUP IS NEEDED
C
               IF (NSUCD(IA7).EQ.1) THEN

                  IF (IA2.NE.LASTPN(IA7)) THEN
                     NSUPN=IA2
                     CALL NSETUP(NSUPN,IA7)

                     IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7))
     1               .EQ.2)THEN
                          CALL DESTIN(IA7)
                     ENDIF

                     RETURN
                  ENDIF
               ENDIF

               IF (IA10.EQ.0) THEN
                  GO TO 3090
               ENDIF
C
C              DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
C              CALLING SUBROUTINE IS A DEPARTURE.
C
               DFLAG=1
               AFLAG=0
               PFLAG=0
C
C              IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C              PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C              THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C              CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C              THE REMOVAL.
C
               CALL PQC(AFLAG,DFLAG,PFLAG,IA7)

                IF (PFLAG.EQ.0) THEN
                   IF (NOPSTA(IOP(IA7)).NE.6) THEN
                      WRITE(6,3089)
3089                  FORMAT(1X,'ERROR:AT D3N1 W/NOPCD=2, PFLAG WILL BE
     1                ZERO ONLY IF HE IS DOING INSPECTION')
                  CALL MESSAGE(IA7)
                  ENDIF
```

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C
                     IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1               XINBUF(IA7).LT.MBUFF(IA7)) THEN
                        CALL CKBLK(IA7)
                     ENDIF
C
                  ELSE
3090                 NIDQ=IA7+MAXN

                     NOPSTA(IOP(IA7))=1
                     CALL MACHIN(IA7,NIDQ)
C
                     IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1               XINBUF(IA7).LT.MBUFF(IA7)) THEN
                        CALL CKBLK(IA7)
                     ENDIF
C
                  ENDIF
C
               ENDIF
C
            ELSE
C
C              VERIFY IF PARTS ARE WAITING IN QUEUE AND IF THERE IS MORE
C              THAN ONE UNIT LOAD IN QUEUE (I.E. SFLAG=1)
C
               CALL QPULL(IA7,QFLAG,SFLAG)
C
               IF (QFLAG.EQ.0) THEN
                  RETURN
               ENDIF
               IF (SFLAG.EQ.1  .AND. ISCHDP(IA7).NE.0) THEN
C
C              PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C              CHOSEN BY THE USER.
C
                  CALL SCHEDP(IA7)
               ENDIF
C
C              DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C              TO BE PROCESSED.
C
               NTRY=MMFE(IA7)
               IA2=QSET(NTRY+2)
               IA10=QSET(NTRY+10)
C
C              VERIFY IF A SETUP IS NEEDED
C
               IF (NSUCD(IA7).EQ.1) THEN

                   IF (IA2.NE.LASTPN(IA7)) THEN
                     NSUPN=IA2
                     CALL NSETUP(NSUPN,IA7)
                     RETURN
                  ENDIF
               ENDIF
C
               IF (IA10.EQ.0) THEN
                  GO TO 3093
               ENDIF
C
C              DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
C              CALLING SUBROUTINE IS A DEPARTURE.
C
               DFLAG=1
               AFLAG=0
               PFLAG=0
C
C              IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C              PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C              THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C              CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C              THE REMOVAL.
C
               CALL PQC(AFLAG,DFLAG,PFLAG,IA7)
               IF (PFLAG.EQ.0) THEN
C
                  IF (NSTATU(IA7).EQ.6) THEN
                     IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1               XINBUF(IA7).LT.MBUFF(IA7)) THEN
                        CALL CKBLK(IA7)
                     ENDIF
                  ENDIF
C
                  RETURN
               ELSE
3093              NIDQ=IA7+MAXN
                  CALL MACHIN(IA7,NIDQ)
C
                  IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1            XINBUF(IA7).LT.MBUFF(IA7)) THEN
                     CALL CKBLK(IA7)
```


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```
                 ENDIF
C
              ENDIF
C
           ENDIF
C
        ENDIF
C
3094    RETURN
        END
C
C *****************************************************************
C
        SUBROUTINE NSETUP(NSUPN,IA7)
C
        INCLUDE '/ncsu/jwilson_ree/PARAM.INC'
        COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
       1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
       2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
        COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
       1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
       2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
       3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
       4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
       5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKNA(50),
       6 RELT(40,500)
C
        COMMON/UCOM2/NMACH
        COMMON/UCOM3/NUL,NRELUL
        COMMON/UCOM4/A(100)
        COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
        COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
        COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTNA,WALKLD
        COMMON/UCOM8/SUTEX,SUTIN
        COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
       1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
       2MAXCO(50),MINCO(50),MAXCA,MINCA
C
        COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
        COMMON/UCOM11/ISCHDP(50)
        COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
        COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
        COMMON/UCOM14/SAMPLP
        COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
        COMMON/UCOM16/TRDRMD,TRWKP1,TRWKP2,TRWKP3
        COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
        COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
        COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
        COMMON/UCOM20/NSURMD(50),SURWP1(50),SURWP2(50),SURWP3(50)
        COMMON/UCOM21/NSERMD(50),SERWP1(50),SERWP2(50),SERWP3(50)
        COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
       1,PROP3(40,50)
        COMMON/UCOM64/CAPAV(50)
        common/ucomd/iffl

        IF (NTYPE(IA7).EQ.5) THEN
           IF (CAPAV(IA7).LT.NCAP(IA7)) THEN
              RETURN
           ENDIF
        ENDIF
C
        IF (NSUTYP(IA7).EQ.1) THEN
           CALL TRADSU(NSUPN,IA7)
           RETURN
        ENDIF
C
        IF (NSUTYP(IA7).EQ.2) THEN
           CALL WCSU(NSUPN,IA7)
           RETURN
        ENDIF
C
        END
C *****************************************************************
C
        SUBROUTINE TRADSU(NSUPN,IA7)
C
        INCLUDE '/ncsu/jwilson_ree/PARAM.INC'
        COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
       1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
       2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
        COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
       1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
       2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
       3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
       4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
       5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKNA(50),
       6 RELT(40,500)
```



```
C
        COMMON/UCOM2/NMACH
        COMMON/UCOM3/NUL,NRELUL
        COMMON/UCOM4/A(100)
        COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
        COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
        COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTNA,WALKLD
        COMMON/UCOM8/SUTEX,SUTIN
        COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
       1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
       2MAXCO(50),MINCO(50),MAXCA,MINCA
C
        COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
        COMMON/UCOM11/ISCHDP(50)
        COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
        COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
        COMMON/UCOM14/SAMPLP
        COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
        COMMON/UCOM16/TRDRMD,TRWKP1,TRWKP2,TRWKP3
        COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
        COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
        COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
        COMMON/UCOM20/NSURMD(50),SURWP1(50),SURWP2(50),SURWP3(50)
        COMMON/UCOM21/NSERMD(50),SERWP1(50),SERWP2(50),SERWP3(50)
        COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
       1,PROP3(40,50)
        common/ucomd/iffl
C
        SETUP=0
        CALL SUTIME(IA7,NSUPN,SETUP)

C       WHEN CALLED FROM AN ARRIVAL SCENARIO, THEN ARRIVING ENTITY WAS PLACED
C       IN QUEUE AT THAT SUB. WHEN CALLED FROM A DEPARTING SCENARIO, THE
C       ENTITY WAS ALREADY IN QUEUE.
C
        CALL COPY(1,IA7,ATRIB)
        CALL SCHDL(11,SETUP,ATRIB)
        NSTATU(IA7)=5
C        CALL PTPROB(LASTPN(IA7),IA7)
        LASTPN(IA7)=NSUPN
        LASLOT(IA7)=ATRIB(3)
C
        RETURN
        END
C
C *****************************************************************
C
        SUBROUTINE WCSU(NSUPN,IA7)
C
        INCLUDE '/ncsu/jwilson_ree/PARAM.INC'
        COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
       1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
       2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
        COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
       1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
       2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
       3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
       4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
       5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKNA(50),
       6 RELT(40,500)
C
        COMMON/UCOM2/NMACH
        COMMON/UCOM3/NUL,NRELUL
        COMMON/UCOM4/A(100)
        COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
        COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
        COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTNA,WALKLD
        COMMON/UCOM8/SUTEX,SUTIN
        COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
       1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
       2MAXCO(50),MINCO(50),MAXCA,MINCA
C
        COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
        COMMON/UCOM11/ISCHDP(50)
        COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
        COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
        COMMON/UCOM14/SAMPLP
        COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
        COMMON/UCOM16/TRDRMD,TRWKP1,TRWKP2,TRWKP3
        COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
        COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
        COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
        COMMON/UCOM20/NSURMD(50),SURWP1(50),SURWP2(50),SURWP3(50)
        COMMON/UCOM21/NSERMD(50),SERWP1(50),SERWP2(50),SERWP3(50)
        COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
```


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```
     1,PROP3(40,50)
      common/ucomd/iffl
c
      IF (NOPCD(IA7).EQ.0) THEN
         WRITE(6,3096)
3096     FORMAT(1X,'ERROR: A MACHINE WITH NOPCD=0 DOES NOT HAVE AN
     1   OPERATOR TO PERFORM A WCSU!!!')
      CALL MESSAGE(IA7)
      ENDIF
c
      IF (NOPSTA(IOP(IA7)).EQ.0 .OR. (NOPSTA(IOP(IA7)).EQ.1 .AND.
     1 LASTMA(IOP(IA7)).EQ.IA7)) THEN
c
         LASTMA(IOP(IA7))=IA7
         SETUP=0
         CALL SUTIME(IA7,NSUPN,SETUP)
c
c        WHEN CALLED FROM AN ARRIVAL SCENARIO, THEN ARRIVING ENTITY WAS
c        PLACED IN QUEUE AT THAT SUB. WHEN CALLED FROM A DEPARTING SCENARIO,
c        THE ENTITY WAS ALREADY IN QUEUE.
c
         CALL COPY(1,IA7,ATRIB)
c
         CALL SCHDL(12,SETUP,ATRIB)
c
         NSTATU(IA7)=5
         NOPSTA(IOP(IA7))=5
c         CALL PYPROB(LASTPN(IA7),IA7)
         LASTPN(IA7)=NSUPN
         LASLOT(IA7)=ATRIB(3)
         RETURN
c
      ELSE
c
c          *WHEN CALLED FROM ARRIVAL, MACHINE STATUS IS ZERO AND REMAINS
c           AS SUCH.
c          *FROM DEPARTURE THIS SUBROUTINE IS CALLED ONLY IF THE OPERATOR
c           IS AVAILABLE, THUS THE 'ELSE' DOES NOT APPLY.
c
           RETURN
c
      ENDIF
c
      END
c
c ****************************************************************
c
      SUBROUTINE CTRASU
c
      INCLUDE '/mcms/jwilson_zoo/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON QSET(600000)
c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NANRSC(50),
     1 NOEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 ICP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLESC(50),NBLEMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSEDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKSN,NAVNT,OPNDT,NDTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLON(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNK,PRCOST(40,51)
      COMMON/UCOM14/SANPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRONMD,TMNKP1,TMNKP2,TMNKP3
      COMMON/UCOM17/TRDRJP(40),TRDNMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNM,TSELNM
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSUNMD(50),SUNMP1(50),SUNMP2(50),SUNMP3(50)
      COMMON/UCOM21/NSENMD(50),SENMP1(50),SENMP2(50),SENMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
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```
      common/ucomd/iffl
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM40/NAUTO
      COMMON/UCOM60/IPNCD(50),IREP(50)
      COMMON/UCOM63/PULLDQ(50)
      COMMON/UCOM82/MAXN
c
      IA7=ATRIB(7)
      NIDQ=IA7+MAXN
c
c     DEFINE AFLAG=1 SUCH THAT AT PQC THE MODEL CHECKS FOR OPERATOR
c     AVAILABILITY. OPERATOR STATUS AND LAST MACHINE ARE REDEFINED
c     AT PQC.
c     IMPORTANT: AT WCSU AND TRADITIONAL SETUP, THE ATTRIBUTES OF THE
c                ENTITY FIRST IN QUEUE (I.E. THE ONE REQUESTING A
c                SETUP) ARE COPIED TO SCHEDULE THE CWCSU OR CTRASU.
c                THE REMOVAL OF THE UNIT IN QUEUE WILL BE DONE AT PQC
c                IF THE SCENARIO IS SUCCESSIVE INSPECTION. IF THE
c                SCENARIO IS TRAD OR PY THE UNIT LOAD CAN BE PROCESSED
c                AND IT IS REMOVED AT MACHINE.
c
c     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
c     GIVE PRIORITY TO THOSE.
c
      PFLAG=0
      CALL BRKCK(IA7,PFLAG)
      IF (PFLAG.EQ.0) THEN
         GO TO 3110
      ENDIF
c
c     CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
c     GIVE PRIORITY TO THOSE.
c
      IF (NAUTO.EQ.1) THEN
         PFLAG=0
         CALL AUTOCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 3110
         ENDIF
      ENDIF
c
c     CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
c     IF THERE ARE,GIVE PRIORITY TO THOSE.
c
      IF (IREP(IA7).EQ.1) THEN
         PFLAG=0
         CALL RPTCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 3110
         ENDIF
      ENDIF

      NTRY=MMFE(IA7)
      IA10=QSET(NTRY+10)

      IF (IA10.EQ.0) THEN
          IF (NOPCD(IA7).EQ.2) THEN
               IF (NOPSTA(ICP(IA7)).NE.0) THEN
                    GO TO 3110
               ELSE
                    NOPSTA(ICP(IA7))=1
                    LASTMA(ICP(IA7))=IA7
                    GO TO 3105
               ENDIF
          ELSE
               GO TO 3105
          ENDIF
      ENDIF
c
      AFLAG=1
      DFLAG=0
      PFLAG=0
c
c     IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
c     PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
c     THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
c     CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
c     THE REMOVAL.
c
      CALL PQC(AFLAG,DFLAG,PFLAG,IA7)
c
      IF (PFLAG.EQ.0) THEN
c
          IF (NSTATU(IA7).EQ.6) THEN
             IF ((XINBUF(IA7)+PULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1       XINBUF(IA7).LT.NBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
             ENDIF
          ENDIF
c
      ELSE
c
```

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```
3105       CALL MACHIN(IA7,NIDQ)
           IF ((KINBUF(IA7)+PULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1     KINBUF(IA7).LT.MBUFF(IA7)) THEN
              CALL CKBLK(IA7)
           ENDIF
C
      ENDIF
C
3110  RETURN
      END
C
C *****************************************************************
C
      SUBROUTINE CWCSU
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MSCLRV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NASRBC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MN(50),
     3 IOP(50),MACK(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),MSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKBC(50),NBLKNA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELOL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NBKD18(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKIN,NAVHT,OPNDT,NDTNA,WALKLO
      COMMON/UCOM8/SUTRE,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CRCOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2NAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHOP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNK,PHCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDMMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDAJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNM,TSELNM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/MSUNMD(50),SUNMP1(50),SUNMP2(50),SUNMP3(50)
      COMMON/UCOM21/MSENMD(50),SENMP1(50),SENMP2(50),SENMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
      COMMON/UCOM32/KINBUF(50)
      COMMON/UCOM40/NAUTO
      COMMON/UCOM50/IPMCD(50),IREP(50)
      COMMON/UCOM63/PULLDQ(50)
      COMMON/UCOM92/MAXN
C
      IA7=ATRIB(7)
C
C     AVAILABILITY
C     IMPORTANT: AT WCSU AND TRADITIONAL SETUP, THE ATTRIBUTES OF THE
C                ENTITY FIRST IN QUEUE (I.E. THE ONE REQUESTING A
C                SETUP) ARE COPIED TO SCHEDULE THE CWCSU OR CTRASU.
C                THE REMOVAL OF THE UNIT IN QUEUE WILL BE DONE AT FQC
C                IF THE SCENARIO IS SUCCESSIVE INSPECTION. IF THE
C                SCENARIO IS TRAD OR PY THE UNIT LOAD CAN BE PROCESSED
C                AND IT IS REMOVED AT MACHINE.
C
C     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
C     GIVE PRIORITY TO THOSE.
C
      PFLAG=0
      CALL BRKCK(IA7,PFLAG)
      IF (PFLAG.EQ.0) THEN
         IF (IOPCD(IOP(IA7)).EQ.2) THEN
            NOPSTA(IOP(IA7))=0
            CALL DESTIN(IA7)
         ELSE
            NOPSTA(IOP(IA7))=0
         ENDIF
         GO TO 3120
      ENDIF
C
      AFLAG=0
```



```
      DFLAG=1
      PFLAG=0
C
      NOPSTA(IOP(IA7))=0
C
C     CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
C     GIVE PRIORITY TO THOSE.
C
      IF (NAUTO.EQ.1) THEN
         PFLAG=0
         CALL AUTOCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 3120
         ENDIF
      ENDIF
C
C     CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C     IF THERE ARE,GIVE PRIORITY TO THOSE.
C
      IF (IREP(IA7).EQ.1) THEN
         PFLAG=0
         CALL RPTCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 3120
         ENDIF
      ENDIF
C
      NTRY=MMFE(IA7)
      IA10=QSET(NTRY+10)
C
      IF (IA10.EQ.0) THEN
         NIDQ=IA7+MAXN
         GO TO 3115
      ENDIF
C
C     IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C     PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C     THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C     CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C     THE REMOVAL.
C
      CALL FQC(AFLAG,DFLAG,PFLAG,IA7)
C
      NIDQ=IA7+MAXN
C
      IF (PFLAG.EQ.1) THEN
C
3115     IF (NOPCD(IA7).EQ.2) THEN
C
            NOPSTA(IOP(IA7))=1
            CALL MACHIN(IA7,NIDQ)
C
            IF ((KINBUF(IA7)+ PULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1      KINBUF(IA7).LT.MBUFF(IA7)) THEN
               CALL CKBLK(IA7)
            ENDIF
C
         ELSE
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               CALL MACHIN(IA7,NIDQ)
C
C              IT IS IMPORTANT TO UNBLOCK FIRST AND THEN CALL DESTIN
C              BECAUSE ATRIB(4) MUST BE OF THE ENTITY REMOVED AT MACHIN.
C
               IF ((KINBUF(IA7)+ PULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1         KINBUF(IA7).LT.MBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
C
               IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                  CALL DESTIN(IA7)
               ENDIF
C
            ELSE
               CALL MACHIN(IA7,NIDQ)
C
               IF ((KINBUF(IA7)+ PULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1         KINBUF(IA7).LT.MBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
C
            ENDIF
         ENDIF
      ELSE
C
C        PFLAG IS ZERO. THEREFORE, THE UNIT SHOULD BE UNDER INSPECTION.
C
         IF (NSTATU(IA7).NE.4) THEN
            WRITE (6,3119)
3119        FORMAT(1X,'ERROR: AT CWCSU, SINCE THE OPERATOR IS AVAILABLE
     1                 IF THE MACHINE IS NOT IN PRODUCTION THEN IT
     1                 SHOULD BE UNDER QUALITY INSPECTION')
```

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```
          CALL MESSAGE(IA7)
        ENDIF
C
        IF ((XINBUF(IA7)+ FULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1  XINBUF(IA7).LT.NBUFF(IA7)) THEN
          CALL CKBLK(IA7)
        ENDIF
C
      ENDIF
C
3120  RETURN
      END
C
C ******************************************************************
C
      SUBROUTINE MACHIN(IA7,NIDQ)
C
      INCLUDE '/ncsu/jwilson_ree/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON QSET(600000)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,SLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNL,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNM,TSELNM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      COMMON/UCOM72/IFAM(40),CAP(50,40),REMCAP(50,40),NUMFAM,CYCLET(50)
      COMMON/UCOM82/NAXN
      COMMON/UCOM83/NWAIT(40)

      common/ucomd/iffl
C
      IF (NTYPE(IA7).EQ.1) THEN
         CALL M1(IA7,NIDQ)
         RETURN
      ENDIF
C
      IF (NTYPE(IA7).EQ.2) THEN
         CALL M2(IA7,NIDQ)
         RETURN
      ENDIF
C
C     ***** TEST STRATEGY OF RUNNING WITH WHATEVER IS IN QUEUE AT M3
C
      IF (NTYPE(IA7).EQ.3) THEN
         CALL M3(IA7,NIDQ)
         RETURN
      ENDIF

C     *****
C
      IF (NTYPE(IA7).EQ.5) THEN
         CALL M5(IA7,NIDQ)
         RETURN
      ENDIF
C
      IF (NTYPE(IA7).EQ.7) THEN
         CALL M7(IA7,NIDQ)
```

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         RETURN
      ENDIF
C
      IF (NTYPE(IA7).EQ.9) THEN
         CALL M9(IA7,NIDQ)
         RETURN
      ENDIF
C
      END
C
C ******************************************************************
C
      SUBROUTINE PROCES(IPN,IA7,DEP)
C
      INCLUDE '/ncsu/jwilson_ree/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,SLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNL,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNM,TSELNM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
C
      K=20+IA7
C
      GO TO (3127,3128,3129,3130,3131,3132,3133,3134,3135,3137
     1) NPROCD(IPN,IA7)
C
3127  D=EXPON(PROP1(IPN,IA7),K)
      GO TO 3139
C
3128  D=UNFRM(PROP1(IPN,IA7),PROP2(IPN,IA7),K)
      GO TO 3139
C
3129  D=WEIBL(PROP1(IPN,IA7),PROP2(IPN,IA7),K)
      GO TO 3139
C
3130  D=TRIAG(PROP1(IPN,IA7),PROP2(IPN,IA7),PROP3(IPN,IA7),K)
      GO TO 3139
C
3131  D=RNORM(PROP1(IPN,IA7),PROP2(IPN,IA7),K)
      GO TO 3139
C
3132  D=RLOGN(PROP1(IPN,IA7),PROP2(IPN,IA7),K)
      GO TO 3139
C
3133  D=ERLNG(PROP1(IPN,IA7),PROP2(IPN,IA7),K)
      GO TO 3139
C
3134  D=GAMA(PROP1(IPN,IA7),PROP2(IPN,IA7),K)
      GO TO 3139
C
3135  D=BETA(PROP1(IPN,IA7),PROP2(IPN,IA7),K)
      GO TO 3139
C
3137  D=PROP1(IPN,IA7)
C
3139  DEP=D
```

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```
c
      RETURN
      END
c
c ********************************************************************
c
      SUBROUTINE SUTIME(IA7,IA2,SETUP)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MABRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/MSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKIN,NAVNT,OPNDT,NOTMA,WALKLO
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUN(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARME,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM22/EXTDIS(40,50),EXTP1(40,50),EXTP2(40,50),EXTP3(40,50)
      COMMON/UCOM23/INDIS(40,50),P1IN(40,50),P2IN(40,50),P3IN(40,50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM36/TRAIN,WCIN
c
c     MACHINES UNDER THE TRADITIONAL SYSTEM OF SETUPS HAVE ALL SETUP
c     TIME REPRESENTED BY THE INTERNAL SETUP. THIS IS TRUE SINCE THE
c     MACHINE IS STOPED DURING THE ENTIRE SETUP PROCESS.
c
c     SETUP TIME FOR MACHINES UNDER WORLD CLASS MANUFACTURING IS DIVIDED
c     INTO EXTERNAL(MACHINE KEEPS RUNNING) AND INTERNAL (MACHINE IS DOWN).
c
      GO TO (3141,3142,3143,3144,3145,3146,3147,3148,3149,3151
     1) INDIS(IA2,IA7)
c
3141  SETUP=EXPON(P1IN(IA2,IA7),1)
      GO TO 3153
c
3142  SETUP=UNFRM(P1IN(IA2,IA7),P2IN(IA2,IA7),1)
      GO TO 3153
c
3143  SETUP=WEIBL(P1IN(IA2,IA7),P2IN(IA2,IA7),1)
      GO TO 3153
c
3144  SETUP=TRIAG(P1IN(IA2,IA7),P2IN(IA2,IA7),P3IN(IA2,IA7),1)
      GO TO 3153
c
3145  SETUP=RNORM(P1IN(IA2,IA7),P2IN(IA2,IA7),1)
      GO TO 3153
c
3146  SETUP=RLOGN(P1IN(IA2,IA7),P2IN(IA2,IA7),1)
      GO TO 3153
c
3147  SETUP=ERLNG(P1IN(IA2,IA7),P2IN(IA2,IA7),1)
      GO TO 3153
c
3148  SETUP=GAMA(P1IN(IA2,IA7),P2IN(IA2,IA7),1)
      GO TO 3153
c
3149  SETUP=BETA(P1IN(IA2,IA7),P2IN(IA2,IA7),1)
      GO TO 3153
c
3151  SETUP=P1IN(IA2,IA7)
```

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```
      GO TO 3153
c
3153  SUTIN=SUTIN+SETUP
c
      IF (MSUTYP(IA7).EQ.1) THEN
         TRAIN=TRAIN+SETUP
      ELSE
         WCIN=WCIN+SETUP
      ENDIF
c
c     FOR MACHINES UNDER WORLD CLASS SETUP, IT IS IMPORTANT TO COLLECT
c     THE TOTAL EXTERNAL SETUP TIME TO DETERMINE CREW REQUIREMENTS.
c
      IF (MSUTYP(IA7).EQ.2) THEN
c
      GO TO (3161,3162,3163,3164,3165,3166,3167,3168,3169,3171
     1) EXTDIS(IA2,IA7)
c
3161  EXTSUP=EXPON(EXTP1(IA2,IA7),2)
      GO TO 3173
c
3162  EXTSUP=UNFRM(EXTP1(IA2,IA7),EXTP2(IA2,IA7),2)
      GO TO 3173
c
3163  EXTSUP=WEIBL(EXTP1(IA2,IA7),EXTP2(IA2,IA7),2)
      GO TO 3173
c
3164  EXTSUP=TRIAG(EXTP1(IA2,IA7),EXTP2(IA2,IA7),EXTP3(IA2,IA7),2)
      GO TO 3173
c
3165  EXTSUP=RNORM(EXTP1(IA2,IA7),EXTP2(IA2,IA7),2)
      GO TO 3173
c
3166  EXTSUP=RLOGN(EXTP1(IA2,IA7),EXTP2(IA2,IA7),2)
      GO TO 3173
c
3167  EXTSUP=ERLNG(EXTP1(IA2,IA7),EXTP2(IA2,IA7),2)
      GO TO 3173
c
3168  EXTSUP=GAMA(EXTP1(IA2,IA7),EXTP2(IA2,IA7),2)
      GO TO 3173
c
3169  EXTSUP=BETA(EXTP1(IA2,IA7),EXTP2(IA2,IA7),2)
      GO TO 3173
c
3171  EXTSUP=EXTP1(IA2,IA7)
c
3173  SUTEX=SUTEX+EXTSUP
c
      ENDIF
c
      RETURN
      END
c
c ********************************************************************
c
      SUBROUTINE DESTIN(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MABRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/MSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKIN,NAVNT,OPNDT,NOTMA,WALKLO
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUN(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARME,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
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      COMMON/UCOM18/TSUCIN,TSELIN,TSUCSM,TSELSM
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)

      common/ucomd/iffl
      COMMON/UCOM29/MINITR,MDESTR
c
c     MDESTR=1 MEANS MOVE TO NEXT MACHINE IN SEQUENCE OF MACHINES
c     ASSIGNED TO HIM COUNTER CLOCKWISE.
c
c     MDESTR=2 MEANS MOVE TO MACHINE ASSIGNED TO HIM W/LARGEST QUEUE
c
c     IT IS IMPORTANT TO HAVE OPERATOR STATUS AS ZERO BEFORE SEARCHING FOR
c     ANOTHER MACHINE. THIS WILL PREVENT PROBLEMS WITH OPERATOR AVAILABILITY
c     IF SUBS SUCH AS PQC AND MSETUP ARE CALLED UPON.
c
      NOPSTA(IOP(IA7))=0
c
      IF (MDESTR.EQ.1) THEN
          CALL NEXTMA(IA7)
          RETURN
      ENDIF
c
      IF (MDESTR.EQ.2) THEN
          CALL LONGQ(IA7)
          RETURN
      ENDIF
c
      END
c
c ******************************************************************
c
      SUBROUTINE MOVEMT(IA7,MOVE)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MSUCD(50),MQCD(50),MANRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/MSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKIN,HAVWT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANML,PHCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCSM,TSELSM
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)

      common/ucomd/iffl
      COMMON/UCOM29/MINITR,MDESTR
c
c     MINITR=1 MEANS MOVE WHEN IDLE
c     MINITR=2 MEANS MOVE AFTER COMPLETING ONE UNIT LOAD
c
      IF (MINITR.EQ.1) THEN
         MOVE=0
         RETURN
      ENDIF
c
      IF (MINITR.EQ.2) THEN
```

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```
c
c     IT IS IMPORTANT TO HAVE MACHINE STATUS AS ZERO BEFORE SEARCHING FOR
c     ANOTHER MACHINE. THIS WILL PREVENT PROBLEMS WITH OPERATOR AVAILABILITY
c     IF SUBS SUCH AS PQC AND MSETUP ARE CALLED UPON.

         CALL DESTIN(IA7)
         MOVE=1
         RETURN
      ENDIF
c
      END
c
c ******************************************************************
c
      SUBROUTINE MANMAN(IA7,QFLAG,NEXTM,MQFLAG)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MSUCD(50),MQCD(50),MANRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/MSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKIN,HAVWT,OPNDT,NOTMA,WALKLO
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANML,PHCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCSM,TSELSM
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM44/BLKTM(50)
      COMMON/UCOM63/PULLDQ(50)
      COMMON/UCOM82/MAXN
      common/ucomd/iffl
c
c     MODEL THE OPERATION AS MANUAL HANDLING ONLY WHEN THE OPERATOR OR MATERIAL
c     HANDLER HAS TO WALK TO THE NEXT STATION. IN CASE HE HANDS THE PART TO THE
c     NEXT STATION WITHOUT LEAVING HIS WORKSTATION, MODEL THE MOVE AS
c     A CONVEYOR OF ZERO LENGHT. OTHERWISE, THE MODEL WILL MOVE THROUGH
c     A SERIES OF UNNECESSARY IF's IN THIS SUBROUTINE.
c
c     VERIFY IF THE HANDLING IS PERFORMED BY A MATERIAL HANDLER OR
c     BY AN OPERATOR. IF PERFORMED BY AN OPERATOR, VERIFY OPERATOR'S
c     AND MATERIAL HANDLING EQUIPMENT AVAILABILITY.
c
      IF (NOPCD(IA7).EQ.0) THEN
         CALL HANDLE(IA7,QFLAG,NEXTM,MQFLAG)
c
      ELSE
c
         IF (NOPSTA(IOP(IA7)).EQ.0 .OR. (NOPSTA(IOP(IA7)).EQ.1 .AND.
     1   LASTMA(IOP(IA7)) .EQ. IA7)) THEN
c
            IF (MNOP(IA7,NEXTM).LE.6) THEN
c
c              EQUIPMENT SUCH AS HAND TRUCK OR PALLET JACK STAGED AT
c              A GIVEN LOCATION WITHIN THE CELL IS NOT NEEDED.
c
               NOPSTA(IOP(IA7))=3
               LASTMA(IOP(IA7))=IA7
c
c              AT MTYPE=3 (I.E. BURN IN OVEN) IT IS ASSUMED THAT THE OPERATOR
c              CAN MOVE TWO ULS ON EACH TRIP.
c
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              IF (NTYPE(IA7).EQ.3) THEN
                 NODQ=IA7+MAXM*2
                 X=NNQ(NODQ)
                 NTRIPS=INT(X/2+.99)
              ELSE
                 NTRIPS=1
              ENDIF

              IF (NHOP(IA7,NEXTM).LE.4) THEN
                 T1=DIST(IA7,NEXTM)/WALKEM*NTRIPS
              ELSE
                 T1=DIST(IA7,NEXTM)/WALKLD*NTRIPS
              ENDIF
c
c             FOR ALL MACHINE TYPES EXCEPT THE TYPE=345, PARTS AT THE
c             DUMMY OUTPUT BUFFER BELONG TO ONE DISTINCT ENTITY. AT THE
c             BURN IN OVEN, EACH PART IN THE OUTPUT BUFFER REPRESENTS A
c             DISTINCT ENTITY.
c
              IF (NTYPE(IA7).EQ.3) THEN
                 NODQ=IA7+MAXM*2

                 DO 3190 J=1,NNQ(NODQ)
                 CALL RMOVE(1,NODQ,ATRIB)
                 IA2=ATRIB(2)
                 ATRIB(6)=ATRIB(6)+1
                 IA6=ATRIB(6)
                 ATRIB(7)=MSEQ(IA6,IA2)
                 NEXTM=ATRIB(7)
                 CALL SCHDL(7,T1,ATRIB)
3190             XINBUF(NEXTM)=XINBUF(NEXTM)+ATRIB(4)

                 T2=T1+T1/NTRIPS
                 CALL SCHDL(9,T2,ATRIB)
                 OPNDT=OPNDT+T2
                 QFLAG=1
                 GO TO 3195

              ENDIF

              IF (NTYPE(IA7).EQ.5) THEN
               NODQ=IA7+MAXM*2

               IF (NQFLAG.EQ.1) THEN
                 DO 3191 J=1,NNQ(NODQ)
                 CALL REMDQQ(IA7)
                 ATRIB(6)=ATRIB(6)+1
                 ATRIB(7)=NEXTM
                 CALL SCHDL(7,T1,ATRIB)
                 XINBUF(NEXTM)=XINBUF(NEXTM)+ATRIB(4)
3191             CONTINUE
                 T2=T1+T1/NTRIPS
                 CALL SCHDL(9,T2,ATRIB)
                 OPNDT=OPNDT+T2
               ELSE
                 ATRIB(6)=ATRIB(6)+1
                 ATRIB(7)=NEXTM
                 CALL SCHDL(7,T1,ATRIB)
                 XINBUF(NEXTM)=XINBUF(NEXTM)+ATRIB(4)
                 T2=T1*2
                 CALL SCHDL(9,T2,ATRIB)
                 OPNDT=OPNDT+T2
               ENDIF
c
c              DEFINE QFLAG AS 1 SINCE ALTHOUGH ME IS NOT AVAILABLE, ME
c              MIGHT NOT BE NEEDED TO PROCESS PARTS AT THE MACHINE WHERE
c              THE UNITS ARE DEPARTING FROM.

               QFLAG=1
               GO TO 3195

              ENDIF


              IF (NQFLAG.EQ.1) THEN
                 CALL REMDQQ(IA7)
              ENDIF
              ATRIB(6)=ATRIB(6)+1
              ATRIB(7)=NEXTM

              IF (ATRIB(6).GT.ATRIB(7).AND.ATRIB(7).LT.20) THEN
                 WRITE(6,3192) ATRIB(2),ATRIB(7),ATRIB(6)
3192             FORMAT(1X,'ERROR W/IA2=',F6.0,1X,'IA7=',F6.0,1X
    1            ,'IA6=',F6.0,'>','IA7')
              ENDIF

              CALL SCHDL(7,T1,ATRIB)
              XINBUF(NEXTM)=XINBUF(NEXTM)+ATRIB(4)
              T2=T1*2
              CALL SCHDL(9,T2,ATRIB)
              OPNDT=OPNDT+T2
c
```

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c                DEFINE QFLAG AS 1 SINCE ALTHOUGH ME IS NOT AVAILABLE, ME
c                MIGHT NOT BE NEEDED TO PROCESS PARTS AT THE MACHINE WHERE
c                THE UNITS ARE DEPARTING FROM.
c
                 QFLAG=1
c
              ELSE
c
                 PENDING!!!!!!!!!
c
              ENDIF
c
           ELSE
c
c             PUT UNITS IN OUTPUT BUFFER AND BLOCK THE MACHINE
c
              MSTATU(IA7)=2
              BLKTM(IA7)=TNOW
              MBLKSC(IA7)=4

              IF (NQFLAG.EQ.0) THEN
                 CALL PUTDQQ(IA7)
              ENDIF

              QFLAG=0
c
           ENDIF
c
        ENDIF
c
3195    RETURN
        END
c
c ***************************************************************************
c
        SUBROUTINE MNEQ(AVAIBL,IA7,NEXTM)
c
        INCLUDE '/ncsu/jwilson_res/PARAM.INC'
        COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
       1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
       2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
        COMMON/UCOM1/NTYPE(50),NOPCD(50),MNOCD(50),MQCD(50),MAPRSC(50),
       1 NOEPSC(50),MBUFF(50),MSUTYP(50),NHOP(50,50),SPEED(50,50),
       2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
       3 IOP(50),MACH(10,50),IOPCD(50),MACNS(50),IUL(40),ISI(40),
       4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),MSTATU(50),
       5 LASTPM(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
       6 RBLT(40,300)
c
        COMMON/UCOM2/NMACH
        COMMON/UCOM3/NUL,NRELUL
        COMMON/UCOM4/A(100)
        COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
        COMMON/UCOM6/NSUDID(50),SUP1(50),SUP2(50),SUP3(50)
c
        COMMON/UCOM7/WALKEM,NAVNT,OPNDT,NDTMA,WALKLD
        COMMON/UCOM8/SUTEX,SUTIN
        COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
       1NOSECO(50),NOSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
       2MAXCO(50),MINCO(50),MAXCA,MINCA
c
        COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
        COMMON/UCOM11/ISCNDP(50)
        COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
        COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PRCOST(40,51)
        COMMON/UCOM14/SAMPLP
        COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
        COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
        COMMON/UCOM17/TNORJP(40),TNDRWP(40)
        COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
        COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
        COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
        COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
        COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
       1,PROP3(40,50)
        common/ucomd/iffl
c
        RETURN
c
        END
c
c ***************************************************************************
c
        SUBROUTINE HANDLE(IA7,QFLAG,NEXTM,NQFLAG)
c
        INCLUDE '/ncsu/jwilson_res/PARAM.INC'
        COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
       1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
       2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
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c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),MARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,NAVNT,OPNOT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQAMK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM26/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      COMMON/UCOM32/XIMBUF(50)
      COMMON/UCOM44/BLKTM(50)
      COMMON/UCOM63/PULLDQ(50)
      common/ucomd/iffl
c
c     IF MATERIAL HANDLING EQUIPMENT IS NEEDED AND AVAILABLE, THEN THE
c     MATERIAL HANDLER MOVES THE PARTS. ALSO TRUE IF HANDLING EQUIPMENT IS
c     NOT NEEDED.
c
      IF (NNOP(IA7,NEXTM) .GE.7) THEN
c
         AVAIBL=0
         CALL MHEQ(AVAIBL,IA7,NEXTM)
         IF (AVAIBL.EQ.0) THEN
            NSTATU(IA7)=2
            BLKTM(IA7)=TNOW
            NBLKSC(IA7)=2

            IF (NQFLAG.EQ.0) THEN
               CALL PUTDOQ(IA7)
            ENDIF

            QFLAG=0
         ELSE
            T1=DIST(IA7,NEXTM)/WALKLD
c
c           IT IS ASSUMED THAT THE TIME NEEDED TO ARRIVE TO THE MACHINE
c           IS TWICE THE TIME TAKEN TO TRAVEL TO THE NEXT MACHINE.
c
            T=T1*3
            IF (NQFLAG.EQ.1) THEN
               CALL REMDOQ(IA7)
            ENDIF
            ATRIB(6)=ATRIB(6)+1
            ATRIB(7)=NEXTM
            CALL SCHDL(7,T,ATRIB)
            XIMBUF(NEXTM)=XIMBUF(NEXTM)+ATRIB(4)
            NDTMA=NDTMA+T
            QFLAG=1
         ENDIF
c
      ELSE
c
         T1=DIST(IA7,NEXTM)/WALKLD
c
c        IT IS ASSUMED THAT THE TIME NEEDED TO ARRIVE TO THE MACHINE
c        IS TWICE THE TIME TAKEN TO TRAVEL TO THE NEXT MACHINE.
c
         T=T1*3
         IF (NQFLAG.EQ.1) THEN
            CALL REMDOQ(IA7)
         ENDIF
         ATRIB(6)=ATRIB(6)+1
         ATRIB(7)=NEXTM
         CALL SCHDL(7,T,ATRIB)
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            XIMBUF(NEXTM)=XIMBUF(NEXTM)+ATRIB(4)
            NDTMA=NDTMA+T
            QFLAG=1
c
      ENDIF
c
      RETURN
      END
c
c ***************************************************************
c
      SUBROUTINE CHNOP
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON QSET(600000)
c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),MARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,NAVNT,OPNOT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQAMK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM26/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM29/NINITR,NDESTR
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM32/XIMBUF(50)
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
      COMMON/UCOM40/REMPT(50)
      COMMON/UCOM43/BRKDSC,NUMEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTM(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM63/PULLDQ(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM82/MAXM
c
c     THE MACHINE AT WHICH THE OPERATOR IS RETURNING IS DETERMINED USING
c     THE ATTRIBUTES OF THE PART NUMBER THE OPERATOR MOVED. THOSE WERE THE
c     ONES USED TO SCHEDULE HIS RETURN TO THE MACHINE WHERE THE PARTS
c     DEPARTED FROM.
c
      NRETMA=ATRIB(12)
      IA7=NRETMA
      NIDQ=IA7+MAXM
c
      NOPSTA(IOP(IA7))=0
c
      QFLAG=0
      SFLAG=0
c
      IF (NOPCD(IA7).EQ.2) THEN
c
       IF (NSTATU(IA7).EQ.0) THEN
c
c        CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED.
c        IF THERE ARE,GIVE PRIORITY TO THOSE.
c
         IF (NAUTO.EQ.1) THEN
            PFLAG=0
```

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            CALL AUTOCK(IA7,PFLAG)
            IF (PFLAG.EQ.0) THEN
               GO TO 3260
            ENDIF
         ENDIF
C
C        THE MACHINE COULD NOT HAVE STARTED PARTS WITHOUT HIM AND THERE
C        SHOULD NOT BE PARTS IN THE OUTPUT QUEUE. HOWEVER, THERE COULD BE
C        PARTS IN THE DUMMY INPUT QUEUE.
C
         IF (NNQ(NIDQ).GT.0) THEN
            NOPSTA(IOP(IA7))=1
            LASTMA(IOP(IA7))=IA7
            CALL MACHIN(IA7,NIDQ)
            GO TO 3260
         ENDIF

         CALL QFULL(IA7,QFLAG,SFLAG)
C
         IF (QFLAG.EQ.0) THEN
C
C           SEND OPERATOR TO ANOTHER MACHINE IF HE IS A SHARED OPERATOR
C           OR FREE HIM IF HE IS A DEDICATED OPERATOR.
C
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               CALL DESTIN(IA7)
            ENDIF
            GO TO 3260

         ELSE
C
C           VERIFY IF THE OPERATOR WILL STAY AT THAT MACHINE OR NEEDS
C           TO MOVE TO ANOTHER MACHINE
C
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               MOVE=0
               CALL MOVEMT(IA7,MOVE)
               IF (MOVE.EQ.1) THEN
                   GO TO 3260
               ENDIF
            ENDIF
C
            IF (SFLAG.EQ.1  .AND. ISCHDP(IA7).NE.0) THEN
C
C              PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C              CHOSEN BY THE USER.
C
               CALL SCHEDP(IA7)
C
            ENDIF
C
C           DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C           TO BE PROCESSED.
C
            NTRY=MMFE(IA7)
            IA2=QSET(NTRY+2)
            IA10=QSET(NTRY+10)
C
C           VERIFY IF A SETUP IS NEEDED
C
            IF (MSUCD(IA7).EQ.1) THEN
               NTRY=MMFE(IA7)
               IA2=QSET(NTRY+2)
               IF (IA2.NE.LASTPN(IA7)) THEN
                  NSUPN=IA2
                  CALL MSETUP(NSUPN,IA7)
C
C                 WE KNOW AN OPERATOR WAS HANDLING PARTS AND NOW IS
C                 AVAILABLE. ITS STATUS WAS CHANGED TO ZERO AT THE BEGINNING
C                 OF THIS SUB. THEREFORE, AT MSETUP, IF HE IS NOT NEEDED THAT
C                 SUB WILL NOT CALL DESTIN BEACUSE HIS STATUS IS ZERO.
C
                  IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7)).EQ.2)
     1            THEN
                     CALL DESTIN(IA7)
                  ENDIF
                  GO TO 3260
C
               ENDIF
            ENDIF

            IF (IA10.EQ.0) THEN
               GO TO 3210
            ENDIF
C
C           DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
C           CALLING SUBROUTINE IS A DEPARTURE.
C
            DFLAG=1
            AFLAG=0
            PFLAG=0
C
```

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mdirizar@c50030-201ps.1            cell6.f            10/17/96  13:49   84/220
C              IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C              PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE,
C              THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C              CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C              THE REMOVAL.
C
               CALL PQC(AFLAG,DFLAG,PFLAG,IA7)

                IF (PFLAG.EQ.0) THEN
                   IF (NOPSTA(IOP(IA7)).NE.6) THEN
                      WRITE(6,3200)
3200                  FORMAT(1X,'ERROR:AT CHNOP W/NOPCD=2, PFLAG WILL BE
     1                ZERO ONLY IF HE IS DOING INSPECTION')
                      CALL MESSAGE(IA7)
                   ENDIF
C
                   IF ((XINBUF(IA7)+PULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1             XINBUF(IA7).LT.MBUFF(IA7)) THEN
                      CALL CKBLK(IA7)
                   ENDIF
C
                ELSE
3210               NIDQ=IA7+MAXN

                   NOPSTA(IOP(IA7))=1
                   CALL MACHIN(IA7,NIDQ)
C
                   IF ((XINBUF(IA7)+PULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1             XINBUF(IA7).LT.MBUFF(IA7)) THEN
                      CALL CKBLK(IA7)
                   ENDIF
C
                ENDIF

            ENDIF
C
         GO TO 3260
         ENDIF
C
C        MACHINE IS UNDER REPAIR
C
         IF (MSTATU(IA7).EQ.11) THEN
           IF (IOPCD(IOP(IA7)).EQ.2) THEN
              CALL DESTIN(IA7)
           ENDIF
           GO TO 3260
         ENDIF

         IF (MSTATU(IA7).EQ.5) THEN
          IF (MSUTYP(IA7).EQ.1) THEN
           IF (IOPCD(IOP(IA7)).EQ.2) THEN
              CALL DESTIN(IA7)
           ENDIF
           GO TO 3260
          ELSE
            WRITE(6,3201) IA7,MSTATU(IA7)
3201        FORMAT(1X,'AT CHNOP MACH=',I3,1X,'CANNOT HAVE STATUS OF',I3)
            CALL MESSAGE(IA7)
            RETURN
          ENDIF
         ENDIF

         IF (MSTATU(IA7).EQ.10) THEN
             IF (NNQ(IA7).EQ.0) THEN
                 IF (IOPCD(IOP(IA7)).EQ.2) THEN
                     CALL DESTIN(IA7)
                 ENDIF
                 GO TO 3260
             ELSE
                 K=1
3202             NTRY=LOCAT(K,IA7)
                 NIA2=QSET(NTRY+2)
                 NIA3=QSET(NTRY+3)
                 NIA10=QSET(NTRY+10)
                 IF (NIA2.EQ.LASTPN(IA7).AND.NIA3.EQ.LASLOT(IA7)) THEN
C
C                   IF IT IS THE SAME PART NUMBER, CALL PQC ONLY IF THERE
C                   ARE GOOD PARTS TO BE INSPECTED. OTHERWISE, CALL MACHINE.
C
                    DFLAG=1
                    AFLAG=0
                    PFLAG=0
                    IF (NIA10.GT.0) THEN

                        IF (K.GT.1) THEN
                           IF (K.NE.NNQ(IA7)) THEN
                              CALL RMOVE(K,IA7,ATRIB)
                              CALL FILEM(IA7,ATRIB)
                           ENDIF
                           DO 3203 I=1,NNQ(IA7)-1
                           CALL RMOVE(1,IA7,ATRIB)
                           CALL FILEM(IA7,ATRIB)
```

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3203                CONTINUE
                 ENDIF

                 CALL FQC(AFLAG,DFLAG,PFLAG,IA7)
                 IF (PFLAG.EQ.1) THEN
                    NOPSTA(IOP(IA7))=1
                    CALL MACHIN(IA7,NIDQ)
c
                    IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7)
     1              .AND.XINBUF(IA7).LT.NBUFF(IA7)) THEN
                       CALL CKBLK(IA7)
                    ENDIF
c
                    GO TO 3260
                 ELSE
c
                    IF (MSTATU(IA7).EQ.6) THEN
                       IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(
     1                 IA7).AND.XINBUF(IA7).LT.NBUFF(IA7)) THEN
                          CALL CKBLK(IA7)
                       ENDIF
                    ENDIF
c
                    GO TO 3260
                 ENDIF
              ELSE

                 IF (K.GT.1) THEN
                    IF (K.NE.NNQ(IA7)) THEN
                       CALL RMOVE(K,IA7,ATRIB)
                       CALL FILEM(IA7,ATRIB)
                    ENDIF
                    DO 3204 I=1,NNQ(IA7)-1
                    CALL RMOVE(1,IA7,ATRIB)
                    CALL FILEM(IA7,ATRIB)
3204                CONTINUE
                 ENDIF

                 NOPSTA(IOP(IA7))=1
                 CALL MACHIN(IA7,NIDQ)
c
                 IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7)
     1           .AND.XINBUF(IA7).LT.NBUFF(IA7)) THEN
                    CALL CKBLK(IA7)
                 ENDIF
                 GO TO 3260
c
              ENDIF
           ELSE
              K=K+1
              IF (NNQ(IA7).GE.K) THEN
                 GO TO 3202
              ELSE
                 WRITE(6,3205)TNOW
3205             FORMAT(1X,'WARNING: AT TNOW=',F8.2,1X,'THE NEXT')
                 WRITE(6,3206)
3206             FORMAT(1X,'PART NUMBER IN QUEUE IS NOT THE SAME')
                 WRITE(6,3207) IA7
3207             FORMAT(1X,'AS THE ONE WAITING IN NODQ OF MACHINE'
     1           ,I4)
                 WRITE(6,3208)
3208             FORMAT()
C
                 IF (NOPCD(IA7).EQ.2) THEN
                    IF (IOPCD(IOP(IA7)).EQ.2) THEN
                       CALL DESTIN(IA7)
                    ENDIF
                    GO TO 3260
                 ENDIF
              ENDIF
           ENDIF
        ENDIF
      ENDIF
C
C     SEND ERROR MESSAGE
C
      IF (MSTATU(IA7).EQ.1 .OR. MSTATU(IA7).EQ.2 .OR. MSTATU(IA7).EQ.4
     1 .OR. MSTATU(IA7).EQ.6 .OR. MSTATU(IA7).EQ.7
     2 .OR. MSTATU(IA7).EQ.8 .OR. MSTATU(IA7).EQ.9 .OR. MSTATU(IA7)
     3 .EQ.12) THEN
C
         WRITE(6,3213) IA7,MSTATU(IA7)
3213     FORMAT(1X,'AT CNMOP MACH=',I3,1X,'CANNOT HAVE STATUS OF',I3)
         CALL MESSAGE(IA7)
         RETURN

      ENDIF
c
     ENDIF
C
C
C    OPERATOR IS NOT NEEDED TO PROCESS PARTS:
```

```
mdirizar@c50030-201pe.i          cell6.f          10/17/96  13:49   86/220
C       FIRST VERIFY IF HE IS SHARED AND DETERMINE IF HE HAS TO MOVE
C       TO ANOTHER MACHINE.
C
           IF (IOPCD(IOP(IA7)).EQ.2) THEN
              MOVE=0
              CALL MOVEMT(IA7,MOVE)
              IF (MOVE.EQ.1) THEN
                 GO TO 3260
              ENDIF
           ENDIF
C
C
C          IF THE OPERATOR STAYS, BECAUSE HE IS DEDICATED OR SHARED AND DECIDED
C          TO STAY, THEN VERIFY THE MACHINE STATUS AND TAKE THE APPROPRIATE
C          ACTION.
C
           IF (MSTATU(IA7).EQ.0) THEN
C
C             CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED.
C             IF THERE ARE,GIVE PRIORITY TO THOSE.
C
              IF (NAUTO.EQ.1) THEN
                 PFLAG=0
                 CALL AUTOCK(IA7,PFLAG)
                 IF (PFLAG.EQ.0) THEN
                    GO TO 3260
                 ENDIF
              ENDIF
C
              PFLAG=0
              CALL BRKCK(IA7,PFLAG)
              IF (PFLAG.EQ.0) THEN
                 IF (IOPCD(IOP(IA7)).EQ.2) THEN
                    CALL DESTIN(IA7)
                 ENDIF
                 GO TO 3260
              ENDIF

C
               QFLAG=0
               SFLAG=0
C
               CALL QFULL(IA7,QFLAG,SFLAG)
C
               IF (QFLAG.EQ.0) THEN
C
                  IF (IOPCD(IOP(IA7)).EQ.2) THEN
                     CALL DESTIN(IA7)
                  ENDIF
                  GO TO 3260
C
               ELSE
C
                  IF (SFLAG.EQ.1 .AND. ISCHDP(IA7).NE.0) THEN
C
C                    PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C                    CHOSEN BY THE USER.
C
                     CALL SCHEDP(IA7)
C
                  ENDIF
C
C                 DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C                 TO BE PROCESSED.
C
                  IF (NTYPE(IA7).EQ.3) THEN
                     GO TO 3215
                  ENDIF
C
                  NTRY=MMFE(IA7)
                  IA2=QSET(NTRY+2)
                  IA10=QSET(NTRY+10)
C
C                 VERIFY IF A SETUP IS NEEDED
C
                  IF (NSUCD(IA7).EQ.1) THEN
C
                     IF (IA2.NE.LASTPN(IA7)) THEN
                        NSUPN=IA2
                        CALL NSETUP(NSUPN,IA7)
C
C                    AT THIS POINT IT IS NOT KNOWN IF THE CHOSEN MACHINE IS UNDER
C                    TRADITIONAL OR WORLD CLASS SETUP. THERFORE IT IS IMPORTANT
C                    TO DETERMINE IF THE OPERATOR HAS BEEN INVOLVED IN THE SETUP
C                    OR NOT.
C
                        IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7))
     1                  .EQ.2)THEN
                           CALL DESTIN(IA7)
                        ENDIF
                        GO TO 3260
                     ENDIF
C
```

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```
            ENDIF
         ENDIF

         IF (IA10.EQ.0) THEN
            GO TO 3215
         ENDIF
C
C        DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
C        CALLING SUBROUTINE IS A DEPARTURE.
C
         DFLAG=1
         AFLAG=0
         PFLAG=0
C
C        IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C        PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C        THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C        CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C        THE REMOVAL.
C
         CALL PQC(AFLAG,DFLAG,PFLAG,IA7)

         IF (PFLAG.EQ.0) THEN
            IF (NOPSTA(IOP(IA7)).NE.6) THEN
               WRITE(6,3214)
3214           FORMAT(1X,'ERROR:AT CHNOP W/NOPCD=2, PFLAG WILL BE
     1               ZERO ONLY IF HE IS DOING INSPECTION')
               CALL MESSAGE(IA7)
            ELSE
C
               IF ((XINBUF(IA7)+PULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1         XINBUF(IA7).LT.MBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
C
               GO TO 3260
            ENDIF
         ELSE
3215        NIDQ=IA7+MAXN
            CALL MACHIN(IA7,NIDQ)
C
            IF ((XINBUF(IA7)+PULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1      XINBUF(IA7).LT.MBUFF(IA7)) THEN
               CALL CKBLK(IA7)
            ENDIF
C
C           CALL DESTIN ONLY IF HIS STATUS IS ZERO WHEN YOU COME BACK
C           FROM CKBLK
C
            IF (NOPSTA(IOP(IA7)).EQ.0) THEN
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  CALL DESTIN(IA7)
               ENDIF
            ENDIF
            GO TO 3260

         ENDIF
C
      ENDIF

C
      IF (MSTATU(IA7).EQ.1 ) THEN
C
C        CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED.
C        IF THERE ARE,GIVE PRIORITY TO THOSE.
C
C         IF (NAUTO.EQ.1) THEN
C            PFLAG=0
C            CALL AUTOCK(IA7,PFLAG)
C            IF (PFLAG.EQ.0) THEN
C
C              NOW REMOVE THE ENTITY BEING PROCESSED FROM THE EVENT
C              CALENDAR AND PLACE IT NUMBER ONE IN THE DUMMY INPUT QUEUE.
C
C               CALL OUT(IA7)
C
C               GO TO 3260
C            ENDIF
C         ENDIF
C
C        THE OPERATOR DECIDED TO STAY. HOWEVER, SINCE HE IS NOT NEEDED
C        TO PROCESSES PARTS WHILE THE MACHINE IS RUNNING IT DOES NOT
C        MAKE SENCE (FROM A PRODUCTIVITY STANDPOINT) TO STAY THERE.
C
         IF (IOPCD(IOP(IA7)).EQ.2) THEN
            CALL DESTIN(IA7)
         ENDIF
         GO TO 3260
      ENDIF
C
      IF (MSTATU(IA7).EQ.10) THEN
C
```



```
C        THE OPERATOR DECIDED TO STAY. HOWEVER, SINCE HE IS NOT NEEDED
C        TO PROCESSES PARTS WHILE THE MACHINE IS RUNNING IT DOES NOT
C        MAKE SENCE (FROM A PRODUCTIVITY STANDPOINT) TO STAY THERE.
C
         IF (IOPCD(IOP(IA7)).EQ.2) THEN
            CALL DESTIN(IA7)
         ENDIF
         GO TO 3260
      ENDIF
C
      IF (MSTATU(IA7).EQ.2 .AND. MBLESC(IA7).EQ.2) THEN
C
C           LACK OF MH EQUIPMENT PENDING !!!!!!!!
C
      ENDIF
C
      IF (MSTATU(IA7).EQ.2 .AND. MBLESC(IA7).EQ.1) THEN
C
C         BLOCKING SOURCE: LACK OF SPACE IN NEXT W/S BUFFER.
C
C         CHECK IF PARTS CAN BE TAKEN TO THE NEXT WORKSTATION. IF SO,
C         CALL MANMAN SUB. IF NOT, SEND THE OPERATOR TO ANOTHER MACHINE
C         IF HE IS SHARED, OR KEEP HIS STATUS AS ZERO IF HE IS DEDICATED.
C
          NODQ=IA7+MAXN*2
C
          BFLAG=0
          NEXTM=MBLEMA(IA7)
          CALL BUFFCK(BFLAG,NEXTM)
          IF (BFLAG.EQ.0) THEN
C
             IF (IOPCD(IOP(IA7)).EQ.2) THEN
                CALL DESTIN(IA7)
             ENDIF
             GO TO 3260
C
          ELSE
C
             QFLAG=0
             NQFLAG=1
C
             CALL MATMAN(IA7,QFLAG,NEXTM,NQFLAG)
C
             IF (QFLAG.EQ.0) THEN
C
C                PARTS ARE RETURNED TO THE OUTPUT BUFFER AT MANMAN SUB.
C
                 IF (IOPCD(IOP(IA7)).EQ.2) THEN
                    CALL DESTIN(IA7)
                 ENDIF
                 GO TO 3260
C
             ELSE
C
                 UPTIME(IA7)=UPTIME(IA7)+TNOW-BLKTM(IA7)
                 TOTUP(IA7)=TOTUP(IA7)+TNOW-BLKTM(IA7)
                 BLKTM(IA7)=0
                 MSTATU(IA7)=0

                 IF (BRKDSC.EQ.2) THEN
                    IF (UPTIME(IA7).GT.BKNEXT(IA7)) THEN
                       CALL UPBRKD(IA7)
                    ENDIF
                 ENDIF
C
                 QFLAG=0
                 SFLAG=0
C
C                THE ASSUMPTION WITH MACHINES TYPE 3 (EX.BIO) IS THAT
C                HANDLING TO NEXT WORKSTATION IS MANUAL. THEREFORE, HE LEFT
C                WITH THE PARTS TO THE NEXT WORKSTATION.
C
                 IF (MTYPE(IA7).EQ.3) THEN
                    GO TO 3260
                 ENDIF

                 CALL QFULL(IA7,QFLAG,SFLAG)
C
                 IF (QFLAG.EQ.0) THEN
C
C                PARTS LEFT. HOWEVER, THE OPERATOR MIGHT BE DOING HANDLING.
C
                    IF (IOPCD(IOP(IA7)).EQ.2 .AND.NOPSTA(IOP(IA7))
     1              .EQ.0) THEN
                       CALL DESTIN(IA7)
                    ENDIF
                    GO TO 3260
                 ENDIF

                 IF (SFLAG.EQ.1  .AND. ISCNOP(IA7).NE.0) THEN
C
C                   PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
```

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```
C                  CHOSEN BY THE USER.
C
                   CALL SCHEDP(IA7)
                ENDIF
C
C               DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C               TO BE PROCESSED.
C
                NTRY=MMPE(IA7)
                IA2=QSET(NTRY+2)
                IA10=QSET(NTRY+10)
C
C               VERIFY IF A SETUP IS NEEDED
C
                IF (NSUCD(IA7).EQ.1) THEN
                   IF (IA2.NE.LASTPN(IA7)) THEN
                      NSUPN=IA2
                      CALL NSETUP(NSUPN,IA7)
C
C                     WE KNOW AN OPERATOR WAS HANDLING PARTS AND NOW MIGHT
C                     BE AVAILABLE. ITS STATUS WAS CHANGED TO ZERO AT
C                     THE BEGINNING OF THIS SUB. THEREFORE, AT NSETUP, IF HE
C                     IS NOT NEEDED THAT SUB WILL NOT CALL DESTIN BEACUSE HIS
C                     STATUS IS ZERO.
C
                      IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP
     1                (IA7)).EQ.2) THEN
                         CALL DESTIN(IA7)
                      ENDIF
                      GO TO 3260
                   ENDIF
                ENDIF
C
                IF (IA10.EQ.0) THEN
                   GO TO 3227
                ENDIF
C
C               DFLAG=1 WITH AFLAG=0 TELLS THE FQC SUBROUTINE THAT THE
C               CALLING SUBROUTINE IS A DEPARTURE.
C
                DFLAG=1
                AFLAG=0
                PFLAG=0
C
C               IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C               PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C               THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C               CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C               THE REMOVAL.
C
                CALL FQC(AFLAG,DFLAG,PFLAG,IA7)
                IF (PFLAG.EQ.0) THEN
                   IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                      WRITE(6,3225) IA7
3225                  FORMAT(1X,'AT CHNOP FOR MACH=',I3,1X,'& ')
                      WRITE(6,3226)
3226                  FORMAT(1X,'PFLAG=0 NOPSTA SHOULD NOT BE ZERO')
                   STOP
                   ENDIF
C
                   IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7)
     1             .AND.XINBUF(IA7).LT.MBUFF(IA7)) THEN
                      CALL CKBLK(IA7)
                   ENDIF
C
                   GO TO 3260
                ELSE
3227               NIDQ=IA7+MAXM
                   CALL MACHIN(IA7,NIDQ)
C
                   IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7)
     1             .AND.XINBUF(IA7).LT.MBUFF(IA7)) THEN
                      CALL CKBLK(IA7)
                   ENDIF
C
C                  IF MACHINE STARTS PROCESSING PARTS, SINCE HE IS NOT
C                  NEEDED, SEARCH FOR ANOTHER MACHINE IF HE IS STILL IDLE.
C
                   IF (NOPSTA(IOP(IA7)).EQ.0 .AND.IOPCD(IOP(IA7))
     1             .EQ.2) THEN
                      CALL DESTIN(IA7)
                   ENDIF
                ENDIF
C
             ENDIF
C
          ENDIF
C
       ENDIF
C
       IF (MSTATU(IA7).EQ.5 .OR. MSTATU(IA7).EQ.11) THEN
C
```



```
C           THE MACHINE IS UNDER TRADITIONAL SETUP, OR
C           UNDER REPAIR
C
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               CALL DESTIN(IA7)
            ENDIF
            GO TO 3260
         ENDIF
C
         IF (MSTATU(IA7).EQ.6 .OR. MSTATU(IA7).EQ.7 .OR.
     1   MSTATU(IA7).EQ.8 .OR. MSTATU(IA7).EQ.9 .OR.
     2   MSTATU(IA7).EQ.12 .OR. MSTATU(IA7).EQ.4) THEN
C
            WRITE(6,3230) IA7,MSTATU(IA7)
3230        FORMAT(1X,'ERROR AT CHNOP W/MACH=',I3,1X,'& MSTATU=',I3)
            WRITE(6,3231)
3231        FORMAT(1X,'HE IS NEEDED FOR THAT OP.')
            CALL MESSAGE(IA7)
         ENDIF
C
         IF (MSTATU(IA7).EQ.2 .AND. MBLKSC(IA7).EQ.3) THEN
C
C             LACK OF OPERATOR FOR FY PENDING !!!!!!!!
C
         ENDIF
C
         IF (MSTATU(IA7).EQ.2 .AND. MBLKSC(IA7).EQ.6) THEN
C
C           BLOCKING SOURCE: LACK OF MATERIAL HANDLING OPERATOR.
C
C           TRY TO MOVE PARTS TO NEXT WORKSTATION. IF SUCCESSFUL, START
C           A NEW UNIT LOAD IF THERE ARE PARTS WAITING IN QUEUE.
C
            NODQ=IA7+MAXM*2
            CALL COPY(1,NODQ,ATRIB)
            IA6=ATRIB(6)+1
            IA2=ATRIB(2)
            NEXTH=NSEQ(IA6,IA2)
            IF (NPARLL(NEXTH).GT.0) THEN
               NEXTH=0
               CALL SELRES(IA7,NEXTH)
            ENDIF
C
            BFLAG=0
            CALL BUFFCK(BFLAG,NEXTH)
             IF (BFLAG.EQ.0) THEN
               MBLKSC(IA7)=1
               MBLKMA(IA7)=NEXTH
C
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  CALL DESTIN(IA7)
               ENDIF
               GO TO 3260
C
             ELSE
C
               QFLAG=0
               NQFLAG=1
C
               CALL MHTHAN(IA7,QFLAG,NEXTH,NQFLAG)
C
               IF (QFLAG.EQ.0) THEN
C
C                 PARTS ARE RETURNED TO THE OUTPUT BUFFER AT MANHAN SUB.
C
                  IF (IOPCD(IOP(IA7)).EQ.2) THEN
                     CALL DESTIN(IA7)
                  ENDIF
                  GO TO 3260
C
               ELSE
C
                  UPTIME(IA7)=UPTIME(IA7)+TNOW-BLKTM(IA7)
                  TOTUP(IA7)=TOTUP(IA7)+TNOW-BLKTM(IA7)
                  MSTATU(IA7)=0
                  BLKTM(IA7)=0
C
                  IF (BRKDSC.EQ.2) THEN
                     IF (UPTIME(IA7).GT.BKNEXT(IA7)) THEN
                        CALL UPBRKD(IA7)
                     ENDIF
                  ENDIF
C
                  QFLAG=0
                  SFLAG=0
C
C                 THE ASSUMPTION WITH MACHINES TYPE 3 (EX.BIO) IS THAT
C                 HANDLING TO NEXT WORKSTATION IS MANUAL. THEREFORE, HE LEFT
C                 WITH THE PARTS TO THE NEXT WORKSTATION.
C
                  IF (MTYPE(IA7).EQ.3) THEN
                     GO TO 3260
```

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```
              ENDIF

              CALL QFULL(IA7,QFLAG,SFLAG)
C
              IF (QFLAG.EQ.0) THEN
                 GO TO 3260
              ENDIF
              IF (SFLAG.EQ.1  .AND. ISCHOP(IA7).NE.0) THEN
C
C                PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C                CHOSEN BY THE USER.
C
                 CALL SCHEDP(IA7)
              ENDIF
C
C             DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C             TO BE PROCESSED.
C
              NTRY=NMFE(IA7)
              IA2=QSET(NTRY+2)
              IA10=QSET(NTRY+10)
C
C             VERIFY IF A SETUP IS NEEDED
C
              IF (NSUCD(IA7).EQ.1) THEN
                 IF (IA2.NE.LASTPN(IA7)) THEN
                    NSUPN=IA2
                    CALL NSETUP(NSUPN,IA7)
C
C                   WE KNOW AN OPERATOR WAS HANDLING PARTS AND
C                   NOW IS AVAILABLE. ITS STATUS WAS CHANGED TO ZERO AT
C                   THE BEGINNING OF THIS SUB. THEREFORE, AT NSETUP, IF HE
C                   IS NOT NEEDED THAT SUB WILL NOT CALL DESTIN BEACUSE HIS
C                   STATUS IS ZERO.
C
                    IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP
     1              (IA7)).EQ.2) THEN
                       CALL DESTIN(IA7)
                    ENDIF
                    GO TO 3260
                 ENDIF
              ENDIF

              IF (IA10.EQ.0) THEN
                 GO TO 3250
              ENDIF
C
C             DFLAG=1 WITH AFLAG=0 TELLS THE FQC SUBROUTINE THAT THE
C             CALLING SUBROUTINE IS A DEPARTURE.
C
              DFLAG=1
              AFLAG=0
              FFLAG=0
C
C             IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C             PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C             THEREFORE,IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C             CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C             THE REMOVAL.
C
              CALL FQC(AFLAG,DFLAG,FFLAG,IA7)
              IF (FFLAG.EQ.0) THEN
C
              IF (NSTATU(IA7).EQ.6) THEN
                 IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1           XINBUF(IA7).LT.NBUFF(IA7)) THEN
                    CALL CKBLK(IA7)
                 ENDIF
              ENDIF
C
                 GO TO 3260
              ELSE
3250             NIDQ=IA7+MAIN
                 CALL MACHIN(IA7,NIDQ)
C
                 IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7)
     1            .AND.XINBUF(IA7).LT.NBUFF(IA7)) THEN
                    CALL CKBLK(IA7)
                 ENDIF
C
C                IF MACHINE STARTS PROCESSING PARTS, SINCE HE IS NOT
C                NEEDED, SEARCH FOR ANOTHER MACHINE.
C
                 IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP
     1           (IA7)).EQ.2) THEN
                    CALL DESTIN(IA7)
                 ENDIF
              ENDIF
C
           ENDIF
C
        ENDIF
```



```
C
         ENDIF
C
      IF (NSTATU(IA7).EQ.2 .AND. NBLKSC(IA7).EQ.5) THEN
C
C        AN OPERATOR WAS NOT AVAILABLE TO UNLOAD PARTS
C
         NOPSTA(IOP(IA7))=0

         UPTIME(IA7)=UPTIME(IA7)+TNOW-BLKTM(IA7)
         TOTUP(IA7)=TOTUP(IA7)+TNOW-BLKTM(IA7)
         BLKTM(IA7)=0
         START(IA7)=TNOW

         IF (BRKDSC.EQ.2) THEN
            IF (UPTIME(IA7).GT.BRKENT(IA7)) THEN
               CALL UPBRKD(IA7)
            ENDIF
         ENDIF
C
C        D10M3 UNLOADS PARTS, TRIES TO LOAD MORE AND SCHEDULES CULOAD
C
         CALL D10M3(IA7)

      ENDIF
C
3260  RETURN
      END
C
C ******************************************************************
C
      SUBROUTINE FREECO(IA2,IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRSLUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNOT,NOTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHOP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWEP1,TRWEP2,TRWEP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/ifff
C
C     RELEASE CONTAINERS
C
      IA4=ATRIB(4)
      NFREED=INT(ATRIB(4)/ICOCAP(IA2,ICOTYP(IA2,IA7))+.99)
C
      NUSECO(ICOTYP(IA2,IA7))=NUSECO(ICOTYP(IA2,IA7))-NFREED
      ICOSUM(ICOTYP(IA2,IA7))=ICOSUM(ICOTYP(IA2,IA7))+
     1        NUSECO(ICOTYP(IA2,IA7))
      NOBSCO(ICOTYP(IA2,IA7))=NOBSCO(ICOTYP(IA2,IA7))+1
C
      IF (NUSECO(ICOTYP(IA2,IA7)).GT.MAXCO(ICOTYP(IA2,IA7)))
     1THEN
          MAXCO(ICOTYP(IA2,IA7))=NUSECO(ICOTYP(IA2,IA7))
      ENDIF
C
      IF (NUSECO(ICOTYP(IA2,IA7)).LT.MINCO(ICOTYP(IA2,IA7)))
```


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```
     1THEN
          MINCO(ICOTYP(IA2,IA7))=NUSECO(ICOTYP(IA2,IA7))
      ENDIF
C
      RETURN
      END
C
C *****************************************************************
C
      SUBROUTINE FREECA(IA2,IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),III(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLESC(50),NBLENA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
C
C     RELEASE CART
C
      NUSECA=NUSECA-1
      ICASUM=ICASUM+NUSECA
      NOBSCA=NOBSCA+1
C
      IF (NUSECA.GT.MAXCA) THEN
          MAXCA=NUSECA
      ENDIF
C
      IF (NUSECA.LT.MINCA) THEN
          MINCA=NUSECA
      ENDIF
C
      RETURN
      END
C
C *****************************************************************
C
      SUBROUTINE SPSCHD(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),III(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLESC(50),NBLENA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
```



```
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
C
      NRANK=NFIND(1,IA7,9,1,0,0)
C
      CALL RMOVE(NRANK,IA7,ATRIB)
      CALL FILEM(IA7,ATRIB)
C
      DO 3200 I=1,NNQ(IA7)-1
      CALL RMOVE(1,IA7,ATRIB)
      CALL FILEM(IA7,ATRIB)
3200  CONTINUE
C
      RETURN
      END
C
C *****************************************************************
C
      SUBROUTINE FISCHD(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),III(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLESC(50),NBLENA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
C
C     FIFO APPLIES TO THE LOT AND NOT THE UNIT LOAD. THUS, IF THERE IS A
C     UNIT LOAD IN THE LINE OF THE SAME PART NUMBER AND LOT NUMBER
```

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C     OF THE ONE THAT COMPLETED PROCESSING, THAT PART SHOULD BE GIVEN
C     PRIORITY.
C
      NTRY=NRPE(IA7)
      IA2=QSET(NTRY+2)
      IA3=QSET(NTRY+3)
      IF(IA2.EQ.LASTPW(IA7) .AND. IA3.EQ.LASLOT(IA7)) THEN
        RETURN
      ENDIF
C
      DO 3275 J=2,NNQ(IA7)
      NTRY=LOCAT(J,IA7)
      IA2=QSET(NTRY+2)
      IA3=QSET(NTRY+3)
      IF (IA2.EQ.LASTPW(IA7) .AND. IA3.EQ.LASLOT(IA7)) THEN
C
          CALL RMOVE(J,IA7,ATRIB)
          CALL FILEM(IA7,ATRIB)
C
          DO 3274 I=1,NNQ(IA7)-1
          CALL RMOVE(1,IA7,ATRIB)
          CALL FILEM(IA7,ATRIB)
3274      CONTINUE
C
          RETURN
C
      ENDIF
3275  CONTINUE
C
      RETURN
      END
C
C **********************************************************************
C
      SUBROUTINE EDSCND(IA7)
C
      INCLUDE '/acsu/jwilson_ree/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NEQT),DDL(NEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(NEQT),
     2SSL(NEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IRI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNE,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCWN,TSELWN
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
C
      NRANK=NFIND(1,IA7,5,1,0,0)
C
      CALL RMOVE(NRANK,IA7,ATRIB)
      CALL FILEM(IA7,ATRIB)
C
      DO 3280 I=1,NNQ(IA7)-1
      CALL RMOVE(1,IA7,ATRIB)
      CALL FILEM(IA7,ATRIB)
3280  CONTINUE
C
      RETURN
```

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      END
C
C **********************************************************************
C
      SUBROUTINE EXPSC(IPN,IA7,EXPECT)
C
      INCLUDE '/acsu/jwilson_ree/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NEQT),DDL(NEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(NEQT),
     2SSL(NEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IRI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNE,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCWN,TSELWN
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
C
      GO TO (3291,3292,3292,3294,3295,3296,3297,3298,3299,3301
     1) NPROCD(IPN,IA7)
C
3291  EXPECT=PROP1(IPN,IA7)
      GO TO 3302
C
3292  EXPECT=(PROP1(IPN,IA7)+PROP2(IPN,IA7))/2
      GO TO 3302
C
C3293  EXPECT=??????
C      GO TO 3302
C
3294  EXPECT=(PROP1(IPN,IA7)+PROP2(IPN,IA7)+PROP3(IPN,IA7))/3
      GO TO 3302
C
3295  EXPECT=PROP1(IPN,IA7)
      GO TO 3302
C
3296  EXPECT=PROP1(IPN,IA7)
      GO TO 3302
C
3297  EXPECT=PROP1(IPN,IA7)*PROP2(IPN,IA7)
      GO TO 3302
C
3298  EXPECT=PROP1(IPN,IA7)*PROP2(IPN,IA7)
      GO TO 3302
C
3299  EXPECT=(PROP1(IPN,IA7)*PROLOW(IA7)+PROP2(IPN,IA7)*PROUPP(IA7))/
     1(PROP1(IPN,IA7)+PROP2(IPN,IA7))
C
      GO TO 3302
C
3301  EXPECT=PROP1(IPN,IA7)
C
3302  RETURN
      END
C
C **********************************************************************
C
      SUBROUTINE ASSWC7(IA7)
C
      INCLUDE '/acsu/jwilson_ree/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NEQT),DDL(NEQT),DTNOW,II,MFA,
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mdirizar8c50030-201ps.i              cell6.f              10/17/96  13:49   97/220
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/NALKIN,NAVNT,OPNDT,NDTMA,NALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQAINE,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDNMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCSM,TSELSM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
C
      CALL ATMN(IA7)
C
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE ATM0(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/NALKIN,NAVNT,OPNDT,NDTMA,NALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQAINE,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDNMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCSM,TSELSM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
```

```
mdirizar8c50030-201ps.i              cell6.f              10/17/96  13:49   98/220
      COMMON/UCOM32/XINBUF(50)
C
      IA2=ATRIB(2)
      IA4=ATRIB(4)
      IA6=ATRIB(6)
      IA7=ATRIB(7)
      IA8=ATRIB(8)
C
      IF (IA6.NE.MACHS(IA2)) THEN
         CALL CKCONT(IA2,IA4,IA6,IA7)
      ENDIF
C
C      NSIZE=INT(IA10*SAMPLP+.99)
C
      TOTINS=0
C      CALL QAINSP(NSIZE,TOTINS)
C      TOTQA=TOTQA+TOTINS
C
      CALL SCHDL(13,TOTINS,ATRIB)
      XINBUF(IA7)=XINBUF(IA7)-ATRIB(4)
C
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE QAINSP(NSIZE,TOTINS)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/NALKIN,NAVNT,OPNDT,NDTMA,NALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQAINE,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDNMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCSM,TSELSM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
C
      DO 3352 I=1,NSIZE
C
      GO TO (3341,3342,3343,3344,3345,3346,3347,3348,3349,3351
     1) QAINSD
C
3341  QAINS=EXPON(QAP1,3)
      GO TO 3352
C
3342  QAINS=UNFRM(QAP1,QAP2,3)
      GO TO 3352
C
3343  QAINS=WEIBL(QAP1,QAP2,3)
      GO TO 3352
C
3344  QAINS=TRIAG(QAP1,QAP2,QAP3,3)
      GO TO 3352
C
3345  QAINS=RNORM(QAP1,QAP2,3)
      GO TO 3352
C
3346  QAINS=RLOGN(QAP1,QAP2,3)
```

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mdirizar@c50030-201ps.i                cell6.f                10/17/96  13:49    99/220
      GO TO 3352
C
3347  QAINS=ERLNG(QAP1,QAP2,3)
      GO TO 3352
C
3348  QAINS=GAMA(QAP1,QAP2,3)
      GO TO 3352
C
3349  QAINS=BETA(QAP1,QAP2,3)
      GO TO 3352
C
3351  QAINS=QAP1
C
3352  TOTINS=TOTINS+QAINS
C
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE CQAINS
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MSUCD(50),MQCD(50),MANRSC(50),
     1 MDEPSC(50),MBUFF(50),MBUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPW,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKIN,NAVNT,OPMDT,MDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2NAXCO(50),NINCO(50),NAXCA,NINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
C
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
      COMMON/UCOM37/TRWK(40,50),QAMG,NWKC(40,50),QATRAI
      COMMON/UCOM60/ASRCO(50),RELCO(50)
      COMMON/UCOM69/ASKCA(50),RELCA(50)
C
      IA2=ATRIB(2)
      IA3=ATRIB(3)
      IA4=ATRIB(4)
      IA6=ATRIB(6)
      IA7=ATRIB(7)
      IA10=ATRIB(10)
      IA12=ATRIB(12)
C
      NQFLAG=0
C
      NREJEC=0
      NRWK=0
      QARWKT=0
C
C      NSIZE=INT(IA4*SAMPLP+.99)
C
      NSIZE=IA10
C
      S=SCRAPP(IA2,IA12)
      R=REWKP(IA2,IA12)
```

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mdirizar@c50030-201ps.i                cell6.f                10/17/96  13:49   100/220
      DO 3360 J=1,NSIZE
      OUTINS=UNFRM(0.0,1.0,5)
C
      IF (OUTINS.LT.S) THEN
          NREJEC=NREJEC+1
      ELSE
          IF (OUTINS.LT.(S+R)) THEN
              NRWK=NRWK+1
          ENDIF
      ENDIF
3360  CONTINUE
C
      TRWK(IA2,IA12)=TRWK(IA2,IA12)+NRWK
      ATRIB(10)=ATRIB(10)-NREJEC
      IF (ATRIB(10).GT.0) THEN
          ATRIB(11)=1
      ELSE
          ATRIB(11)=0
      ENDIF
C
      TOTSCR(IA2,IA12)=TOTSCR(IA2,IA12)+NREJEC
      SCRAP(IA2)=SCRAP(IA2)+NREJEC
      LSCRAP(IA2,IA3)=LSCRAP(IA2,IA3)+NREJEC
C
C     FREE THOSE CONTAINERS IN WHICH THE PARTS ARRIVED TO Q.A. W/S
C     ONCE INSPECTION HAS BEEN COMPLETED.
C
      IF (RELCO(IA7).EQ.1) THEN
          CALL FREECO(IA2,IA7)
      ENDIF
C
      IF (RELCA(IA7).EQ.1) THEN
       CALL FREECA(IA2,IA7)
      ENDIF
C
C     IF THERE IS REWORK TO BE DONE, SCHEDULE THE COMPLETION OF REWORK.
C
      IF (NRWK.GT.0) THEN
          QARWKT=0
          CALL SELRWK(NRWK,IA12,QARWKT)
          TQARWK=TQARWK+QARWKT
          CALL SCHDL(14,QARWKT,ATRIB)
      ELSE
C
C         CALL FINODS IF THIS IS THE LAST W/S OR SCHEDULE ARRIVAL
C         TO THE NEXT MACHINE IN THE PART ROUTING.
C         NOTE: Q.A. W/S SHOULD HAVE NOPCD=0 SUCH THAT IF HANDLING IS
C         MANUAL, IT IS PERFORMED BY A MATERIAL HANDLER.
C
          IF (IA6.EQ.MACHS(IA2)) THEN
              CALL FINODS(IA7)
          ELSE
              IA6=ATRIB(6)+1
              ATRIB(12)=IA7
              NEXTM=MSEQ(IA6,IA2)
              IF (NPARLL(NEXTM).EQ.0) THEN
                  QFLAG=0
                  CALL MATHAN(IA7,QFLAG,NEXTM,NQFLAG)
              ELSE
                  NEXTM=0
                  CALL SELRES(IA7,NEXTM)
                  QFLAG=0
                  CALL MATHAN(IA7,QFLAG,NEXTM,NQFLAG)
              ENDIF
          ENDIF
      ENDIF
C
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE QARWK(NRWK,QARWKT)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MSUCD(50),MQCD(50),MANRSC(50),
     1 MDEPSC(50),MBUFF(50),MBUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPW,NLOTS,NPARTS,TOTLOT
C
```


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```
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKIN,NAVNT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANMK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucmnd/iffl
C
      DO 3392 I=1,NRWK
C
      GO TO (3301,3302,3303,3304,3305,3306,3307,3308,3309,3391
     1) TRDRWD
C
3301  REWORK=EXPON(TRWKP1,4)
      GO TO 3392
C
3302  REWORK=UNFRM(TRWKP1,TRWKP2,4)
      GO TO 3392
C
3303  REWORK=WEIBL(TRWKP1,TRWKP2,4)
      GO TO 3392
C
3304  REWORK=TRIAG(TRWKP1,TRWKP2,TRWKP3,4)
      GO TO 3392
C
3305  REWORK=RNORM(TRWKP1,TRWKP2,4)
      GO TO 3392
C
3306  REWORK=RLOGN(TRWKP1,TRWKP2,4)
      GO TO 3392
C
3307  REWORK=ERLNG(TRWKP1,TRWKP2,4)
      GO TO 3392
C
3308  REWORK=GAMA(TRWKP1,TRWKP2,4)
      GO TO 3392
C
3309  REWORK=BETA(TRWKP1,TRWKP2,4)
      GO TO 3392
C
3391  REWORK=TRWKP1
C
3392  QARWKT=QARWKT+REWORK
C
      RETURN
      END
C
C ****************************************************************
C
      SUBROUTINE CTRANW
C
      INCLUDE '/ncsu/jwilson_ree/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NABRSC(50),
     1 NDEPSC(50),NSUPP(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKIN,NAVNT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
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```
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANMK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucmnd/iffl
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
C
      IA2=ATRIB(2)
      IA6=ATRIB(6)
      IA7=ATRIB(7)
C
      NQFLAG=0
C
      IF (IA6.EQ.MACHS(IA2)) THEN
         CALL FINDDS(IA7)
C
C        AT THIS POINT THERE IS NO NEED TO RELEASE CONTAINERS OR CARTS
C        BECAUSE IA6 IS THE LAST MACHINE IN THE PART ROUTING AND CARTS
C        OR CONTAINERS WERE NOT REQUESTED AT THE BEGINNING OF QAINSP.
C
      ELSE
C
C        SEND PARTS TO NEXT WORKSTATION.
C        NOTE: BUFFCK IS NOT CALLED FROM THIS SUBROUTINE SINCE PARTS
C        CANNOT BE BLOCKED AT Q.A. OR TRADNWK STATION. THEREFORE, IT IS
C        POSSIBLE THAT AT A GIVEN TIME, THE NUMBER IN QUEUE MAY EXCEED
C        THE SPECIFIED QUEUE CAPACITY.
C
         IA6=ATRIB(6)+1
         NEXTN=NSEQ(IA6,IA2)
         ATRIB(12)=IA7
         IF (NPARLL(NEXTN).EQ.0) THEN
            QFLAG=0
            CALL MATRAN(IA7,QFLAG,NEXTN,NQFLAG)
         ELSE
            NEXTN=0
            CALL SELRES(IA7,NEXTN)
            QFLAG=0
            CALL MATRAN(IA7,QFLAG,NEXTN,NQFLAG)
         ENDIF
      ENDIF
C
      RETURN
      END
C
C ****************************************************************
C
      SUBROUTINE SUCINS(IA10,IA7,TOTIME)
C
      INCLUDE '/ncsu/jwilson_ree/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NABRSC(50),
     1 NDEPSC(50),NSUPP(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKIN,NAVNT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
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```
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDAJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
C
      DO 3422 I=1,IA10
C
      GO TO (3411,3412,3413,3414,3415,3416,3417,3418,3419,3421
     1) NSUDIS(IA7)
C
3411  SUINSP=EXPON(SUP1(IA7),6)
      GO TO 3422
C
3412  SUINSP=UNFRM(SUP1(IA7),SUP2(IA7),6)
      GO TO 3422
C
3413  SUINSP=WEIBL(SUP1(IA7),SUP2(IA7),6)
      GO TO 3422
C
3414  SUINSP=TRIAG(SUP1(IA7),SUP2(IA7),SUP3(IA7),6)
      GO TO 3422
C
3415  SUINSP=RNORM(SUP1(IA7),SUP2(IA7),6)
      GO TO 3422
C
3416  SUINSP=RLOGN(SUP1(IA7),SUP2(IA7),6)
      GO TO 3422
C
3417  SUINSP=ERLNG(SUP1(IA7),SUP2(IA7),6)
      GO TO 3422
C
3418  SUINSP=GAMA(SUP1(IA7),SUP2(IA7),6)
      GO TO 3422
C
3419  SUINSP=BETA(SUP1(IA7),SUP2(IA7),6)
      GO TO 3422
C
3421  SUINSP=SUP1(IA7)
C
3422  TOTINS=TOTINS+SUINSP
C
      RETURN
      END
C
C ****************************************************************
C
      SUBROUTINE CSUCIN
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MBUTYP(50),MMOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MMLESC(50),MBLEMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/MALERM,MAVNT,OPNOT,NOTMA,MALRLD
      COMMON/UCOM8/SUTRX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NUMSCO(50),NCMSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHOP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
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      COMMON/UCOM17/TRDAJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM22/EXTOIS(50),EXTP1(50),EXTP2(50),EXTP3(50)
      COMMON/UCOM23/INDIS(50),P1IN(50),P2IN(50),P3IN(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
C
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      COMMON/UCOM26/SESCP,SUSCP,SERWP,SURWP
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM48/MAUTO
      COMMON/UCOM57/TRWK(40,50),QAWD,RWKC(40,50),QATRA1
      COMMON/UCOM58/IPRCD(50),IREP(50)
      COMMON/UCOM83/MAXN
C
      IA2=ATRIB(2)
      IA3=ATRIB(3)
      IA4=ATRIB(4)
      IA7=ATRIB(7)
      IA10=ATRIB(10)
C
      IF (BRKDSC.EQ.2) THEN
         IF (UPTIME(IA7).GT.BKNEXT(IA7)) THEN
            CALL UPBRKD(IA7)
         ENDIF
      ENDIF
C
      NREJEC=0
      NRWK=0
      TOTRWK=0
      NPREVN=ATRIB(12)
C
C     CALCULATE THE PROBABILITY OF FINDING SCRAP DURING SUCCESSIVE INSPECTION.
C     THAT IS, THE SCRAP OF THAT PART NUMBER AT THAT MACHINE NUMBER TIMES THE
C     PERCENTAGE THAT IS EXPECTED TO BE FOUND DURING SUCCESSIVE INSPECTION.
C     DO THE SAME FOR REWORK.
C
      S=SCRAPP(IA2,NPREVN)*SUSCP
      R=REWKP(IA2,NPREVN)*SURWP
C
      DO 3440 I=1,IA10
      OUTINS=UNFRM(0.0,1.0,7)
C
      IF (OUTINS.LT.S) THEN
         NREJEC=NREJEC+1
      ELSE
         IF (OUTINS.LT.(S+R)) THEN
            NRWK=NRWK+1
         ENDIF
      ENDIF
3440  CONTINUE
C
      TRWK(IA2,IA7)=TRWK(IA2,IA7)+NRWK
      ATRIB(10)=ATRIB(10)-NREJEC
      IF (ATRIB(10).GT.0) THEN
         ATRIB(11)=1
      ELSE
         ATRIB(11)=0
      ENDIF

      TOTSCR(IA2,IA7)=TOTSCR(IA2,IA7)+NREJEC
      SCRAP(IA2)=SCRAP(IA2)+NREJEC
      LSCRAP(IA2,IA3)=LSCRAP(IA2,IA3)+NREJEC
C
      IF (NRWK.GT.0) THEN
          CALL SUCRWK(NRWK,IA7,TOTRWK)
          TSUCRW=TSUCRW+TOTRWK
          CALL SCHDL(3,TOTRWK,ATRIB)
          UPTIME(IA7)=UPTIME(IA7)+TOTRWK
          TOTUP(IA7)=TOTUP(IA7)+TOTRWK
          MOPSTA(IOP(IA7))=0
          MSTATU(IA7)=0
          GO TO 3470
      ENDIF
C
C     PUT INSPECTED UNITS IN DUMMY INPUT BUFFER AND CALL MACHIN
C     SUBROUTINE TO PROCESS THE UNITS.
C
C     QUALITY OF EACH UNIT IN THE UNIT LOAD NEEDS TO BE DEFINED
C     BEFORE PLACING THE UNIT IN THE DUMMY INPUT QUEUE.
C
      NIDQ=IA7+MAXN
      IA10=ATRIB(10)

      IF (MTYPE(IA7).EQ.2) THEN

         CALL FILEM(NIDQ,ATRIB)
```

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```
         GO TO 3460

      ENDIF
C
      IF (IA10.EQ.0) THEN
C
C        ALL UNITS IN THE UNIT LOAD ARE BAD.
C
         DO 3450 J=1,IA4
         ATRIB(11)=0
3450     CALL FILEM(NIDQ,ATRIB)
         GO TO 3460
      ENDIF
C
      IF (IA10.EQ.IA4) THEN
C
C        ALL UNITS IN THE UNIT LOAD ARE GOOD.
C
         DO 3455 J=1,IA4
         ATRIB(11)=1
3455     CALL FILEM(NIDQ,ATRIB)
         GO TO 3460
      ENDIF
C
      IF (IA10.LT.IA4) THEN
C
C        THE UNIT LOAD HAS A COMBINATION OF GOOD AND BAD UNITS.
C
         DO 3460 J=1,IA10
         ATRIB(11)=1
3460     CALL FILEM(NIDQ,ATRIB)
         N=IA4-IA10
         DO 3465 J=1,N
         ATRIB(11)=0
3465     CALL FILEM(NIDQ,ATRIB)
      ENDIF
C
C     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
C     GIVE PRIORITY TO THOSE.
C
3460  FFLAG=0
      CALL BRECK(IA7,FFLAG)
      IF (FFLAG.EQ.0) THEN
         IF (IOPCD(IOP(IA7)).EQ.2) THEN
            MOPSTA(IOP(IA7))=0
            CALL DESTIN(IA7)
         ELSE
            MOPSTA(IOP(IA7))=0
         ENDIF
         GO TO 3470
      ENDIF
C
C     CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
C     GIVE PRIORITY TO THOSE.
C
      MOPSTA(IOP(IA7))=0
      IF (MAUTO.EQ.1) THEN
         FFLAG=0
         CALL AUTOCK(IA7,FFLAG)
         IF (FFLAG.EQ.0) THEN
            GO TO 3470
         ENDIF
      ENDIF
C
C     CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C     IF THERE ARE,GIVE PRIORITY TO THOSE.
C
      IF (IREP(IA7).EQ.1) THEN
         FFLAG=0
         CALL RSTCK(IA7,FFLAG)
         IF (FFLAG.EQ.0) THEN
            GO TO 3470
         ENDIF
      ENDIF
C
      CALL MACHIN(IA7,NIDQ)
      MOPSTA(IOP(IA7))=1
C
3470  RETURN
      END
C
C *****************************************************************
C
      SUBROUTINE SUCNWK(NUMK,IA7,TOTNWK)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MABRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MMOP(50,50),SPEED(50,50),
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     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),NSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/MSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NRVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQAMNK,PNCOST(40,51)
      COMMON/UCOM16/TREWND,TRWLP1,TRWLP2,TRWLP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSUNWD(50),SUNWP1(50),SUNWP2(50),SUNWP3(50)
      COMMON/UCOM21/NSENWD(50),SENWP1(50),SENWP2(50),SENWP3(50)
      common/ucomd/iffl
C
      DO 3482 I=1,NUMK
C
      GO TO (3471,3472,3473,3474,3475,3476,3477,3478,3479,3481
     1) NSUNWD(IA7)
C
3471  SUNWK=EXPON(SUNWP1(IA7),0)
      GO TO 3482
C
3472  SUNWK=UNFRM(SUNWP1(IA7),SUNWP2(IA7),0)
      GO TO 3482
C
3473  SUNWK=WEIBL(SUNWP1(IA7),SUNWP2(IA7),0)
      GO TO 3482
C
3474  SUNWK=TRIAG(SUNWP1(IA7),SUNWP2(IA7),SUNWP3(IA7),0)
      GO TO 3482
C
3475  SUNWK=RNORM(SUNWP1(IA7),SUNWP2(IA7),0)
      GO TO 3482
C
3476  SUNWK=RLOGN(SUNWP1(IA7),SUNWP2(IA7),0)
      GO TO 3482
C
3477  SUNWK=ERLNG(SUNWP1(IA7),SUNWP2(IA7),0)
      GO TO 3482
C
3478  SUNWK=GAMA(SUNWP1(IA7),SUNWP2(IA7),0)
      GO TO 3482
C
3479  SUNWK=BETA(SUNWP1(IA7),SUNWP2(IA7),0)
      GO TO 3482
C
3481  SUNWK=SUNWP1(IA7)
C
3482  TOTNWK=TOTNWK+SUNWK
C
      RETURN
      END
C
C *****************************************************************
C
      SUBROUTINE CSUCIN
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MABRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MMOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),NSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/MSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
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      COMMON/UCOM7/WALKEM,NAVNT,OPHDT,HDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
c
      COMMON/UCOM43/BRKDSC,BRKEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM60/IPRCD(50),IREP(50)
      COMMON/UCOM82/MAXN
c
      IA4=ATRIB(4)
      IA7=ATRIB(7)
      IA10=ATRIB(10)
      NIDQ=IA7+MAXN
c
      IF (BRKDSC.EQ.2) THEN
         IF (UPTIME(IA7).GT.BRKEXT(IA7)) THEN
            CALL UPBRKD(IA7)
         ENDIF
      ENDIF
c
c     PUT INSPECTED UNITS IN DUMMY INPUT BUFFER AND CALL MACHIN
c     SUBROUTINE TO PROCESS THE UNITS.
c
c     QUALITY OF EACH UNIT IN THE UNIT LOAD NEEDS TO BE DEFINED
c     BEFORE PLACING THE UNIT IN THE DUMMY INPUT QUEUE.
c
      IF (NTYPE(IA7).EQ.2) THEN

         CALL FILEM(NIDQ,ATRIB)
         GO TO 3520

      ENDIF
c
      IF (IA10.EQ.0) THEN
c
c        ALL UNITS IN THE UNIT LOAD ARE BAD.
c
         DO 3490 J=1,IA4
         ATRIB(11)=0
3490     CALL FILEM(NIDQ,ATRIB)
         GO TO 3520
      ENDIF
c
      IF (IA10.EQ.IA4) THEN
c
c        ALL UNITS IN THE UNIT LOAD ARE GOOD.
c
         DO 3495 J=1,IA4
         ATRIB(11)=1
3495     CALL FILEM(NIDQ,ATRIB)
         GO TO 3520
      ENDIF
c
      IF (IA10.LT.IA4) THEN
c
c        THE UNIT LOAD HAS A COMBINATION OF GOOD AND BAD UNITS.
c
         DO 3500 J=1,IA10
         ATRIB(11)=1
3500     CALL FILEM(NIDQ,ATRIB)
         N=IA4-IA10
         DO 3505 J=1,N
         ATRIB(11)=0
3505     CALL FILEM(NIDQ,ATRIB)
      ENDIF

c     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
c     GIVE PRIORITY TO THOSE.
c
3520  PFLAG=0
      CALL BRECK(IA7,PFLAG)
      IF (PFLAG.EQ.0) THEN
         IF (IOPCD(IOP(IA7)).EQ.2) THEN
```



```
            NOPSTA(IOP(IA7))=0
            CALL DEPTIN(IA7)
         ELSE
            NOPSTA(IOP(IA7))=0
         ENDIF
         GO TO 3530
      ENDIF
c
c     CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
c     GIVE PRIORITY TO THOSE.
c
      NOPSTA(IOP(IA7))=0
      IF (NAUTO.EQ.1) THEN
         PFLAG=0
         CALL AUTOCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 3530
         ENDIF
      ENDIF
c
c     CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
c     IF THERE ARE,GIVE PRIORITY TO THOSE.
c
      IF (IREP(IA7).EQ.1) THEN
         PFLAG=0
         CALL RSTCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 3530
         ENDIF
      ENDIF
c
      CALL MACHIN(IA7,NIDQ)
      NOPSTA(IOP(IA7))=1
c
3530  RETURN
      END
c
c ********************************************************************
c
      SUBROUTINE SELFIQ(IA7,QFLAG,NQFLAG)
c
      INCLUDE '/mcsu/jwilson_rse/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NMUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPU(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 NELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEM,NAVNT,OPHDT,HDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
      COMMON/UCOM30/TLASTP(50)
c
      COMMON/UCOM43/BRKDSC,BRKEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM82/MAXN
c
c     SINCE SELF INSPETION OCCURS ONCE THE UNIT LOAD HAS BEEN COMPLETED,
c     AND AT A MACHINE IN WHICH THE OPERATOR IS NEEDED AT ALL TIMES, THE
c     OPERATOR IS ASSUMED TO BE AVAILABLE.
c
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mdirisar@c50030-201ps,1          cell16.f          8/17/96  13:49   109/220
C     THE ONLY EXCEPTION TO THE ABOVE IS WHEN NQCD=4 (SELF INSP ONLY) W/
C     ENTITIES LEAVING IN BATCHES AND NOPCD=1 (SUCH AS NTYPE=3). HOWEVER,
C     EVEN FOR THAT CASE, THIS SUB IS CALLED ONLY IF THE OPERATOR IS
C     AVAILABLE.
C
      IF (NOPCD(IA7).EQ.1 .and. NQCD(IA7).EQ.2) THEN
          WRITE(6,3550)
3550      FORMAT(1X,'ERROR: DO NOT USE NOPCD OF 1 WITH NQCD AS 2')
          CALL MESSAGE(IA7)
      ENDIF
C
      IF (NQFLAG.EQ.0) THEN
          NODQ=IA7+MAXN*2
          CALL FILEM(NODQ,ATRIB)
      ENDIF
C
      NOPSTA(IOP(IA7))=7
      IF (NOPCD(IA7).EQ.2) THEN
          NSTATU(IA7)=7
      ENDIF

      TOTINS=0
C
      IF (MDEPSC(IA7).EQ.10 .OR. MDEPSC(IA7).EQ.4) THEN
C
C        THE ASSUMPTION WITH MACHINE DEPSC=10 IS THAT EACH ENTITY IN THE OUTPUT
C        BUFFER REPRESENTS A CONTAINER OF UNITS WITH ITS UNIQUE VALUE IN
C        ATTRIBUTE 10 REPRESENTING THE NUMBER OF GOOD UNITS IN THE CONTAINER.
C
C        THE ASSUMPTION WITH DEPARTURE SCENARIO 4 IS THAT EACH ENTITY IN THE
C        OUTPUT BUFFER REPRESENTS ONE UNIT WITH A UNIQUE VALUE ON ATTRIBUTE
C        10.
C
         NODQ=IA7+MAXN*2
         NIQ=SUMQ(10,NODQ)
         CALL EXSELF(IA7,EXPSEL)
         TOTINS=NIQ*EXPSEL
         TSELIN=TSELIN+TOTINS
         CALL SCHDL(5,TOTINS,ATRIB)
C
C        INSPECTION IN NTYPE=3 MIGHT BE GOING IN PARALLEL W/PROCESSING.
C
         IF (NTYPE(IA7).NE.3) THEN
            UPTIME(IA7)=UPTIME(IA7)+TOTINS
            TOTUP(IA7)=TOTUP(IA7)+TOTINS
         ENDIF

      ELSE

         IA10=ATRIB(10)
         CALL SELINS(IA10,IA7,TOTINS)
         TSELIN=TSELIN+TOTINS
         CALL SCHDL(5,TOTINS,ATRIB)
         UPTIME(IA7)=UPTIME(IA7)+TOTINS
         TOTUP(IA7)=TOTUP(IA7)+TOTINS

      ENDIF
C
      IF (NTYPE(IA7).EQ.9) THEN
         TLASTP(IA7)=TNOW+TOTINS
      ENDIF

      QFLAG=0
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE SELINS(IA10,IA7,TOTINS)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),MARRSC(50),
     1 MDEPSC(50),NBUFP(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPW,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTWA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
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mdirisar@c50030-201ps,1          cell16.f          8/17/96  13:49   110/220
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQASME,PRCOST(40,51)
      COMMON/UCOM17/TRDRJP(40),TRDSMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      common/ucomd/iffl
C
      ia2=atrib(2)

      DO 3612 J=1,IA10
C
      GO TO (3601,3602,3603,3604,3605,3606,3607,3608,3609,3611
     1) SELDIS(IA7)
C
3601  SEINSP=EXPON(SEP1(IA7),9)
      GO TO 3612
C
3602  SEINSP=UNFRM(SEP1(IA7),SEP2(IA7),9)
      GO TO 3612
C
3603  SEINSP=WEIBL(SEP1(IA7),SEP2(IA7),9)
      GO TO 3612
C
3604  SEINSP=TRIAG(SEP1(IA7),SEP2(IA7),SEP3(IA7),9)
      GO TO 3612
C
3605  SEINSP=RNORM(SEP1(IA7),SEP2(IA7),9)
      GO TO 3612
C
3606  SEINSP=RLOGN(SEP1(IA7),SEP2(IA7),9)
      GO TO 3612
C
3607  SEINSP=ERLNG(SEP1(IA7),SEP2(IA7),9)
      GO TO 3612
C
3608  SEINSP=GAMA(SEP1(IA7),SEP2(IA7),9)
      GO TO 3612
C
3609  SEINSP=BETA(SEP1(IA7),SEP2(IA7),9)
      GO TO 3612
C
3611  SEINSP=SEP1(IA7)
C
3612  TOTINS=TOTINS+SEINSP
C
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE CSELIN
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),MARRSC(50),
     1 MDEPSC(50),NBUFP(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPW,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTWA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQASME,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAISED,QAP1,QAP2,QAP3
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      COMMON/UCOM16/TRDRMD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRM,TSELRM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERMD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
C
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      common/ucomd/i[1]
      COMMON/UCOM28/SESCP,SUSCP,SERWP,SUWP
      COMMON/UCOM29/NINITR,NOENTR
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM43/NNLDSC,NENEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM57/TRWK(40,50),QAMD,NWKC(40,50),QATRAI
      COMMON/UCOM58/IPNCD(50),IREP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM82/MAXN
C
      NQFLAG=1

      IA7=ATRIB(7)
C
      IF (NNLDSC.EQ.2) THEN
         IF (UPTIME(IA7).GT.NENEXT(IA7)) THEN
            CALL UPNEXD(IA7)
         ENDIF
      ENDIF
C
      NREJEC=0
      NRWK=0
      TOTRWK=0
      NIDQ=IA7+MAXN
C
C     CALCULATE THE PROBABILITY OF FINDING SCRAP DURING SELF INSPECTION.
C     THAT IS, THE SCRAP OF THAT PART NUMBER AT THAT MACHINE NUMBER TIMES THE
C     PERCENTAGE THAT IS EXPECTED TO BE FOUND DURING SELF INSPECTION.
C     DO THE SAME FOR REWORK.
C
C     THE ASSUMPTION WITH MACHINE DEPSC=10 IS THAT EACH ENTITY IN THE OUTPUT
C     BUFFER REPRESENTS A CONTAINER OF UNITS WITH ITS UNIQUE VALUE IN
C     ATTRIBUTE 10 REPRESENTING THE NUMBER OF GOOD UNITS IN THE CONTAINER.
C
      IF (NDEPSC(IA7).EQ.10) THEN
         NODQ=IA7+MAXN*2

         DO 3635 I=1,NNQ(NODQ)
         NREJEC=0

         NTRY=LOCAT(I,NODQ)
         IA2=QSET(NTRY+2)
         IA10=QSET(NTRY+10)

         IF (NQCD(IA7).EQ.4) THEN
            S=SCRAPP(IA2,IA7)
            R=REWKP(IA2,IA7)
         ELSE
            S=SCRAPP(IA2,IA7)*SESCP
            R=REWKP(IA2,IA7)*SERWP
         ENDIF

         DO 3630 J=1,IA10
         OUTINS=UNFRM(0.0,1.0,10)
C
         IF (OUTINS.LT.S) THEN
             NREJEC=NREJEC+1
         ELSE
            IF (OUTINS.LT.(S+R)) THEN
               NRWK=NRWK+1
            ENDIF
         ENDIF
3630     CONTINUE
C
         TRWK(IA2,IA7)=TRWK(IA2,IA7)+NRWK
         QSET(NTRY+10)=QSET(NTRY+10)-NREJEC
         IF (QSET(NTRY+10).GT.0) THEN
            QSET(NTRY+11)=1
         ELSE
            QSET(NTRY+11)=0
         ENDIF

         TOTSCR(IA2,IA7)=TOTSCR(IA2,IA7)+NREJEC
         SCRAP(IA2)=SCRAP(IA2)+NREJEC
         LSCRAP(IA2,IA3)=LSCRAP(IA2,IA3)+NREJEC

3635     CONTINUE

         GO TO 3650
```



```
      ENDIF

C     THE ASSUMPTION WITH DEPARTURE SCENARIO 3&4 IS THAT EACH ENTITY IN THE
C     OUTPUT BUFFER REPRESENTS ONE UNIT, ALL THE SAME PN, WITH A UNIQUE
C     VALUE ON ATTRIBUTE 11 FOR EACH UNIT.

      IF (NDEPSC(IA7).EQ.3 .OR. NDEPSC(IA7).EQ.4) THEN

         NODQ=IA7+MAXN*2
         NTRY=LOCAT(1,NODQ)
         IA2=QSET(NTRY+2)

         IF (NQCD(IA7).EQ.4) THEN
            S=SCRAPP(IA2,IA7)
            R=REWKP(IA2,IA7)
         ELSE
           S=SCRAPP(IA2,IA7)*SESCP
           R=REWKP(IA2,IA7)*SERWP
         ENDIF

         DO 3640 I=1,NNQ(NODQ)
         NTRY=LOCAT(I,NODQ)
         IA11=QSET(NTRY+11)

         IF (IA11.EQ.0) THEN
             GO TO 3640
         ENDIF

         OUTINS=UNFRM(0.0,1.0,10)
C
         IF (OUTINS.LT.S) THEN
            NREJEC=NREJEC+1

            QSET(NTRY+11)=QSET(NTRY+11)-1
            IF (QSET(NTRY+11).GT.0) THEN
               QSET(NTRY+10)=1
            ELSE
               QSET(NTRY+10)=0
            ENDIF

         ELSE
            IF (OUTINS.LT.(S+R)) THEN
               NRWK=NRWK+1
            ENDIF
         ENDIF
3640     CONTINUE

         TRWK(IA2,IA7)=TRWK(IA2,IA7)+NRWK
         TOTSCR(IA2,IA7)=TOTSCR(IA2,IA7)+NREJEC
         SCRAP(IA2)=SCRAP(IA2)+NREJEC
         LSCRAP(IA2,IA3)=LSCRAP(IA2,IA3)+NREJEC

         GO TO 3650

      ENDIF
C
C     NOTHING HAS BEEN PROGRAMMED FOR DEPARTURE SCENARIO 0
C
C     ON DEPARTURE SCENARIO 1 AND 2 THERE IS ONY ONE ENTITY IN THE OUTPUT
C     BUFFER AND IT REPRESENTS ONE UNIT.
C
      IF (NDEPSC(IA7).EQ.1 .OR. NDEPSC(IA7).EQ.2) THEN

         IA10=ATRIB(10)
         IA2=ATRIB(2)

         IF (NQCD(IA7).EQ.4) THEN
            S=SCRAPP(IA2,IA7)
            R=REWKP(IA2,IA7)
         ELSE
            S=SCRAPP(IA2,IA7)*SESCP
            R=REWKP(IA2,IA7)*SERWP
         ENDIF
C
         OUTINS=UNFRM(0.0,1.0,10)
C
         IF (OUTINS.LT.S) THEN
             NREJEC=NREJEC+1
         ELSE
            IF (OUTINS.LT.(S+R)) THEN
               NRWK=NRWK+1
            ENDIF
         ENDIF
C
         TRWK(IA2,IA7)=TRWK(IA2,IA7)+NRWK
         ATRIB(10)=ATRIB(10)-NREJEC
         IF (ATRIB(10).GT.0) THEN
            ATRIB(11)=1
         ELSE
            ATRIB(11)=0
         ENDIF
```

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            TOTSCR(IA2,IA7)=TOTSCR(IA2,IA7)+NREJEC
            SCRAP(IA2)=SCRAP(IA2)+NREJEC
            LSCRAP(IA2,IA3)=LSCRAP(IA2,IA3)+NREJEC

            GO TO 3650

         ENDIF
C
C        AT DEPARTURE SCENARIO 6 THERE IS ONLY ONE ENTITY IN THE OUTPUT BUFFER
C        AND IT REPRESENTS A CONTAINER OF UNITS.
C
         IF (MCNPOC(IA7).EQ.6) THEN

            NODQ=IA7+NMAX*2
            NTRY=LOCAT(1,NODQ)
            IA2=QSET(NTRY+2)
            IA10=QSET(NTRY+10)

            IF (NQCD(IA7).EQ.4) THEN
               S=SCRAPP(IA2,IA7)
               R=REWKP(IA2,IA7)
            ELSE
              S=SCRAPP(IA2,IA7)*SRSCP
              R=REWKP(IA2,IA7)*SRSWP
            ENDIF

            DO 3645 I=1,IA10

            OUTINS=UNFRM(0.0,1.0,10)
C
            IF (OUTINS.LT.S) THEN
               NREJEC=NREJEC+1
            ELSE
               IF (OUTINS.LT.(S+R)) THEN
                  NRWK=NRWK+1
               ENDIF
            ENDIF
3645        CONTINUE

            QSET(NTRY+10)=QSET(NTRY+10)-NREJEC
            IF (QSET(NTRY+10).GT.0) THEN
               QSET(NTRY+11)=1
            ELSE
               QSET(NTRY+11)=0
            ENDIF

            TRWK(IA2,IA7)=TRWK(IA2,IA7)+NRWK
            TOTSCR(IA2,IA7)=TOTSCR(IA2,IA7)+NREJEC
            SCRAP(IA2)=SCRAP(IA2)+NREJEC
            LSCRAP(IA2,IA3)=LSCRAP(IA2,IA3)+NREJEC

            GO TO 3650

         ENDIF
C
C        IF THERE IS THE NEED FOR REWORK THEN SCHEDULE THE COMPLETION OF
C        REWORK.
C
3650     IF (NRWK.GT.0) THEN
            CALL SELRWK(NRWK,IA7,TOTRWK)
            TSELRW=TSELRW+TOTRWK
            CALL SCHDL(6,TOTRWK,ATRIB)
            UPTIME(IA7)=UPTIME(IA7)+TOTRWK
            TOTUP(IA7)=TOTUP(IA7)+TOTRWK
            NOPSTA(IOP(IA7))=9
            IF (NOPCD(IA7).EQ.2) THEN
               MSTATU(IA7)=9
            ENDIF
            GO TO 3675
         ENDIF
C
C        IF THE UNIT LOAD WAS A COMBINATION OF GOOD AND SCRAPPED UNITS THEN
C        SEND THE UNIT LOAD TO THE NEXT WORKSTATION. THE OPERATIONS NEEDED
C        TO DO THAT ARE CONTAINED IN THE TRADITIONAL QUALITY SUB.
C
C        NOTE: FREE THE OPERATOR AND MACHINE BEFORE CALLING TRADQ.
C
         NOPSTA(IOP(IA7))=0
         IF (NOPCD(IA7).EQ.2) THEN
            MSTATU(IA7)=0
         ENDIF

         QFLAG=0
         CALL TRADQ(IA7,QFLAG,NQFLAG)
C
C        QFLAG=1 MEANS THE QUEUE OR DUMMY INPUT BUFFER OF MACHINE IA7
C        SHOULD BE CHECKED FOR PARTS WAITING TO BE PROCESSED.
C
         IF (QFLAG.NE.1) THEN
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               CALL DESTIN(IA7)
            ENDIF
```



```
            GO TO 3675
         ENDIF
C
C        THE ABOVE IF (QFLAG.NE.1) DOES NOT CONTEMPLATE THE FOLLOWING
C        CASE: QFLAG=1, NOPCD=2 (I.E. OPERATOR NEEDED
C        AT ALL TIMES, HOWEVER MATERIAL HANDLING IS MANUAL. CHECK IF THE
C        OPERATOR IS HANDLING THE PROCESSED PART. IF THAT IS THE CASE,
C        THEN SET MACHINE STATUS TO 0.
C
         IF (NOPSTA(IOP(IA7)).EQ.3 .AND. LASTMA(IOP(IA7)).EQ.IA7) THEN
            IF (MTYPE(IA7).EQ.3 .AND. MSTATU(IA7).EQ.0) THEN
               PFLAG=0
               CALL BRKCK(IA7,PFLAG)
            ENDIF
            GO TO 3675
         ENDIF
C
         IF (MTYPE(IA7).EQ.3) THEN
            WRITE(6,3655)
3655        FORMAT(1X,'ERROR AT CELLIN W/MTYPE=3, PARTS LEFT WITHOUT
        1 THE OPERATOR')
            CALL MESSAGE(IA7)
         ENDIF
C
         QFLAG=0
         SFLAG=0
C
C        THE NEXT PART TO BE PROCESSED COULD COME FROM A PARTIALLY PROCESSED
C        UNIT LOAD (EX. BATCH ARRIVAL AND LEAVE ONE BY ONE)
C
         IF (NNQ(NIDQ).GT.0) THEN
            NOPSTA(IOP(IA7))=1
            CALL MACHIN(IA7,NIDQ)
            GO TO 3675
         ENDIF
C
C        CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
C        GIVE PRIORITY TO THOSE. PUT INSPECTED UNITS IN DUMMY OUTPUT QUEUE BEFORE
C        CALLING BRKCK.
C
         PFLAG=0
         CALL BRKCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               CALL DESTIN(IA7)
            ENDIF
            GO TO 3675
         ENDIF
C
C        CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
C        GIVE PRIORITY TO THOSE.
C
         IF (MAUTO.EQ.1) THEN
            PFLAG=0
            CALL AUTOCK(IA7,PFLAG)
            IF (PFLAG.EQ.0) THEN
               GO TO 3675
            ENDIF
         ENDIF
C
C        CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C        IF THERE ARE,GIVE PRIORITY TO THOSE.
C
         IF (IREP(IA7).EQ.1) THEN
            PFLAG=0
            CALL MATCK(IA7,PFLAG)
            IF (PFLAG.EQ.0) THEN
               GO TO 3675
            ENDIF
         ENDIF
C
         CALL QPULL(IA7,QFLAG,SFLAG)
C
         IF (QFLAG.EQ.0) THEN
C
C           SEND OPERATOR TO ANOTHER MACHINE IF HE IS A SHARED OPERATOR
C           OR FREE HIM IF HE IS A DEDICATED OPERATOR. MACHINE STATUS
C           CHANGES TO ZERO AT N1QPUL.
C
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               CALL DESTIN(IA7)
            ENDIF
            GO TO 3675
C
         ELSE
C
C           VERIFY IF THE OPERATOR WILL STAY AT THAT MACHINE OR NEEDS
C           TO MOVE TO ANOTHER MACHINE
C
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               MOVE=0
               CALL MOVEMT(IA7,MOVE)
```

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```
            IF (MOVE.EQ.1) THEN
               GO TO 3675
            ENDIF
         ENDIF
C
         IF (SFLAG.EQ.1 .AND. ISCHOP(IA7).NE.0) THEN
C
C           PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C           CHOSEN BY THE USER.
C
            CALL SCHEOP(IA7)
C
         ENDIF
C
C        DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C        TO BE PROCESSED.
C
         NTRY=NNPS(IA7)
         IA2=QSET(NTRY+2)
         IA10=QSET(NTRY+10)
C
C        VERIFY IF A SETUP IS NEEDED
C
         IF (NSUCD(IA7).EQ.1) THEN
C
            IF (IA2.NE.LASTPN(IA7)) THEN
               NSUPN=IA2
               CALL NSETUP(NSUPN,IA7)
C
C              WE KNOW AN OPERATOR WAS PERFORMING INSPECTION AND NOW IS
C              AVAILABLE. ITS STATUS WAS CHANGED TO ZERO AT THE BEGINNING
C              OF THIS SUB. THEREFORE, AT NSETUP, IF HE IS NOT NEEDED THAT
C              SUB WILL NOT CALL DESTIN BEACUSE HIS STATUS IS ZERO.
C
               IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7)).EQ.2)
     1         THEN
                  CALL DESTIN(IA7)
               ENDIF
               GO TO 3675
C
            ENDIF
         ENDIF

         IF (IA10.EQ.0) THEN
            GO TO 3670
         ENDIF
C
C        DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
C        CALLING SUBROUTINE IS A DEPARTURE.
C
         DFLAG=1
         AFLAG=0
         PFLAG=0
C
C        IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C        PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C        THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C        CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C        THE REMOVAL.
C
         CALL PQC(AFLAG,DFLAG,PFLAG,IA7)

         IF (PFLAG.EQ.0) THEN
            IF (NOPSTA(IOP(IA7)).NE.6) THEN
               WRITE(6,3660)
3660           FORMAT(1X,'ERROR:AT CSELIN W/NOPCD=2, PFLAG WILL BE
     1                ZERO ONLY IF HE IS DOING INSPECTION')
            CALL MESSAGE(IA7)
            ENDIF
C
            IF ((XINBUF(IA7)+PULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1      XINBUF(IA7).LT.NBUFF(IA7)) THEN
               CALL CKBLK(IA7)
            ENDIF
C
         ELSE
3670        NIDQ=IA7+NMAIN

            NOPSTA(IOP(IA7))=1

            CALL MACHIN(IA7,NIDQ)
C
            IF ((XINBUF(IA7)+PULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1      XINBUF(IA7).LT.NBUFF(IA7)) THEN
               CALL CKBLK(IA7)
            ENDIF
C
            GO TO 3675
         ENDIF
C
       ENDIF
C
```



```
3675  RETURN
      END
C
C ******************************************************************
C
      SUBROUTINE SELNMK(NSMK,IA7,TOTNMK)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),MARRSC(50),
     1 MDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGM(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACNS(50),IDL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEM,NAVNT,OPNOT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANMK,PUCOST(40,51)
      COMMON/UCOM16/TRDRWD,TNMKP1,TNMKP2,TNMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      common/ucomd/iffl
C
      DO 3692 I=1,NSMK
C
      GO TO (3681,3682,3683,3684,3685,3686,3687,3688,3689,3691
     1) NSERWD(IA7)
C
3681  SERMK=EXPON(SERWP1(IA7),11)
      GO TO 3692
C
3682  SERMK=UNFRM(SERWP1(IA7),SERWP2(IA7),11)
      GO TO 3692
C
3683  SERMK=WEIBL(SERWP1(IA7),SERWP2(IA7),11)
      GO TO 3692
C
3684  SERMK=TRIAG(SERWP1(IA7),SERWP2(IA7),SERWP3(IA7),11)
      GO TO 3692
C
3685  SERMK=RNORM(SERWP1(IA7),SERWP2(IA7),11)
      GO TO 3692
C
3686  SERMK=RLOGN(SERWP1(IA7),SERWP2(IA7),11)
      GO TO 3692
C
3687  SERMK=ERLNG(SERWP1(IA7),SERWP2(IA7),11)
      GO TO 3692
C
3688  SERMK=GAMA(SERWP1(IA7),SERWP2(IA7),11)
      GO TO 3692
C
3689  SERMK=BETA(SERWP1(IA7),SERWP2(IA7),11)
      GO TO 3692
C
3691  SERMK=SERWP1(IA7)
C
3692  TOTNMK=TOTNMK+SERMK
C
      RETURN
      END
C
C ******************************************************************
C
      SUBROUTINE CSELIN
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
```


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```
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),NNBQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLESC(50),NBLEMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,SLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVMT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNE,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRND,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNM,TSELNM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURND(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERND(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
C
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      common/ucomd/iffl
      COMMON/UCOM28/SESCP,SUSCP,SERMP,SURMP
      COMMON/UCOM29/MINITR,MOESTR
      COMMON/UCOM32/XIMBUP(50)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM60/IPMCD(50),IREP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM62/MAXN
C
      NQFLAG=1
C
      IA6=ATRIB(6)
      IA7=ATRIB(7)
      NIDQ=IA7+MAXN
C
      IF (BRKDSC.EQ.2) THEN
         IF (UPTIME(IA7).GT.BKNEXT(IA7)) THEN
            CALL UPBRKD(IA7)
         ENDIF
      ENDIF
C
C     SEND THE UNIT LOAD TO THE NEXT WORKSTATION. THE OPERATIONS NEEDED
C     TO DO THAT ARE CONTAINED IN THE TRADITIONAL QUALITY SUB.
C
C     NOTE: FREE THE OPERATOR BEFORE CALLING TRADQ.
C
      QFLAG=0
      NOPSTA(IOP(IA7))=0
      IF (NOPCD(IA7).EQ.2) THEN
         NSTATU(IA7)=0
      ENDIF
      CALL TRADQ(IA7,QFLAG,NQFLAG)
C
C     QFLAG=1 MEANS THE QUEUE OR DUMMY INPUT BUFFER OF MACHINE IA7
C     SHOULD BE CHECKED FOR PARTS WAITING TO BE PROCESSED.
C
      IF (QFLAG.NE.1) THEN
         IF (IOPCD(IOP(IA7)).EQ.2) THEN
            CALL DESTIN(IA7)
         ENDIF
         GO TO 3765
      ENDIF
C
C     THE ABOVE IF (QFLAG.NE.1) DOES NOT CONTEMPLATE THE FOLLOWING
C     CASE: QFLAG=1, NOPCD=2 (I.E. OPERATOR NEEDED
C     AT ALL TIMES, HOWEVER MATERIAL HANDLING IS MANUAL. CHECK IF THE
C     OPERATOR IS HANDLING THE PROCESSED PART. IF THAT IS THE CASE,
C     THEN SET MACHINE STATUS TO 0.
C
      IF (NOPSTA(IOP(IA7)).EQ.3 .AND. LASTMA(IOP(IA7)).EQ.IA7) THEN
         IF (NTYPE(IA7).EQ.3 .AND. NSTATU(IA7).EQ.0) THEN
            PFLAG=0
```



```
            CALL BRKCK(IA7,PFLAG)
         ENDIF
         GO TO 3765
      ENDIF
C
      QFLAG=0
      SFLAG=0

      IF (NTYPE(IA7).EQ.3) THEN
         WRITE(6,3768)
 3768    FORMAT(1X,'ERROR AT CELLIN W/NTYPE=3, PARTS LEFT WITHOUT
     1 THE OPERATOR')
         CALL MESSAGE(IA7)
      ENDIF
C
C     THE NEXT PART TO BE PROCESSED COULD COME FROM A PARTIALLY PROCESSED
C     UNIT LOAD (EX. BATCH ARRIVAL AND LEAVE ONE BY ONE)
C
      IF (NNQ(NIDQ).GT.0) THEN
         NOPSTA(IOP(IA7))=1
         CALL MACHIN(IA7,NIDQ)
         GO TO 3765
      ENDIF
C
C     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
C     GIVE PRIORITY TO THOSE. PUT INSPECTED UNITS IN DUMMY OUTPUT QUEUE BEFORE
C     CALLING BRKCK.
C
      PFLAG=0
      CALL BRKCK(IA7,PFLAG)
      IF (PFLAG.EQ.0) THEN
         IF (IOPCD(IOP(IA7)).EQ.2) THEN
            NOPSTA(IOP(IA7))=0
            CALL DESTIN(IA7)
         ELSE
            NOPSTA(IOP(IA7))=0
         ENDIF
         GO TO 3765
      ENDIF
C
C     CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
C     GIVE PRIORITY TO THOSE.
C
      NOPSTA(IOP(IA7))=0
      IF (NAUTO.EQ.1) THEN
         PFLAG=0
         CALL AUTOCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 3765
         ENDIF
      ENDIF
C
C     CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C     IF THERE ARE,GIVE PRIORITY TO THOSE.
C
      IF (IREP(IA7).EQ.1) THEN
         PFLAG=0
         CALL RSTCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 3765
         ENDIF
      ENDIF
C
      CALL QFULL(IA7,QFLAG,SFLAG)
C
      IF (QFLAG.EQ.0) THEN
C
C        SEND OPERATOR TO ANOTHER MACHINE IF HE IS A SHARED OPERATOR
C        OR FREE HIM IF HE IS A DEDICATED OPERATOR. MACHINE STATUS
C        CHANGES TO ZERO AT EIQFUL.
C
         IF (IOPCD(IOP(IA7)).EQ.2) THEN
            CALL DESTIN(IA7)
         ENDIF
         GO TO 3765
C
      ELSE
C
C        VERIFY IF THE OPERATOR WILL STAY AT THAT MACHINE OR NEEDS
C        TO MOVE TO ANOTHER MACHINE
C
         IF (IOPCD(IOP(IA7)).EQ.2) THEN
            MOVE=0
            CALL MOVEMT(IA7,MOVE)
            IF (MOVE.EQ.1) THEN
               GO TO 3765
            ENDIF
         ENDIF
C
         IF (SFLAG.EQ.1 .AND. ISCHDP(IA7).NE.0) THEN
C
C           PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
```

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```
c          CHOSEN BY THE USER.
c
           CALL SCHEDP(IA7)
c
        ENDIF
c
c       DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
c       TO BE PROCESSED.
c
        NTRY=NNFE(IA7)
        IA2=QSET(NTRY+2)
        IA10=QSET(NTRY+10)
c
c       VERIFY IF A SETUP IS NEEDED
c
        IF (NSUCD(IA7).EQ.1) THEN
c
           IF (IA2.NE.LASTPN(IA7)) THEN
              NSUPN=IA2
              CALL NSETUP(NSUPN,IA7)
c
c             WE KNOW AN OPERATOR WAS PERFORMING REWORK AND NOW IS
c             AVAILABLE. ITS STATUS WAS CHANGED TO ZERO AT THE BEGINNING
c             OF THIS SUB. THEREFORE, AT NSETUP, IF HE IS NOT NEEDED THAT
c             SUB WILL NOT CALL DESTIN BEACUSE HIS STATUS IS ZERO.
c
              IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7)).EQ.2)
     1        THEN
                 CALL DESTIN(IA7)
              ENDIF
              GO TO 3765
c
           ENDIF
        ENDIF

        IF (IA10.EQ.0) THEN
           GO TO 3760
        ENDIF
c
c       DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
c       CALLING SUBROUTINE IS A DEPARTURE.
c
        DFLAG=1
        AFLAG=0
        FFLAG=0
c
c       IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
c       PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
c       THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
c       CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
c       THE REMOVAL
c
        CALL PQC(AFLAG,DFLAG,FFLAG,IA7)

        IF (FFLAG.EQ.0) THEN
           IF (NOPSTA(IOP(IA7)).NE.6) THEN
              WRITE(6,3750)
3750          FORMAT(1X,'ERROR:AT CELLIR W/NOPCD=2, FFLAG WILL BE
     1               ZERO ONLY IF HE IS DOING INSPECTION')
           CALL MESSAGE(IA7)
           ENDIF
c
           IF ((XINBUF(IA7)+PULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1     XINBUF(IA7).LT.NBUFF(IA7)) THEN
              CALL CKBLK(IA7)
           ENDIF
c
        ELSE
3760       NIDQ=IA7+MAXN

           NOPSTA(IOP(IA7))=1
           CALL MACHIN(IA7,NIDQ)
c
           IF ((XINBUF(IA7)+PULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1     XINBUF(IA7).LT.NBUFF(IA7)) THEN
              CALL CKBLK(IA7)
           ENDIF
c
           GO TO 3765
        ENDIF
c
      ENDIF
c
3765  RETURN
      END
c
c ********************************************************************
c
      SUBROUTINE NEXTMA(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NRQT),DDL(NRQT),DTNOW,II,MFA,
```

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```
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(NRQT),
     2SSL(NRQT),TNEXT,TNOW,XX(MEEXV)
c
       COMMON QSET(600000)
c
       COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NHOP(50,50),SPEED(50,50),
     2 CLEMGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 KELT(40,500)
c
       COMMON/UCOM2/NMACH
       COMMON/UCOM3/NUL,NRELUL
       COMMON/UCOM4/A(100)
       COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
       COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
       COMMON/UCOM7/WALKIN,NAVNT,OPNOT,NOTMA,WALKLD
       COMMON/UCOM8/SUTEX,SUTIN
       COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
       COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
       COMMON/UCOM11/ISCHDP(50)
       COMMON/UCOM12/PROLOM(50),PROCPP(50),PROEXP(50)
       COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANVL,PNCOST(40,51)
       COMMON/UCOM14/SAMPLP
       COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
       COMMON/UCOM16/TREWND,TRWKP1,TRWKP2,TRWKP3
       COMMON/UCOM17/TRKRJP(40),TRDUMP(40)
       COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
c
       COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
       COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
       COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
       COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)

       common/ucom4/iff1
       COMMON/UCOM29/MINITR,MDEPTR
       COMMON/UCOM30/TLASTP(50)
       COMMON/UCOM32/XINBUF(50)
       COMMON/UCOM33/NPARLL(50),NRBS(10,50)
       COMMON/UCOM40/REMPT(50)
       COMMON/UCOM43/BRKDSC,BRKEXT(50),UPTIME(50),TOTUP(50)
       COMMON/UCOM44/BLKTM(50)
       COMMON/UCOM48/NAUTO
       COMMON/UCOM63/PULLDQ(50)
       COMMON/UCOM82/MAXN
c
c      J IS A POINTER TO THE SEQUENCE OF MACHINES.
c      K IS A COUNTER THAT TELLS HOW MANY MACHINES HAVE BEEN CHECKED
c        FOR MACHINE STATUS.
c      I IS A POINTER TO THE NEXT MACHINE TO BE CHECKED FOR STATUS
c      NEXMA IS THE MACHINE TO BE CHECKED FOR STATUS
c
       J=1
       K=0
       NEXMA=0
c
c      THIS IF FINDS THE POSITION OF THE LAST MACHINE THE OPERATOR WORKED ON
c      IN THE SEQUENCE OF MACHINES ASSIGNED TO HIM.
c
4010   IF (LASTMA(IOP(IA7)).EQ.MACH(J,IOP(IA7))) THEN
           IF (J.EQ.1) THEN
              I=NN(IOP(IA7))
           ELSE
              I=J-1
           ENDIF
           NEXMA=MACH(I,IOP(IA7))
           K=K+1
           GO TO 4020
       ELSE
           J=J+1
           GO TO 4010
       ENDIF
c
c      THE FOLLOWING SERIES OF IF'S DEAL WITH THE POSSIBLE STATUS OF THE
c      MACHINE DURING HIS ROUND OF CHECKS AND THE CORRESPONDING COURSE OF
c      ACTION.
c
4020   IF (NSTATU(NEXMA).EQ.0) THEN
c
c         CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF
c         THERE ARE,GIVE PRIORITY TO THOSE.
c
          IF (NAUTO.EQ.1) THEN
             FFLAG=0
```

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            CALL AUTOCK(NEXMA,PFLAG)
            IF (PFLAG.EQ.0) THEN
               GO TO 5100
            ENDIF
         ENDIF
C
         NIDQ=NEXMA+MAXN
C
         IF (NPQ(NIDQ).GT.0) THEN
            IF (NOPCD(NEXMA).NE.2) THEN
               WRITE(6,4021) TNOW,NEXMA
4021           FORMAT(1X,'ERROR: AT TNOW=',F8.2,1X,'IN NEXTMA W/MACH=',
     1         I3)
               WRITE(6,4022)
4022           FORMAT(1X,'IF AN OPERATOR WAS NOT NEEDED THE PARTS
     1         SHOULD HAVE BEEN PULLED')
               CALL MESSAGE(NEXMA)
            ELSE
               NOPSTA(IOP(IA7))=1
               LASTMA(IOP(IA7))=NEXMA
               CALL MACHIN(NEXMA,NIDQ)
               GO TO 5100
            ENDIF
         ENDIF
C
         QFLAG=0
         SFLAG=0
C
         CALL QPULL(NEXMA,QFLAG,SFLAG)
C
         IF (QFLAG.EQ.0) THEN
C
            GO TO 5090
C
         ELSE
C
            IF (SFLAG.EQ.1 .AND. ISCHDP(NEXMA).NE.0) THEN
C
C              PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C              CHOSEN BY THE USER.
C
               CALL SCHEDP(NEXMA)
C
            ENDIF
C
C           DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C           TO BE PROCESSED.
C
            NTRY=NNFE(NEXMA)
            IA2=QSET(NTRY+2)
            IA10=QSET(NTRY+10)
C
C           VERIFY IF A SETUP IS NEEDED
C
            IF (NSUCD(NEXMA).EQ.1) THEN
C
               IF (IA2.NE.LASTPN(NEXMA)) THEN
                 NSUPN=IA2
                 CALL NSETUP(NSUPN,NEXMA)
C
                 IF (NSTATU(NEXMA).EQ.5) THEN
                     IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                        GO TO 5090
                     ELSE
                        GO TO 5100
                     ENDIF
                 ENDIF
C
               ENDIF
            ENDIF
C
            IF (IA10.EQ.0) THEN
               GO TO 4030
            ENDIF
C
C           DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
C           CALLING SUBROUTINE IS A DEPARTURE.
C
            DFLAG=1
            AFLAG=0
            PFLAG=0
C
C           IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C           PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C           THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C           CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C           THE REMOVAL.
C
            CALL PQC(AFLAG,DFLAG,PFLAG,NEXMA)
C
            IF (PFLAG.EQ.0) THEN
               IF (NOPSTA(IOP(IA7)).NE.6) THEN
```



```
                  WRITE(6,4025)
4025              FORMAT(1X,'ERROR:AT NEXTMA W/NOPCD=2, PFLAG WILL BE
     1                  ZERO ONLY IF HE IS DOING INSPECTION')
                  CALL MESSAGE(NEXMA)
               ELSE
C
                  IF ((XINBUF(NEXMA)+FULLDQ(NEXMA)).GE.NBUFF(NEXMA)
     1             .AND.XINBUF(NEXMA).LT.NBUFF(NEXMA)) THEN
                     CALL CKBLK(NEXMA)
                  ENDIF
C
                  GO TO 5100
               ENDIF
            ELSE
4030           NIDQ=NEXMA+MAXN
               IF (NOPCD(NEXMA).NE.2) THEN
C
C              IF THE MACHINE DID NOT NEED SETUP OR THE PART DID NOT NEED
C              INSPECTION,THEN PRODUCTION SHOULD HAVE STARTED ONLY IF
C              IA10 ne 0 (SINCE WHEN IA10=0 THE MODEL JUMPS PQC AND SETUP.
C
                 IF (IA10.NE.0) THEN
                   WRITE(6,4031) NEXMA
4031               FORMAT(1X,'AT NEXTMA W/MACH=',I3,1X,'IF OPERATOR
     1WAS')
                   WRITE(6,4032)
4032               FORMAT(1X,'NOT NEEDED PRODUCTION SHOULD HAVE
     1STARTED')
                   CALL MESSAGE(NEXMA)
                 ELSE
C
C                  IF IA10=0 PQC AND SETUP ARE JUMPED
C
                   CALL MACHIN(NEXMA,NIDQ)
C
                   IF ((XINBUF(NEXMA)+ FULLDQ(NEXMA)).GE.NBUFF(NEXMA)
     1             .AND. XINBUF(NEXMA).LT.NBUFF(NEXMA)) THEN
                        CALL CKBLK(NEXMA)
                   ENDIF
C
                   IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                      GO TO 5090
                   ELSE
                      GO TO 5100
                   ENDIF

                 ENDIF

               ENDIF

               NOPSTA(IOP(IA7))=1
               LASTMA(IOP(IA7))=NEXMA
               CALL MACHIN(NEXMA,NIDQ)
C
               IF ((XINBUF(NEXMA)+ FULLDQ(NEXMA)).GE.NBUFF(NEXMA)
     1          .AND.XINBUF(NEXMA).LT.NBUFF(NEXMA)) THEN
                  CALL CKBLK(NEXMA)
               ENDIF
C
               GO TO 5100
            ENDIF
C
         ENDIF

      ENDIF
C
      GO TO (4041,4053,4063,4074,4085,4096,5007,5018,5029,5040
     1,5051,5062,5073) NSTATU(NEXMA)
C
C     MACHINE STATUS IS ONE: BUSY
C
4041  IF (NOPCD(NEXMA).EQ.2) THEN
         WRITE(6,4042)
4042     FORMAT(1X,'ERROR: MACHINE STATUS CAN BE ONE DURING ROUND OF
     1STATUS CHECKS ONLY IF NOPCD=1')
         CALL MESSAGE(NEXMA)
      ENDIF
C
C     CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
C     GIVE PRIORITY TO THOSE.
C
C      IF (NAUTO.EQ.1) THEN
C         PFLAG=0
C         CALL AUTOCK(NEXMA,PFLAG)
C         IF (PFLAG.EQ.0) THEN
C
C           NOW REMOVE THE ENTITY BEING PROCESSED FROM THE EVENT CALENDAR
C           AND PLACE IT NUMBER ONE IN THE DUMMY INPUT QUEUE.
C
C             CALL OUT(IA7)
C             GO TO 5100
C         ELSE
```

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```
C             GO TO 5090
C          ENDIF
C       ELSE

          GO TO 5090

C       ENDIF
C
C     MACHINE STATUS IS TWO: THERE ARE MANY BLOCKING SOURCES
C
4053      IF (MSTATU(NEXMA).EQ.2 .AND. NBLKSC(NEXMA).EQ.2) THEN
C
C              LACK OF MH EQUIPMENT PENDING !!!!!!!!
C
          ENDIF
C
          IF (MSTATU(NEXMA).EQ.2 .AND. NBLKSC(NEXMA).EQ.1) THEN
C
C             BLOCKING SOURCE: LACK OF SPACE IN NEXT W/S BUFFER.
C
C             CHECK IF PARTS CAN BE TAKEN TO THE NEXT WORKSTATION. IF SO,
C             CALL MANMAN SUB. IF NOT, SEND THE OPERATOR TO ANOTHER MACHINE
C             IF HE IS SHARED, OR KEEP HIS STATUS AS ZERO IF HE IS DEDICATED.
C
             NODQ=NEXMA+MAXM*2
C
             BFLAG=0
             NEXTM=NBLKMA(NEXMA)
             CALL BUFFCK(BFLAG,NEXTM)
             IF (BFLAG.EQ.0) THEN
C
                GO TO 5090
C
             ELSE
C
                QFLAG=0
                EQFLAG=1
C
                CALL MATMAN(NEXMA,QFLAG,NEXTM,EQFLAG)
C
                IF (QFLAG.EQ.0) THEN
C
C                   PARTS ARE RETURNED TO THE OUTPUT BUFFER AT MANMAN SUB.
C
                   GO TO 5090
C
                ELSE
C
                   UPTIME(NEXMA)=UPTIME(NEXMA)+(TNOW-BLKTM(NEXMA))
                   TOTUP(NEXMA)=TOTUP(NEXMA)+(TNOW-BLKTM(NEXMA))
                   MSTATU(NEXMA)=0
                   BLKTM(NEXMA)=0

                   IF (BRKDSC.EQ.2) THEN
                      IF (UPTIME(NEXMA).GT.BKMEXT(NEXMA)) THEN
                         CALL UPBRKD(NEXMA)
                      ENDIF
                   ENDIF
C
C                  AT THIS POINT HE MIGHT BE HANDLING PARTS. HOWEVER, HE
C                  MIGHT NOT BE NEEDED TO PROCESS PARTS OR DO SETUP.
C                  THEREFORE, AFTER UNBLOCKING THE MACHINE IT IS IMPORTANT
C                  TO DETERMINE IF SOMETHING ELSE CAN BE DONE AT THAT MACH.
C
C                  CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE
C                  DELAYED. IF THERE ARE,GIVE PRIORITY TO THOSE.
C
                   IF (NOPSTA(IOP(NEXMA)).EQ.0) THEN
                      IF (MAUTO.EQ.1) THEN
                         FFLAG=0
                         CALL AUTOCK(NEXMA,FFLAG)
                         IF (FFLAG.EQ.0) THEN
                            GO TO 5100
                         ENDIF
                      ENDIF
                   ENDIF
C
                   NIDQ=NEXMA+MAXM
C
                   IF (NNQ(NIDQ).GT.0) THEN
                      IF (NOPCD(NEXMA).NE.2) THEN
                         CALL MACHIN(NEXMA,NIDQ)
                         IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                            GO TO 5090
                         ENDIF
                         GO TO 5100
                      ELSE
                         IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                            NOPSTA(IOP(IA7))=1
                            LASTMA(IOP(IA7))=NEXMA
                            CALL MACHIN(NEXMA,NIDQ)
```

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```
                            GO TO 5100
                         ELSE
                            GO TO 5100
                         ENDIF
                      ENDIF
                   ENDIF
C
                   QFLAG=0
                   SFLAG=0
                   CALL QFULL(NEXMA,QFLAG,SFLAG)
C
                   IF (QFLAG.EQ.0) THEN
C
C                  PARTS LEFT. HOWEVER, THE OPERATOR MIGHT BE DOING HANDLING.
C
                      IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                         GO TO 5090
                      ENDIF
                      GO TO 5100
                   ENDIF

                   IF (SFLAG.EQ.1  .AND. ISCHOP(NEXMA).NE.0) THEN
C
C                     PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C                     CHOSEN BY THE USER.
C
                      CALL SCHEDP(NEXMA)
                   ENDIF
C
C                  DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C                  TO BE PROCESSED.
C
                   NTRY=NNFE(NEXMA)
                   IA2=QSET(NTRY+2)
                   IA10=QSET(NTRY+10)
C
C                  VERIFY IF A SETUP IS NEEDED
C
                   IF (MSUCD(NEXMA).EQ.1) THEN
                      IF (IA2.NE.LASTPN(NEXMA)) THEN
                         MSUPN=IA2
                         CALL MSETUP(MSUPN,NEXMA)
C
                         IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                            GO TO 5090
                         ENDIF
                         GO TO 5100
                      ENDIF
                   ENDIF

                   IF (IA10.EQ.0) THEN
                      IF (NOPCD(NEXMA).EQ.2) THEN
                         IF (NOPSTA(IOP(IA7)).NE.0) THEN
                            GO TO 5100
                         ELSE
                            NOPSTA(IOP(IA7))=1
                            LASTMA(IOP(IA7))=IA7
                            GO TO 4057
                         ENDIF
                      ELSE
                         GO TO 4057
                      ENDIF
                   ENDIF
C
C                  DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
C                  CALLING SUBROUTINE IS A DEPARTURE.
C
                   DFLAG=1
                   AFLAG=0
                   PFLAG=0
C
C                  IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C                  PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C                  THEREFORE,IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C                  CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C                  THE REMOVAL.
C
                   CALL PQC(AFLAG,DFLAG,PFLAG,NEXMA)
C
                   IF (PFLAG.EQ.0) THEN
                      IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                         WRITE(6,4055) NEXMA
4055                     FORMAT(1X,'AT NEXTMA FOR MACH=',I3,1X,'& ')
                         WRITE(6,4056)
4056                     FORMAT(1X,'PFLAG=0 NOPSTA SHOULD NOT BE ZERO')
                      STOP
                      ENDIF
C
                      IF ((XINBUP(NEXMA)+FULLDQ(NEXMA)).GE.MBUFF
     1                (NEXMA).AND.XINBUP(NEXMA).LT.MBUFF(NEXMA)) THEN
                         CALL CKBLK(NEXMA)
                      ENDIF
```

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```
c
                        GO TO 5100
                     ELSE
 4057                   NIDQ=NEXMA+MAXN
c
                        CALL MACHIN(NEXMA,NIDQ)
c
                        IF ((XINBUF(NEXMA)+FULLDQ(NEXMA)).GE.NBUFF
     1                  (NEXMA).AND.XINBUF(NEXMA).LT.NBUFF(NEXMA))
     1                  THEN
                           CALL CKBLK(NEXMA)
                        ENDIF
c
                        IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                           GO TO 5090
                        ELSE
                           GO TO 5100
                        ENDIF
c
                     ENDIF
c
                  ENDIF
c
               ENDIF
c
            ENDIF
c
c
            IF (MSTATU(NEXMA).EQ.2 .AND. NBLKSC(NEXMA).EQ.3) THEN
c
c               LACK OF OPERATOR FOR PY PENDING !!!!!!!!
c
            ENDIF
c
            IF (MSTATU(NEXMA).EQ.2 .AND. NBLKSC(NEXMA).EQ.4) THEN
c
c              BLOCKING SOURCE: LACK OF MATERIAL HANDLING OPERATOR.
c
c              TRY TO MOVE PARTS TO NEXT WORKSTATION. IF SUCCESSFUL, START
c              A NEW UNIT LOAD IF THERE ARE PARTS WAITING IN QUEUE.
c
               NODQ=NEXMA+MAXP*2
               CALL COPY(1,NODQ,ATRIB)
               IA2=ATRIB(2)
               IA6=ATRIB(6)+1
               NEXTM=NSEQ(IA6,IA2)
               IF (NPARLL(NEXTM).GT.0) THEN
                  NEXTM=0
                  CALL SELARS(NEXMA,NEXTM)
               ENDIF
c
               BFLAG=0
               CALL BUFFCK(BFLAG,NEXTM)
                IF (BFLAG.EQ.0) THEN
                  NBLKSC(NEXMA)=1
                  NBLKMA(NEXMA)=NEXTM
c
                  GO TO 5090
c
                ELSE
c
                  QFLAG=0
                  MQFLAG=1
c
                  CALL MATHAN(NEXMA,QFLAG,NEXTM,MQFLAG)
c
                  IF (QFLAG.EQ.0) THEN
c
c                     PARTS ARE RETURNED TO THE OUTPUT BUFFER AT MANHAN SUB.
c
                      GO TO 5090
c
                  ELSE
c
                      UPTIME(NEXMA)=UPTIME(NEXMA)+(TNOW-BLKTM(NEXMA))
                      TOTUP(NEXMA)=TOTUP(NEXMA)+(TNOW-BLKTM(NEXMA))

                      MSTATU(NEXMA)=0
                      BLKTM(NEXMA)=0

                      IF (BRKDSC.EQ.2) THEN
                         IF (UPTIME(NEXMA).GT.BKNEXT(NEXMA)) THEN
                            CALL UPBRKD(NEXMA)
                         ENDIF
                      ENDIF
c
c                     AT THIS POINT THE OPERATOR IS HANDLING PARTS. HOWEVER,
c                     THE MACHINE MIGHT NOT NEED HIM FOR SETUP OR PROCESSING
c                     PARTS.
c
                      NIDQ=NEXMA+MAXN
c
```



```
                      IF (NNQ(NIDQ).GT.0) THEN
                         IF (NOPCD(NEXMA).NE.2) THEN
                              CALL MACHIN(NEXMA,NIDQ)
                              GO TO 5100
                         ELSE
                              GO TO 5100
                         ENDIF
                      ENDIF
c
                      QFLAG=0
                      SFLAG=0
                      CALL QFULL(NEXMA,QFLAG,SFLAG)
c
                      IF (QFLAG.EQ.0) THEN
                          GO TO 5100
                      ENDIF
                      IF (SFLAG.EQ.1  .AND. IOCHOP(NEXMA).NE.0) THEN
c
c                        PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
c                        CHOSEN BY THE USER.
c
                         CALL SCHEDP(NEXMA)
                      ENDIF
c
c                     DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
c                     TO BE PROCESSED.
c
                      NTRY=MNFE(NEXMA)
                      IA2=QSET(NTRY+2)
                      IA10=QSET(NTRY+10)
c
c                     VERIFY IF A SETUP IS NEEDED
c
                      IF (MSUCD(NEXMA).EQ.1) THEN
                         IF (IA2.NE.LASTPN(NEXMA)) THEN
                              NSUPN=IA2
                              CALL MSETUP(NSUPN,NEXMA)
                              GO TO 5100
                         ENDIF
                      ENDIF

                      IF (IA10.EQ.0) THEN
                         IF (NOPCD(NEXMA).EQ.2) THEN
                            IF (NOPSTA(IOP(IA7)).NE.0) THEN
                               GO TO 5100
                            ELSE
                               NOPSTA(IOP(IA7))=1
                               LASTMA(IOP(IA7))=IA7
                               GO TO 4060
                            ENDIF
                         ELSE
                            GO TO 4060
                         ENDIF
                      ENDIF
c
c                     DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
c                     CALLING SUBROUTINE IS A DEPARTURE.
c
                      DFLAG=1
                      AFLAG=0
                      PFLAG=0
c
c                     IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
c                     PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
c                     THEREFORE,IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
c                     CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
c                     THE REMOVAL.
c
                      CALL PQC(AFLAG,DFLAG,PFLAG,NEXMA)
                      IF (PFLAG.EQ.0) THEN
c
                         IF (MSTATU(NEXMA).EQ.6) THEN
                            IF ((XINBUF(NEXMA)+FULLDQ(NEXMA)).GE.NBUFF(
     1                      NEXMA).AND.XINBUF(NEXMA).LT.NBUFF(NEXMA))
     1                      THEN
                                 CALL CKBLK(NEXMA)
                            ENDIF
                         ENDIF
c
                         GO TO 5100
                      ELSE
 4060                    NIDQ=NEXMA+MAXN

                         CALL MACHIN(NEXMA,NIDQ)
c
                         IF ((XINBUF(NEXMA)+FULLDQ(NEXMA)).GE.NBUFF(
     1                   NEXMA).AND.XINBUF(NEXMA).LT.NBUFF(NEXMA)) THEN
                              CALL CKBLK(NEXMA)
                         ENDIF
c
                         IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                            GO TO 5090
```

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```
                  ELSE
                     GO TO 5100
                  ENDIF
               ENDIF
C
            ENDIF
C
         ENDIF

      ENDIF
C
C     MACHINE STATUS IS THREE: ERROR
C
4063  WRITE(6,4064)
4064  FORMAT(1X'ERROR: MACHINE STATUS CAN NEVER BE THREE')
      CALL MESSAGE(NEXMA)
C
C     MACHINE STATUS IS FOUR: ERROR
C
4074  WRITE(6,4075)
4075  FORMAT(1X,'ERROR: MACHINE STATUS CANNOT BE FOUR DURING ROUND OF
     1STATUS CHECKS BECAUSE HE IS NEEDED FOR AUTOM. MAINT.')
      CALL MESSAGE(NEXMA)
C
C     MACHINE STATUS IS FIVE: UNDER SETUP
C
4085  IF (MSUTYP(NEXMA).EQ.3) THEN
         WRITE(6,4086)
4086     FORMAT(1X,'ERROR: MACHINE STATUS CAN BE FIVE DURING ROUND OF
     1STATUS CHECKS ONLY UNDER TRADITIONAL SETUP')
         CALL MESSAGE(NEXMA)
      ELSE
         GO TO 5090
      ENDIF

C
C     MACHINE STATUS IS SIX: ERROR
C
4096  WRITE(6,4097)
4097  FORMAT(1X,'ERROR: MACHINE STATUS CANNOT BE SIX DURING ROUND OF
     1STATUS CHECKS BECAUSE HE IS NEEDED FOR SUCCESSIVE INSP.')
      CALL MESSAGE(NEXMA)
C
C     MACHINE STATUS IS SEVEN: ERROR
C
5007  WRITE(6,5008)
5008  FORMAT(1X,'ERROR: MACHINE STATUS CANNOT BE SEVEN DURING ROUND OF
     1STATUS CHECKS BECAUSE HE IS NEEDED FOR SELF INSP.')
      CALL MESSAGE(NEXMA)
C
C     MACHINE STATUS IS EIGHT: ERROR
C
5018  WRITE(6,5019)
5019  FORMAT(1X,'ERROR: MACHINE STATUS CANNOT BE EIGHT DURING ROUND OF
     1STATUS CHECKS BECAUSE HE IS NEEDED FOR SUCC. BMK.')
      CALL MESSAGE(NEXMA)
C
C     MACHINE STATUS IS NINE: ERROR
C
5029  WRITE(6,5030)
5030  FORMAT(1X,'ERROR: MACHINE STATUS CANNOT BE NINE DURING ROUND OF
     1STATUS CHECKS BECAUSE HE IS NEEDED FOR SELF BMK.')
      CALL MESSAGE(NEXMA)
C
C     MACHINE STATUS IS TEN: MACH. IS WAITING TO COMPLETE UNIT LOAD.
C
5040  IF (NNQ(NEXMA).EQ.0) THEN
            GO TO 5090
         ELSE
            K=1
5041        NTRY=LOCNT(K,NEXMA)
            NIA2=QSET(NTRY+2)
            NIA3=QSET(NTRY+3)
            NIA10=QSET(NTRY+10)
            IF (NIA2.EQ.LASTPN(NEXMA).AND.NIA3.EQ.LASLOT(NEXMA)) THEN
C
C              IF IT IS THE SAME PART NUMBER, CALL PQC ONLY IF THERE
C              ARE GOOD PARTS TO BE INSPECTED. OTHERWISE, CALL MACHINE.
C
               DFLAG=1
               AFLAG=0
               PFLAG=0
               IF (NIA10.GT.0) THEN

                  IF (K.GT.1) THEN
                     IF (K.NE.NNQ(NEXMA)) THEN
                        CALL RMOVE(K,NEXMA,ATRIB)
                        CALL FILEM(NEXMA,ATRIB)
                     ENDIF
                     DO 5042 I=1,NNQ(NEXMA)-1
                     CALL RMOVE(1,NEXMA,ATRIB)
                     CALL FILEM(NEXMA,ATRIB)
```



```
5042                    CONTINUE
                     ENDIF

                     CALL PQC(AFLAG,DFLAG,PFLAG,NEXMA)
                     IF (PFLAG.EQ.1) THEN
                        MOPSTA(ICP(NEXMA))=1
                        CALL MACHIN(NEXMA,NIDQ)

                        IF ((XINBUF(NEXMA)+PULLDQ(NEXMA)).GE.MBUFF(NEXMA)
     1                  .AND.XINBUF(NEXMA).LT.MBUFF(NEXMA)) THEN
                           CALL CKBLK(NEXMA)
                        ENDIF
c
                        GO TO 5100
                     ELSE
c
                        IF (MSTATU(NEXMA).EQ.6) THEN
                          IF ((XINBUF(NEXMA)+PULLDQ(NEXMA)).GE.MBUFF(
     1                    NEXMA).AND.XINBUF(NEXMA).LT.MBUFF(NEXMA)) THEN
                              CALL CKBLK(NEXMA)
                          ENDIF
                        ENDIF
c
                        GO TO 5100
                     ENDIF
                  ELSE

                     IF (K.GT.1) THEN
                        IF (K.NE.NNQ(NEXMA)) THEN
                             CALL RMOVE(K,NEXMA,ATRIB)
                             CALL FILEM(NEXMA,ATRIB)
                        ENDIF
                        DO 5043 I=1,NNQ(NEXMA)-1
                        CALL RMOVE(1,NEXMA,ATRIB)
                        CALL FILEM(NEXMA,ATRIB)
5043                    CONTINUE
                     ENDIF

                     MOPSTA(ICP(NEXMA))=1
                     CALL MACHIN(NEXMA,NIDQ)

                     IF ((XINBUF(NEXMA)+PULLDQ(NEXMA)).GE.MBUFF(NEXMA)
     1               .AND.XINBUF(NEXMA).LT.MBUFF(NEXMA)) THEN
                         CALL CKBLK(NEXMA)
                     ENDIF
                     GO TO 5100
c
                  ENDIF
               ELSE
                  K=K+1
                  IF (NNQ(NEXMA).GE.K) THEN
                     GO TO 5041
                  ELSE
                     WRITE(6,5044)TNOW
5044                 FORMAT(1X,'WARNING: AT TNOW=',F8.2,1X,'THE NEXT')
                     WRITE(6,5045)
5045                 FORMAT(1X,'PART NUMBER IN QUEUE IS NOT THE SAME')
                     WRITE(6,5046) NEXMA
5046                 FORMAT(1X,'AS THE ONE WAITING IN NODQ OF MACHINE'
     1                     ,I6)
                     WRITE(6,5047)
5047                 FORMAT()

                     GO TO 5090
                  ENDIF
               ENDIF
            ENDIF
C
C     MACHINE STATUS IS ELEVEN: UNDER REPAIR
C
5051  GO TO 5090

C
C     MACHINE STATUS IS TWELVE: UNDER PM BY MAINT. CREW
C
5062  GO TO 5090

C
C     MACHINE STATUS IS THIRTEEN: ERROR
C
5073  WRITE(6,5074)
5074  FORMAT(1X,'ERROR: MACHINE STATUS CANNOT BE THIRTEEN DURING
     1ROUND OF STATUS CHECKS BECAUSE HE IS NEEDED FOR P.YOKE INP.')
      CALL MESSAGE(NEXMA)
C
5090  K=K+1
      IF (K.GT.NM(ICP(IA7))) THEN
         MOPSTA(ICP(IA7))=0
         GO TO 5100
      ELSE
         I=I-1
         IF (I.EQ.0) THEN
```

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```
            I=NN(IOP(IA7))
         ENDIF
         NEXMA=MACH(I,IOP(IA7))
         GO TO 4020
      ENDIF

5100  RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE LONGQ(IA7)
C
      INCLUDE '/ncsu/juilson_ree/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NSQT),DDL(NSQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(NSQT),
     2SSL(NSQT),TNEXT,TNOW,XX(NNXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NAREGC(50),
     1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLRSC(50),NBLRMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOPLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKSN,NAVNT,OPNDT,NDTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUN(50),ICASUN,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQASUM,PNCOST(40,51)
      COMMON/UCOM14/SAMFLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRONMD,TRMLP1,TRMLP2,TRMLP3
      COMMON/UCOM17/TRORJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNN,TSELNN
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSUNMD(50),SUNMP1(50),SUNMP2(50),SUNMP3(50)
      COMMON/UCOM21/NSENMD(50),SENMP1(50),SENMP2(50),SENMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)

      common/ucomd/iff1
      COMMON/UCOM29/MINITR,MDESTR
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM31/MLONG(10),NUNITS(50)
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
      COMMON/UCOM40/REMPT(50)
      COMMON/UCOM43/BRKDSC,BDNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTN(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM82/MAXN
C
C     J IS A POINTER TO THE SEQUENCE OF MACHINES.
C     K REPRESENTS THE NUMBER OF MACHINES CHECKED SO FAR.
C     N(K) SAVES THE MACHINE NUMBER OF THE MACHINE CHECKED.
C     NUNITS(N(K)) SAVES THE NUMBER OF UNITS WAITING IN QUEUE AT MACH. N(K).
C
C     FIND THE POSITION, IN THE SEQUENCE OF MACHINES ASSIGNED TO HIM, OF THE
C     MACHINE AT WHICH HE WAS WORKING WHEN LONGQ WAS CALLED.
C
      J=1
C
5105  IF (IA7.EQ.MACH(J,IOP(IA7))) THEN
         GO TO 5110
      ELSE
         J=J+1
         GO TO 5105
      ENDIF
C
C     DETERMINE THE NUMBER OF UNITS IN QUEUE FOR ALL MACHINES ASSIGNED TO
C     HIM EXCEPT THE ONE HE WAS WORKING ON.
C
5110  K=0
      LL=NN(IOP(IA7))-1
```



```
C
      DO 5115 I=1,LL
       J=J+1
       IF (J.GT.NN(IOP(IA7))) THEN
          J=1
       ENDIF
       K=K+1
       MLONG(K)=MACH(J,IOP(IA7))
       NUPSIZ=0
         DO 5112 N=1,NNQ(MLONG(K))
            NTRY=LOCAT(N,MLONG(K))
            IA4=QSET(NTRY+4)
            NUPSIZ=NUPSIZ+IA4
5112     CONTINUE
         NUNITS(MLONG(K))=NUPSIZ
5115  CONTINUE
C
C     SELECT THE ONE WITH THE LONGEST QUEUE
C
5116  MAXQ=0
      DO 5117 I=1,LL
      IF (NUNITS(MLONG(I)).GT.MAXQ) THEN
         MAXQ=NUNITS(MLONG(I))
         NEXMA=MLONG(I)
      ENDIF
5117  CONTINUE
C
C     IF THE NUMBER OF MACHINES TO BE CHECKED EXCEED ONE, THEN
C     REMOVE THE MACHINE WITH THE LONGEST QUEUE FROM THE LIST
C
      IF (LL.GT.1) THEN
         DO 5119 I=1,LL
         IF (MLONG(I).EQ.NEXMA) THEN
            DO 5118 N=I,LL-1
            MLONG(N)=MLONG(N+1)
            NUNITS(MLONG(N))=NUNITS(MLONG(N+1))
5118        CONTINUE
            LL=LL-1
            GO TO 5120
         ENDIF
5119     CONTINUE
      ELSE
         LL=LL-1
      ENDIF
C
5120  IF (NSTATU(NEXMA).EQ.0) THEN
C
C        CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF
C        THERE ARE,GIVE PRIORITY TO THOSE.
C
         IF (NAUTO.EQ.1) THEN
            FFLAG=0
            CALL AUTOCK(NEXMA,FFLAG)
            IF (FFLAG.EQ.0) THEN
               GO TO 5300
            ENDIF
         ENDIF
C
         NIDQ=NEXMA+MAXN
C
         IF (NNQ(NIDQ).GT.0) THEN
            IF (NOPCD(NEXMA).NE.2) THEN
               WRITE(6,5121) TNOW,NEXMA
5121           FORMAT(1X,'ERROR: AT TNOW=',F8.2,1X,'IN NEXTMA W/MACH=',
     1         I3)
               WRITE(6,5122)
5122           FORMAT(1X,'IF AN OPERATOR WAS NOT NEEDED THE PARTS
     1         SHOULD HAVE BEEN PULLED')
               CALL MESSAGE(NEXMA)
            ELSE
               NOPSTA(IOP(IA7))=1
               LASTMA(IOP(IA7))=NEXMA
               CALL MACHIN(NEXMA,NIDQ)
               GO TO 5300
            ENDIF
         ENDIF
C
         QFLAG=0
         SFLAG=0
C
         CALL QFULL(NEXMA,QFLAG,SFLAG)
C
         IF (QFLAG.EQ.0) THEN
C
            GO TO 5290
C
         ELSE
C
            IF (SFLAG.EQ.1 .AND. ISCHDP(NEXMA).NE.0) THEN
C
C              PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C              CHOSEN BY THE USER.
```

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```
C
              CALL SCHEDP(NEXMA)
C
           ENDIF
C
C          DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C          TO BE PROCESSED.
C
           NTRY-NNPZ(NEXMA)
           IA2-QSET(NTRY+2)
           IA10-QSET(NTRY+10)
C
C          VERIFY IF A SETUP IS NEEDED
C
           IF (NSUCD(NEXMA).EQ.1) THEN
C
              IF (IA2.NE.LASTPN(NEXMA)) THEN
                NSUPN-IA2
                CALL NSETUP(NSUPN,NEXMA)
C
C               AT THIS POINT IT IS NOT KNOWN IF THE CHOSEN MACHINE IS UNDER
C               TRADITIONAL OR WORLD CLASS SETUP. THERFORE IT IS IMPORTANT
C               TO DETERMINE IF THE OPERATOR HAS BEEN INVOLVED IN THE SETUP
C               OR NOT.
C
                IF (NSTATU(NEXMA).EQ.5) THEN
                    IF (NOPSTA(IOP(IA7)).EQ.5) THEN
                        GO TO 5300
                    ELSE
                        GO TO 5290
                    ENDIF
                ENDIF
C
              ENDIF
           ENDIF

           IF (IA10.EQ.0) THEN
              GO TO 5130
           ENDIF
C
C          DFLAG-1 WITH AFLAG-0 TELLS THE PQC SUBROUTINE THAT THE
C          CALLING SUBROUTINE IS A DEPARTURE.
C
           DFLAG-1
           AFLAG-0
           PFLAG-0
C
C          IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C          PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C          THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C          CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C          THE REMOVAL.
C
           CALL PQC(AFLAG,DFLAG,PFLAG,NEXMA)

           IF (PFLAG.EQ.0) THEN
              IF (NOPSTA(IOP(IA7)).NE.6) THEN
                 WRITE(6,5125)
5125             FORMAT(1X,'ERROR:AT NEXTMA W/NOPCD-2, PFLAG WILL BE
     1                 ZERO ONLY IF HE IS DOING INSPECTION')
                 CALL MESSAGE(NEXMA)
              ELSE
C
                 IF ((XINBUF(NEXMA)+FULLDQ(NEXMA)).GE.NBUFF(NEXMA)
     1            .AND.XINBUF(NEXMA).LT.NBUFF(NEXMA)) THEN
                     CALL CKBLK(NEXMA)
                 ENDIF
C
                 GO TO 5300
              ENDIF
           ELSE
5130          NIDQ-NEXMA+NAEN

              IF (NOPCD(NEXMA).NE.2) THEN
C
C               IF THE MACHINE DID NOT NEED SETUP OR THE PART DID NOT NEED
C               INSPECTION,THEN PRODUCTION SHOULD HAVE STARTED ONLY IF
C               IA10 ne 0 (SINCE WHEN IA10-0 THE MODEL JUMPS PQC AND SETUP.
C234567
                IF (IA10.NE.0) THEN
                  WRITE(6,5135) NEXMA
5135              FORMAT(1X,'AT LONGQ W/MACN-',I3,1X,'IF OPERATOR
     1WAS')
                  WRITE(6,5136)
5136              FORMAT(1X,'NOT NEEDED PRODUCTION SHOULD HAVE
     1STARTED')
                  CALL MESSAGE(NEXMA)
                ELSE
C
C                 IF IA10-0 PQC AND SETUP ARE JUMPED
C
                  CALL MACHIN(NEXMA,NIDQ)
```



```
C
                    IF ((XINBUF(NEXMA)+FULLDQ(NEXMA)).GE.NBUFF(NEXMA)
     1               .AND.XINBUF(NEXMA).LT.NBUFF(NEXMA)) THEN
                       CALL CKBLK(NEXMA)
                    ENDIF
C
                    IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                       GO TO 5290
                    ELSE
                       GO TO 5300
                    ENDIF

                  ENDIF

                ENDIF

                NOPSTA(IOP(IA7))-1
                LASTMA(IOP(IA7))-NEXMA
                CALL MACHIN(NEXMA,NIDQ)
C
                IF ((XINBUF(NEXMA)+FULLDQ(NEXMA)).GE.NBUFF(NEXMA) .AND.
     1          XINBUF(NEXMA).LT.NBUFF(NEXMA)) THEN
                    CALL CKBLK(NEXMA)
                ENDIF
                GO TO 5300
C
              ENDIF
C
           ENDIF

        ENDIF
C
        GO TO (5141,5152,5163,5174,5185,5196,5207,5218,5229,5240
     1,5251,5262,5273) NSTATU(NEXMA)
C
C       MACHINE STATUS IS ONE: BUSY
C
5141    IF (NOPCD(NEXMA).EQ.2) THEN
            WRITE(6,5142)
5142        FORMAT(1X,'ERROR: MACHINE STATUS CAN BE ONE DURING ROUND OF
     1STATUS CHECKS ONLY IF NOPCD-1')
            CALL MESSAGE(NEXMA)
        ENDIF
C
C       CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
C       GIVE PRIORITY TO THOSE.
C
C        IF (NAUTO.EQ.1) THEN
C           PFLAG-0
C           CALL AUTOCK(NEXMA,PFLAG)
C           IF (PFLAG.EQ.0) THEN
C
C              NOW REMOVE THE ENTITY BEING PROCESSED FROM THE EVENT CALENDAR
C              AND PLACE IT NUMBER ONE IN THE DUMMY INPUT QUEUE.
C
C               CALL OUT(IA7)
C               GO TO 5300
C           ELSE
C               GO TO 5290
C           ENDIF
C        ELSE
C          GO TO 5290
C        ENDIF
C
C       MACHINE STATUS IS TWO: BLOCKED, THERE ARE MAY BLOCKING SOURCES.
C
5152       IF (NSTATU(NEXMA).EQ.2 .AND. NBLKSC(NEXMA).EQ.2) THEN
C
C               LACK OF MH EQUIPMENT PENDING !!!!!!!!
C
           ENDIF
C
           IF (NSTATU(NEXMA).EQ.2 .AND. NBLKSC(NEXMA).EQ.1) THEN
C
C              BLOCKING SOURCE: LACK OF SPACE IN NEXT W/S BUFFER.
C
C              CHECK IF PARTS CAN BE TAKEN TO THE NEXT WORKSTATION. IF SO,
C              CALL MANMAN SUB. IF NOT, SEND THE OPERATOR TO ANOTHER MACHINE
C              IF HE IS SHARED, OR KEEP HIS STATUS AS ZERO IF HE IS DEDICATED.
C
              NODQ-NEXMA+NAEN*2
C
              BFLAG-0
              NEXTM-NBLKMA(NEXMA)
              CALL BUFFCK(BFLAG,NEXTM)
              IF (BFLAG.EQ.0) THEN
C
                 GO TO 5290
C
              ELSE
C
                 QFLAG-0
```

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                NQFLAG=1

                CALL MATHAN(NEXMA,QFLAG,NEXTM,NQFLAG)
c
                IF (QFLAG.EQ.0) THEN
c
c                   PARTS ARE RETURNED TO THE OUTPUT BUFFER AT MANHAN SUB.
c
                    GO TO 5390
c
                ELSE
c
                    UPTIME(NEXMA)=UPTIME(NEXMA)+(TNOW-BLKTM(NEXMA))
                    TOTUP(NEXMA)=TOTUP(NEXMA)+(TNOW-BLKTM(NEXMA))
                    MSTATU(NEXMA)=0
                    BLKTM(NEXMA)=0

                    IF (NMEDSC.EQ.2) THEN
                       IF (UPTIME(IA7).GT.BMEVENT(IA7)) THEN
                          CALL UPMNXD(IA7)
                       ENDIF
                    ENDIF
c
c                   AT THIS POINT WE MIGHT BE HANDLING PARTS. HOWEVER, WE
c                   MIGHT NOT BE NEEDED TO PROCESS PARTS OR DO SETUP.
c                   THEREFORE, AFTER UNBLOCKING THE MACHINE IT IS IMPORTANT
c                   TO DETERMINE IF SOMETHING ELSE CAN BE DONE AT THAT MACH.
c
c                   CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE
c                   DELAYED. IF THERE ARE,GIVE PRIORITY TO THOSE.
c
                    IF (NOPSTA(IOP(NEXMA)).EQ.0) THEN
                        IF (MAUTO.EQ.1) THEN
                            PFLAG=0
                            CALL AUTOCK(NEXMA,PFLAG)
                            IF (PFLAG.EQ.0) THEN
                               GO TO 5300
                            ENDIF
                        ENDIF
                    ENDIF
c
                    NIDQ=NEXMA+NAXM
c
                    IF (NNQ(NIDQ).GT.0) THEN
                       IF (NOPCD(NEXMA).NE.2) THEN
                           CALL MACHIN(NEXMA,NIDQ)
                           IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                              GO TO 5290
                           ENDIF
                           GO TO 5300
                       ELSE
                          IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                             NOPSTA(IOP(IA7))=1
                             LASTMA(IOP(IA7))=NEXMA
                             CALL MACHIN(NEXMA,NIDQ)
                             GO TO 5300
                          ELSE
                             GO TO 5300
                          ENDIF
                       ENDIF
                    ENDIF
c

                    QFLAG=0
                    SFLAG=0
                    CALL QFULL(NEXMA,QFLAG,SFLAG)
c
                    IF (QFLAG.EQ.0) THEN
c
c                   PARTS LEFT. HOWEVER, THE OPERATOR MIGHT BE DOING HANDLING.
c
                       IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                          GO TO 5290
                       ENDIF
                       GO TO 5300
                    ENDIF

                    IF (SFLAG.EQ.1  .AND. ISCHOP(NEXMA).NE.0) THEN
c
c                      PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
c                      CHOSEN BY THE USER.
c
                       CALL SCHEDP(NEXMA)
                    ENDIF
c
c                   DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
c                   TO BE PROCESSED.
c
                    NTRY=MMFE(NEXMA)
                    IA2=QSET(NTRY+2)
                    IA10=QSET(NTRY+10)
c
```

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c                   VERIFY IF A SETUP IS NEEDED
c
                    IF (MSUCD(NEXMA).EQ.1) THEN
                       IF (IA2.NE.LASTPN(NEXMA)) THEN
                           NSUPN=IA2
                           CALL MSETUP(NSUPN,NEXMA)
c
                           IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                              GO TO 5290
                           ENDIF
                           GO TO 5300
                       ENDIF
                    ENDIF

                    IF (IA10.EQ.0) THEN
                       IF (NOPCD(NEXMA).EQ.2) THEN
                          IF (NOPSTA(IOP(IA7)).NE.0) THEN
                             GO TO 5300
                          ELSE
                             NOPSTA(IOP(IA7))=1
                             LASTMA(IOP(IA7))=IA7
                             GO TO 5157
                          ENDIF
                       ELSE
                          GO TO 5157
                       ENDIF
                    ENDIF
c
c                   DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
c                   CALLING SUBROUTINE IS A DEPARTURE.
c
                    DFLAG=1
                    AFLAG=0
                    PFLAG=0
c
c                   IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
c                   PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
c                   THEREFORE,IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
c                   CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
c                   THE REMOVAL.
c
                    CALL PQC(AFLAG,DFLAG,PFLAG,NEXMA)
                    IF (PFLAG.EQ.0) THEN
                       IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                          WRITE(6,5155) NEXMA
5155                      FORMAT(1X,'AT NEXTMA FOR MACH=',I3,1X,'& ')
                          WRITE(6,5156)
5156                      FORMAT(1X,'PFLAG=0 NOPSTA SHOULD NOT BE ZERO')
                       STOP
                       ENDIF
c
                       IF ((XINBUF(NEXMA)+FULLDQ(NEXMA)).GE.MBUFF(NEXMA)
     1                 .AND. XINBUF(NEXMA).LT.MBUFF(NEXMA)) THEN
                           CALL CRBLK(NEXMA)
                       ENDIF
c
                    GO TO 5300
                    ELSE
5157                   NIDQ=NEXMA+NAXM
c
                        CALL MACHIN(NEXMA,NIDQ)
c
                        IF ((XINBUF(NEXMA)+FULLDQ(NEXMA)).GE.MBUFF
     1                  (NEXMA).AND. XINBUF(NEXMA).LT.MBUFF
     2                     (NEXMA))THEN
                           CALL CRBLK(NEXMA)
                        ENDIF
c
                        IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                           GO TO 5290
                        ELSE
                           GO TO 5300
                        ENDIF
c
                    ENDIF
c
                ENDIF
c
            ENDIF
c
         ENDIF
c
c
         IF (MSTATU(NEXMA).EQ.2 .AND. MBLKSC(NEXMA).EQ.3) THEN
c
c             LACK OF OPERATOR FOR PT PENDING !!!!!!!!
c
         ENDIF
c
         IF (MSTATU(NEXMA).EQ.2 .AND. MBLKSC(NEXMA).EQ.4) THEN
c
c           BLOCKING SOURCE: LACK OF MATERIAL HANDLING OPERATOR.
```


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mdirizar@c50030-201ps.1          cell6.f          0/17/96  13:53   135/220
C
C         TRY TO MOVE PARTS TO NEXT WORKSTATION. IF SUCCESSFUL, START
C         A NEW UNIT LOAD IF THERE ARE PARTS WAITING IN QUEUE.
C
          NODQ=NEXMA+MAXM*2
          CALL COPY(1,NODQ,ATRIB)
          IA2=ATRIB(2)
          IA6=ATRIB(6)+1
          NEXTM=NSEQ(IA6,IA2)
          IF (NPARLL(NEXTM).GT.0) THEN
               NEXTM=0
               CALL NSLRES(NEXMA,NEXTM)
          ENDIF
C
          BFLAG=0
          CALL BUFFCK(BFLAG,NEXTM)
           IF (BFLAG.EQ.0) THEN
               NBLKSC(NEXMA)=1
               NBLKMA(NEXMA)=NEXTM
C
               GO TO 5290
C
           ELSE
C
               QFLAG=0
               NQFLAG=1

               CALL MATHAN(NEXMA,QFLAG,NEXTM,NQFLAG)
C
               IF (QFLAG.EQ.0) THEN
C
C                   PARTS ARE RETURNED TO THE OUTPUT BUFFER AT MANHAN SUB.
C
                    GO TO 5290
C
               ELSE
C
                    UPTIME(NEXMA)=UPTIME(NEXMA)+(TNOW-BLKTM(NEXMA))
                    TOTUP(NEXMA)=TOTUP(NEXMA)+(TNOW-BLKTM(NEXMA))
                    NSTATU(NEXMA)=0
                    BLKTM(NEXMA)=0

                    IF (BRKDSC.EQ.2) THEN
                       IF (UPTIME(IA7).GT.BRKENT(IA7)) THEN
                          CALL UPBRKD(IA7)
                       ENDIF
                    ENDIF
C
C                   AT THIS POINT THE OPERATOR IS HANDLING PARTS. HOWEVER,
C                   THE MACHINE MIGHT NOT NEED HIM FOR SETUP OR PROCESSING
C                   PARTS.
C
                    NIDQ=NEXMA+MAXM
C
                    IF (NNQ(NIDQ).GT.0) THEN
                       IF (NOPCD(NEXMA).NE.2) THEN
                            CALL MACHIN(NEXMA,NIDQ)
                            GO TO 5300
                       ELSE
                            GO TO 5300
                       ENDIF
                    ENDIF
C
                    QFLAG=0
                    SFLAG=0
                    CALL QFULL(NEXMA,QFLAG,SFLAG)
C
                    IF (QFLAG.EQ.0) THEN
                        GO TO 5300
                    ENDIF
                    IF (SFLAG.EQ.1  .AND. ISCHOP(NEXMA).NE.0) THEN
C
C                      PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C                      CHOSEN BY THE USER.
C
                       CALL SCHEDP(NEXMA)
                    ENDIF
C
C                   DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C                   TO BE PROCESSED.
C
                    NTRY=MMFE(NEXMA)
                    IA2=QSET(NTRY+2)
                    IA10=QSET(NTRY+10)
C
C                   VERIFY IF A SETUP IS NEEDED
C
                    IF (NSUCD(NEXMA).EQ.1) THEN
                       IF (IA2.NE.LASTPN(NEXMA)) THEN
                            NSUPN=IA2
                            CALL NSETUP(NSUPN,NEXMA)
                            GO TO 5300
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                          ENDIF
                       ENDIF

                       IF (IA10.EQ.0) THEN
                          IF (NOPCD(NEXMA).EQ.2) THEN
                             IF (NOPSTA(IOP(IA7)).NE.0) THEN
                                GO TO 5300
                             ELSE
                                NOPSTA(IOP(IA7))=1
                                LASTMA(IOP(IA7))=IA7
                                GO TO 5160
                             ENDIF
                          ELSE
                             GO TO 5160
                          ENDIF
                       ENDIF
C
C                      DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
C                      CALLING SUBROUTINE IS A DEPARTURE.
C
                       DFLAG=1
                       AFLAG=0
                       PFLAG=0
C
C                      IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C                      PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C                      THEREFORE,IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C                      CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C                      THE REMOVAL.
C
                       CALL PQC(AFLAG,DFLAG,PFLAG,NEXMA)
                       IF (PFLAG.EQ.0) THEN
C
                          IF (NSTATU(NEXMA).EQ.6) THEN
                             IF ((XINBUF(NEXMA)+PULLDQ(NEXMA)).GE.NBUFF(
     1                       NEXMA).AND.XINBUF(NEXMA).LT.NBUFF(NEXMA))
     1                       THEN
                                CALL CKBLK(NEXMA)
                             ENDIF
                          ENDIF
C
                          GO TO 5300
                       ELSE
5160                      NIDQ=NEXMA+MAXM

                          CALL MACHIN(NEXMA,NIDQ)
C
                          IF ((XINBUF(NEXMA)+PULLDQ(NEXMA)).GE.NBUFF(
     1                    NEXMA).AND.XINBUF(NEXMA).LT.NBUFF(NEXMA)) THEN
                             CALL CKBLK(NEXMA)
                          ENDIF
C
                          IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                             GO TO 5290
                          ELSE
                             GO TO 5300
                          ENDIF

                       ENDIF
C
                   ENDIF
C
               ENDIF

           ENDIF
C
C      MACHINE STATUS IS THREE: ERROR
C
5163   WRITE(6,5164)
5164   FORMAT(1X'ERROR: MACHINE STATUS CAN NEVER BE THREE')
       CALL MESSAGE(NEXMA)
C
C      MACHINE STATUS IS FOUR: ERROR
C
5174   WRITE(6,5175)
5175   FORMAT(1X,'ERROR: MACHINE STATUS CANNOT BE FOUR DURING ROUND OF
     1STATUS CHECKS BECAUSE HE IS NEEDED FOR AUTOM. MAINT.')
       CALL MESSAGE(NEXMA)
C
C      MACHINE STATUS IS FIVE: UNDER SETUP
C
5185   IF (NSUTYP(NEXMA).EQ.3) THEN
          WRITE(6,5186)
5186      FORMAT(1X,'ERROR: MACHINE STATUS CAN BE FIVE DURING ROUND OF
     1STATUS CHECKS ONLY UNDER TRADITIONAL SETUP')
          CALL MESSAGE(NEXMA)
       ELSE
          GO TO 5290
       ENDIF
C
C      MACHINE STATUS IS SIX: ERROR
```

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```
C
5196  WRITE(6,5197)
5197  FORMAT(1X,'ERROR: MACHINE STATUS CANNOT BE SIX DURING ROUND OF
     1STATUS CHECKS BECAUSE HE IS NEEDED FOR SUCCESSIVE INSP.')
      CALL MESSAGE(NEXMA)
C
C     MACHINE STATUS IS SEVEN: ERROR
C
5207  WRITE(6,5208)
5208  FORMAT(1X,'ERROR: MACHINE STATUS CANNOT BE SEVEN DURING ROUND OF
     1STATUS CHECKS BECAUSE HE IS NEEDED FOR SELF INSP.')
      STOP
C
C     MACHINE STATUS IS EIGHT: ERROR
C
5218  WRITE(6,5219)
5219  FORMAT(1X,'ERROR: MACHINE STATUS CANNOT BE EIGHT DURING ROUND OF
     1STATUS CHECKS BECAUSE HE IS NEEDED FOR SUCC. BMK.')
      CALL MESSAGE(NEXMA)
C
C     MACHINE STATUS IS NINE: ERROR
C
5229  WRITE(6,5230)
5230  FORMAT(1X,'ERROR: MACHINE STATUS CANNOT BE NINE DURING ROUND OF
     1STATUS CHECKS BECAUSE HE IS NEEDED FOR SELF BMK.')
      CALL MESSAGE(NEXMA)
C
C     MACHINE STATUS IS TEN: MACH. IS WAITING TO COMPLETE UNIT LOAD
C
5240      IF (NNQ(NEXMA).EQ.0) THEN
             GO TO 5290
          ELSE
             K=1
5241         NTRY=LOCAT(K,NEXMA)
             NIA2=QSET(NTRY+2)
             NIA3=QSET(NTRY+3)
             NIA10=QSET(NTRY+10)
             IF (NIA2.EQ.LASTPN(NEXMA).AND.NIA3.EQ.LASLOT(NEXMA)) THEN
C
C                IF IT IS THE SAME PART NUMBER, CALL FQC ONLY IF THERE
C                ARE GOOD PARTS TO BE INSPECTED. OTHERWISE, CALL MACHINE.
C
                 DFLAG=1
                 AFLAG=0
                 PFLAG=0
                 IF (NIA10.GT.0) THEN

                    IF (K.GT.1) THEN
                       IF (K.NE.NNQ(NEXMA)) THEN
                          CALL RMOVE(K,NEXMA,ATRIB)
                          CALL FILEM(NEXMA,ATRIB)
                       ENDIF
                       DO 5242 I=1,NNQ(NEXMA)-1
                       CALL RMOVE(1,NEXMA,ATRIB)
                       CALL FILEM(NEXMA,ATRIB)
5242                   CONTINUE
                    ENDIF

                    CALL FQC(AFLAG,DFLAG,PFLAG,NEXMA)
                    IF (PFLAG.EQ.1) THEN
                      NOPSTA(IOP(NEXMA))=1
                      CALL MACHIN(NEXMA,NIDQ)

                      IF ((XINBUF(NEXMA)+FULLDQ(NEXMA)).GE.MBUFF(NEXMA)
     1                .AND.XINBUF(NEXMA).LT.MBUFF(NEXMA)) THEN
                         CALL CKBLK(NEXMA)
                      ENDIF
c
                      GO TO 5300
                    ELSE
c
                      IF (MSTATU(NEXMA).EQ.6) THEN
                         IF ((XINBUF(NEXMA)+FULLDQ(NEXMA)).GE.MBUFF(
     1                   NEXMA).AND.XINBUF(NEXMA).LT.MBUFF(NEXMA)) THEN
                             CALL CKBLK(NEXMA)
                         ENDIF
                      ENDIF
c
                      GO TO 5300
                    ENDIF
                 ELSE

                    IF (K.GT.1) THEN
                       IF (K.NE.NNQ(NEXMA)) THEN
                           CALL RMOVE(K,NEXMA,ATRIB)
                           CALL FILEM(NEXMA,ATRIB)
                       ENDIF
                       DO 5243 I=1,NNQ(NEXMA)-1
                       CALL RMOVE(1,NEXMA,ATRIB)
                       CALL FILEM(NEXMA,ATRIB)
5243                   CONTINUE
                    ENDIF
```



```
                      NOPSTA(IOP(NEXMA))=1
                      CALL MACHIN(NEXMA,NIDQ)
c
                      IF ((XINBUF(NEXMA)+FULLDQ(NEXMA)).GE.MBUFF(NEXMA)
     1                .AND.XINBUF(NEXMA).LT.MBUFF(NEXMA)) THEN
                          CALL CKBLK(NEXMA)
                      ENDIF
                      GO TO 5300
c
                 ENDIF
             ELSE
                 K=K+1
                 IF (NNQ(NEXMA).GE.K) THEN
                    GO TO 5241
                 ELSE
                    WRITE(6,5244)TNOW
5244                FORMAT(1X,'WARNING: AT TNOW=',F8.2,1X,'THE NEXT')
                    WRITE(6,5245)
5245                FORMAT(1X,'PART NUMBER IN QUEUE IS NOT THE SAME')
                    WRITE(6,5246) NEXMA
5246                FORMAT(1X,'AS THE ONE WAITING IN NODQ OF MACHINE'
     1                     ,I4)
                    WRITE(6,5247)
5247                FORMAT()

                    GO TO 5290
                 ENDIF
             ENDIF
          ENDIF

C
C     MACHINE STATUS IS ELEVEN: UNDER REPAIR
C
5251  GO TO 5290

C
C     MACHINE STATUS IS TWELVE: UNDER PM BY MAINT. CREW
C
5262  GO TO 5290

C
C     MACHINE STATUS IS THIRTEEN: ERROR
C
5273  WRITE(6,5274)
5274  FORMAT(1X,'ERROR: MACHINE STATUS CANNOT BE THIRTEEN DURING
     1ROUND OF STATUS CHECKS BECAUSE HE IS NEEDED FOR P.YOKE INP.')
      CALL MESSAGE(NEXMA)
C
C     WHEN IT REACHES THIS POINT WITH NEXMA=IA7, IT MEANS IT CHECKED ALL
C     MACHINES ASSIGNED TO HIM (INCLUDING THE LAST ONE HE WORKED ON) AND
C     THERE IS NOTHING WAITING IN QUEUE.
C
5290  IF (NEXMA.EQ.IA7) THEN
         NOPSTA(IOP(IA7))=0
         GO TO 5300
      ENDIF
C
      IF (LL.EQ.0) THEN
         NEXMA=IA7
         GO TO 5120
      ELSE
         GO TO 5116
      ENDIF
C
5300  RETURN
      END
C
C ***********************************************************************
C
      SUBROUTINE SELASS(IA7,NEXTN)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MPUCD(50),MQCD(50),MAMRSC(50),
     1 NDEPSC(50),MBUFF(50),MBUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(60,50),REWKP(60,50),MA(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(60),IBI(60),
     4 IDEFUL(60,50),NCAP(50),L(50),MSEQ(50,60),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(60,300)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELOL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(60),TOTAL(60,300),NPN,NLOTS,NPARTS,TOTLOT
C
```

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mdirizar0c50030-201ps.1          cell6.f          .0/17/96  13:53   139/220
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NOTMA,WALKLO
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQAMNK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRORMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRORJP(40),TRORMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNM,TSELNM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSEMMD(50),SEMMP1(50),SEMMP2(50),SEMMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
C
C     DETERMINE WHICH IS THE NEXT MACHINE IN THE PART ROUTING
C
      IA6=ATRIB(6)+1
      IA2=ATRIB(2)
      IA3=ATRIB(3)
      IA4=ATRIB(4)
      MAINRE=NSEQ(IA6,IA2)
C
C     USE THAT NUMBER TO DETERMINE IF THERE WILL BE A CHANGE IN UNIT
C     LOAD SIZE AT THAT MACHINE. IF NO CHANGES ARE EXPECTED, IT MEANS
C     THE MAIN RESOURCE OR ANY PARALLEL MACHINE CAN BE CHOSEN TO PROCESS
C     THIS ENTITY. GIVE PRIORITY TO MACHINES AS FOLLOWS:
C
C     1. IDLE MACHINES.
C     2. MACHINES WITH SHORTEST QUEUE.
C
C     THE SAME WOULD BE DONE IF THE UNIT LOAD SIZE CHANGES TO A LOWER
C     NUMBER. THEREFORE, THE UNIT LOAD SPLITS AND THE CONDITION OF HAVING
C     THE MACHINE WAITING FOR A PART NUMBER WILL NOT OCCUR.
C
C     IF A CHANGE IN UNIT LOAD SIZE IS EXPECTED (AND CHANGES TO A BIGGER
C     NUMBER, THEN GIVE PRIORITY TO MACHINES AS FOLLOWS:
C
C     1. BLOCKED MACHINES (STATUS=10) WAITING FOR THAT PN.
C     2. MACHINES THAT PROCESSED THAT PN AND LOT NUMBER.
C     3. MACHINES WITH THE SAME PN AND LOT NO. WAITING IN QUEUE.
C     4. MACHINES PERFORMING AN OPERATION ON THAT PN. AND LOT NO.
C     5. MACHINES WITH ARRIVALS SCHEDULED FOR THAT PN. AND LOT NO.
C     6. IDLE MACHINES.
C     7. MACHINES WITH SHORTEST QUEUE.
C
      IF (IDEFUL(IA2,MAINRE).EQ.0 .OR. (IDEFUL(IA2,MAINRE).GT.0 .AND.
     1 IDEFUL(IA2,MAINRE).LT.IA4)) THEN
C
C        SEARCH FOR AN IDLE MACHINE
C
         IF (NSTATU(MAINRE).EQ.0 .AND. NNQ(MAINRE).EQ.0) THEN
            NEXTM=MAINRE
            GO TO 5400
         ELSE
            DO 5320 J=1,NPARLL(MAINRE)
            IF (NSTATU(NRES(J,MAINRE)).EQ.0 .AND. NNQ(NRES(J,MAINRE))
     1      .EQ.0) THEN
               NEXTM=NRES(J,MAINRE)
               GO TO 5400
            ENDIF
5320        CONTINUE
         ENDIF
C
C        SELECT MACHINE WITH SHORTEST QUEUE
C
         NEXTM=MAINRE
         MINQ=NNQ(MAINRE)
         DO 5330 J=1,NPARLL(MAINRE)
         IF (NNQ(NRES(J,MAINRE)).LT.MINQ) THEN
            NEXTM=NRES(J,MAINRE)
            MINQ=NNQ(NRES(J,MAINRE))
         ENDIF
5330     CONTINUE
         GO TO 5400
C
      ELSE
C
C        GIVE PRIORITY TO MACHINES WAITING FOR THAT PN.
C
         IF (NSTATU(MAINRE).EQ.10 .AND. IA2.EQ.LASTPN(MAINRE)) THEN
```

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mdirizar0c50030-201ps.1          cell6.f          .0/17/96  13:53   140/220
            NEXTM=MAINRE
            GO TO 5400
         ELSE
            DO 5340 J=1,NPARLL(MAINRE)
            IF (NSTATU(NRES(J,MAINRE)).EQ.10 .AND. IA2.EQ.LASTPN(NRES
     1      (J,MAINRE))) THEN
               NEXTM=NRES(J,MAINRE)
               GO TO 5400
            ENDIF
5340        CONTINUE
         ENDIF
C
C        SEARCH FOR A MACHINE THAT PROCESSED THE SAME PN AND LOT NUMBER.
C
         IF (IA2.EQ.LASTPN(MAINRE) .AND. IA3.EQ.LASLOT(MAINRE)) THEN
             NEXTM=MAINRE
             GO TO 5400
         ENDIF
C
         DO 5345 J=1,NPARLL(MAINRE)
         IF (IA2.EQ.LASTPN(NRES(J,MAINRE)) .AND. IA3.EQ.
     1   LASLOT(NRES(J,MAINRE))) THEN
             NEXTM=NRES(J,MAINRE)
             GO TO 5400
         ENDIF
5345     CONTINUE
C
C        SEARCH FOR A MACHINE WITH THAT SAME PART NUMBER AND LOT NUMBER
C        IN QUEUE
C
         IA3=ATRIB(3)
         IF (NNQ(MAINRE).GT.0) THEN
            NTRY=LOCAT(NNQ(MAINRE),MAINRE)
            IPN=QSET(NTRY+2)
            ILOT=QSET(NTRY+3)
            IF (IA2.EQ.IPN .AND. IA3.EQ.ILOT) THEN
               NEXTM=MAINRE
               GO TO 5400
            ENDIF
         ENDIF
C
         DO 5350 J=1,NPARLL(MAINRE)
         IF (NNQ(NRES(J,MAINRE)).GT.0) THEN
            NTRY=LOCAT(NNQ(NRES(J,MAINRE)),NRES(J,MAINRE))
            IPN=QSET(NTRY+2)
            ILOT=QSET(NTRY+3)
            IF (IA2.EQ.IPN .AND. IA3.EQ.ILOT) THEN
               NEXTM=NRES(J,MAINRE)
               GO TO 5400
            ENDIF
         ENDIF
5350     CONTINUE
C
C        SEARCH THE EVENT CALENDAR FOR SCHEDULED ARRIVALS OF THE SAME
C        PN AND LOT NO. IF AN EVENT IS FOUND AND CORRESPONDS TO IA7 OR
C        ANY OF ITS PARALLEL RESOURCES, SEND THE ENTITY TO THAT MACHINE.
C
         IF (NNQ(NCLNR).GT.0) THEN
            N=1
5370        NRANK=NFIND(N,NCLNR,21,0,7.0,0.)
            IF (NRANK.EQ.0) THEN
               GO TO 5380
            ELSE
               NTRY=LOCAT(NRANK,NCLNR)
               IPN=QSET(NTRY+2)
               ILOT=QSET(NTRY+3)
               IMACH=QSET(NTRY+7)
               IF (IA2.EQ.IPN .AND. IA3.EQ.ILOT) THEN
                  IF (IMACH.EQ.MAINRE) THEN
                      NEXTM=MAINRE
                      GO TO 5400
                  ENDIF
                  DO 5375 J=1,NPARLL(MAINRE)
                  IF (IMACH.EQ.NRES(J,MAINRE)) THEN
                     NEXTM=NRES(J,MAINRE)
                     GO TO 5400
                  ENDIF
5375              CONTINUE
                  N=NRANK+1
                  IF (N.LE.NNQ(NCLNR)) THEN
                     GO TO 5370
                  ELSE
                     GO TO 5380
                  ENDIF
               ELSE
                  N=NRANK+1
                  IF (N.LE.NNQ(NCLNR)) THEN
                     GO TO 5370
                  ELSE
                     GO TO 5380
                  ENDIF
               ENDIF
```


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          ENDIF
        ENDIF
C
C       SEARCH FOR AN IDLE MACHINE
C
5300    IF (NSTATU(MAINRE).EQ.0 .AND. NNQ(MAINRE).EQ.0) THEN
           NEXTM=MAINRE
           GO TO 5400
        ELSE
           DO 5390 J=1,NPARLL(MAINRE)
           IF (NSTATU(NRES(J,MAINRE)).EQ.0 .AND. NNQ(NRES(J,MAINRE))
     1     .EQ.0) THEN
              NEXTM=NRES(J,MAINRE)
              GO TO 5400
           ENDIF
5390       CONTINUE
        ENDIF
C
C       SELECT MACHINE WITH SHORTEST QUEUE
C
        NEXTM=MAINRE
        MINQ=NNQ(MAINRE)
        DO 5395 J=1,NPARLL(MAINRE)
        IF (NNQ(NRES(J,MAINRE)).LT.MINQ) THEN
           NEXTM=NRES(J,MAINRE)
           MINQ=NNQ(NRES(J,MAINRE))
        ENDIF
5395    CONTINUE
        GO TO 5400
C
      ENDIF
C
5400  RETURN
      END
C
C *****************************************************************
C
      SUBROUTINE CKBLK(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NABASC(50),
     1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NNSQ(50,40),NOPWTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTWA(50),NBLKSC(50),NBLKNA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/NALKEN,NAVNT,OPNDT,NDTNA,NALKLD
      COMMON/UCOM8/SUTRX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCKDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNL,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TNONWD,TNWKP1,TNWKP2,TNWKP3
      COMMON/UCOM17/TNDRJP(40),TRDNWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNN,TSELNN
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
C
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      COMMON/UCOM26/NP3,NP4
      COMMON/UCOM27/NOP
      common/ucom4/iffl

      COMMON/UCOM28/SESCP,SUSCP,SERWP,SURWP
      COMMON/UCOM29/MINITR,NOESTR
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM31/NLONG(10),NUNITS(50)
c
      COMMON/UCOM32/XINBUF(50)
```



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      COMMON/UCOM35/IBLKSC(50),NNABLK(50),NBLK(50,50)
      COMMON/UCOM63/FULLOQ(50)
      COMMON/UCOM62/MAXN
C
C     K = TOTAL NUMBER OF 'POSSIBLE' BLOCKING SOURCES FOUND SO FAR.
C         THE FIRST 'POSSIBLE' BLOCKING SOURCE IS THE MACHINE CALLING
C         UNBLK (I.E. IA7)
C     N = TOTAL NUMBER OF 'POSSIBLE' BLOCKING SOURCES FOUND UP TO THE
C         PREVIOUS-TO-LAST ITERATION.
C     J = (K-N) = THE NUMBER OF 'POSSIBLE' BLOCKING SOURCES FOUND
C         DURING THE LAST ITERATION.
C
      K=1
      N=K
      LL=1
      IBLKSC(LL)=IA7
C
5410  DO 5430 II=LL,K
      NNABLK(IBLKSC(II))=0
      DO 5420 I=1,MAXN
      IF (I.NE.IBLKSC(II) .AND. NSTATU(I).EQ.2 .AND. NBLKSC(I).EQ.1)
     1 THEN
         IF (NBLKNA(I).EQ.IBLKSC(II)) THEN
            NNABLK(IBLKSC(II))=NNABLK(IBLKSC(II))+1
            NBLK(NNABLK(IBLKSC(II)),IBLKSC(II))=I
            K=K+1
            IBLKSC(K)=I
         ENDIF
      ENDIF
5420  CONTINUE
5430  CONTINUE
C
      IF (K.GT.N) THEN
C
C        IF K>N IT MEANS THAT NEW 'POSSIBLE' BLOCKING SOURCES WERE FOUND
C        IN THE LAST ITERATION. J=(N-K) MEASURES HOW MANY WERE FOUND.
C
         J=K-N
C
C        REDEFINE N TO DETERMINE IF NEW 'POSSIBLE' BLOCKING SOURCES ARE
C        ADDED IN THE NEXT ITERATION.
C
         N=K
C
C        LL SETS THE STARTING POINT FOR THE NEXT ITERATION. START AT THE
C        FIRST 'POSSIBLE' BLOCKING SOURCE ADDED IN THE LAST ITERATION.
C
         LL=K-J+1
C
         GO TO 5410
C
      ENDIF
C
      IF (NNABLK(IA7).EQ.0) THEN
         GO TO 5450
      ELSE
         CALL UNBLK(IA7)
      ENDIF
C
      DO 5440 I=2,K
      IF (NSTATU(IBLKSC(I)).NE.2 .AND. NNABLK(IBLKSC(I)).GT.0) THEN
C
C        THE FACT THAT THE MACHINE STATUS IS NO LONGER ZERO DOES NOT MEAN
C        THAT ITS BUFFER SIZE WAS REDUCED. LIKE THE CASE IN WHICH THE
C        STATUS CHANGED FROM 2 TO 11.
C
         BFLAG=0
         CALL BUFFCK(BFLAG,IBLKSC(I))
         IF (BFLAG.EQ.0) THEN
            GO TO 5440
         ENDIF
         CALL UNBLK(IBLKSC(I))
      ENDIF
5440  CONTINUE
C
5450  RETURN
      END
C
C *****************************************************************
C
      SUBROUTINE UNBLK(J)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NABASC(50),
     1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
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```
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),MBQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPW,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKIN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNL,PSCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDPWD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(40),TRIRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCSM,TSELSM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
C
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      COMMON/UCOM26/NP3,NP4
      COMMON/UCOM27/NOP
      common/ucomd/iffl

      COMMON/UCOM28/SESCP,SUSCP,SERWP,SURWP
      COMMON/UCOM29/MINITR,NOESTR
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM31/MLONG(10),NUNITS(50)
c
      COMMON/UCOM32/XINSUP(50)
      COMMON/UCOM35/IBLKSC(50),NNABLK(50),NBLK(50,50)
      COMMON/UCOM37/TBPDIS(50),TBPP1(50),TBPP2(50),TBPP3(50),NBWKD(50)
      COMMON/UCOM43/BRKDSC,MONENT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTM(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM60/IPMCD(50),IREP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM66/CAPAV(50)
      COMMON/UCOM82/MAXN
C
C     J REPRESENTS THE BLOCKING MACHINE.
C     NBLK(I,J) REPRESENTS THE Ith MACHINE BEING BLOCKED BY J.
C
      DO 5590 I=1,NNABLK(J)
C
      NEXTM=J
C
      QFLAG=0
      NQFLAG=1
C
      IF (NTYPE(NBLK(I,J)).EQ.7) THEN
         TTBLK=TNOW-BLKTM(NBLK(I,J))
         UPTIME(NBLK(I,J))=UPTIME(NBLK(I,J))+TTBLK
         TOTUP(NBLK(I,J))=TOTUP(NBLK(I,J))+TTBLK
         BLKTM(NBLK(I,J))=0
         CALL M7(NBLK(I,J),NQFLAG)
         GO TO 5590
      ENDIF
C
      CALL MATMAN(NBLK(I,J),QFLAG,NEXTM,NQFLAG)
C
      IF (QFLAG.EQ.0) THEN
C
C         PARTS ARE RETURNED TO THE OUTPUT BUFFER AT MANMAN SUB.
C
          GO TO 5590
C
      ENDIF
C
C     SAVE UPTIME AND DETERMINE IF IT IS TIME TO SCHEDULE THE NEXT BRKDWN.
C
      TTBLK=TNOW-BLKTM(NBLK(I,J))
      UPTIME(NBLK(I,J))=UPTIME(NBLK(I,J))+TTBLK
      TOTUP(NBLK(I,J))=TOTUP(NBLK(I,J))+TTBLK
      BLKTM(NBLK(I,J))=0
C
      IF (BRKDSC.EQ.2) THEN
```



```
         IF (UPTIME(NBLK(I,J)).GT.MONENT(NBLK(I,J))) THEN
            CALL UPBRKD(NBLK(I,J))
         ENDIF
      ENDIF
C
C     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
C     GIVE PRIORITY TO THOSE.
C
      PFLAG=0
      IF (NTYPE(NBLK(I,J)).EQ.5) THEN
         IF (CAPAV(NBLK(I,J)).EQ.NCAP(NBLK(I,J))) THEN
            CALL BRKCK(NBLK(I,J),PFLAG)
            IF (PFLAG.EQ.0) THEN
               GO TO 5590
            ENDIF
         ENDIF
      ELSE
         CALL BRKCK(NBLK(I,J),PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 5590
         ENDIF
      ENDIF
C
C     CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
C     GIVE PRIORITY TO THOSE.
C
      IF (NAUTO.EQ.1) THEN
        PFLAG=0
        IF (NTYPE(NBLK(I,J)).EQ.5) THEN
         IF (CAPAV(NBLK(I,J)).EQ.NCAP(NBLK(I,J))) THEN
            CALL AUTOCK(NBLK(I,J),PFLAG)
            IF (PFLAG.EQ.0) THEN
               GO TO 5590
            ENDIF
         ENDIF
        ELSE
         CALL AUTOCK(NBLK(I,J),PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 5590
         ENDIF
        ENDIF
      ENDIF
C
C     CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C     IF THERE ARE,GIVE PRIORITY TO THOSE.
C
      IF (IREP(NBLK(I,J)).EQ.1) THEN
        IF (NTYPE(NBLK(I,J)).EQ.5) THEN
         IF (CAPAV(NBLK(I,J)).EQ.NCAP(NBLK(I,J))) THEN
            CALL MSTCK(NBLK(I,J),PFLAG)
            IF (PFLAG.EQ.0) THEN
               GO TO 5590
            ENDIF
         ENDIF
        ELSE
         PFLAG=0
         CALL MSTCK(NBLK(I,J),PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 5590
         ENDIF
        ENDIF
      ENDIF
C
      IF (NTYPE(NBLK(I,J)).EQ.5) THEN
         IF (CAPAV(NBLK(I,J)).EQ.NCAP(NBLK(I,J))) THEN
            NSTATU(NBLK(I,J))=0
         ELSE
            NSTATU(NBLK(I,J))=1
         ENDIF
      ELSE
         NSTATU(NBLK(I,J))=0
      ENDIF
C
      NIDQ=NBLK(I,J)+MAXN
C
      IF (NNQ(NIDQ).GT.0) THEN
         IF (NOPCD(NBLK(I,J)).NE.2) THEN
            CALL MACHIN(NBLK(I,J),NIDQ)
            GO TO 5590
         ELSE
            IF (NOPSTA(IOP(NBLK(I,J))).EQ.0) THEN
               NOPSTA(IOP(NBLK(I,J)))=1
               LASTMA(IOP(NBLK(I,J)))=NBLK(I,J)
               CALL MACHIN(NBLK(I,J),NIDQ)
               GO TO 5590
            ELSE
               GO TO 5590
            ENDIF
         ENDIF
      ENDIF
C
      QFLAG=0
```

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```
      SFLAG=0
      CALL QFULL(MBLK(I,J),QFLAG,SFLAG)
C
      IF (QFLAG.EQ.0) THEN
C
C        THERE IS NOTHING WAITING IN QUEUE
C
         GO TO 5590
C
      ENDIF
C
      IF (SFLAG.EQ.1  .AND. ISCHOP(MBLK(I,J)).NE.0) THEN
C
C          PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C          CHOSEN BY THE USER.
C
           CALL SCHEDP(MBLK(I,J))
      ENDIF
C
C     DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C     TO BE PROCESSED.
C
      NTRY=NNFE(MBLK(I,J))
      IA2=QSET(NTRY+2)
      IA10=QSET(NTRY+10)
C
C     VERIFY IF A SETUP IS NEEDED
C
      IF (MSUCD(MBLK(I,J)).EQ.1) THEN
         IF (IA2.NE.LASTPN(MBLK(I,J))) THEN

            IF (MTYPE(MBLK(I,J)).EQ.5) THEN
             IF (CAPAV(MBLK(I,J)).EQ.NCAP(MBLK(I,J))) THEN
                CALL MSETUP(IA2,MBLK(I,J))
             ENDIF
            ELSE
             CALL MSETUP(IA2,MBLK(I,J))
            ENDIF
C
            GO TO 5590
         ENDIF
      ENDIF

      IF (IA10.EQ.0) THEN
         IF (MOPCD(MBLK(I,J)).EQ.1) THEN
            IF (NOPSTA(IOP(MBLK(I,J))).NE.0) THEN
               GO TO 5590
            ELSE
               NOPSTA(IOP(MBLK(I,J)))=1
               LASTMA(IOP(MBLK(I,J)))=MBLK(I,J)
               GO TO 5580
            ENDIF
         ELSE
            GO TO 5580
         ENDIF
      ENDIF
C
C     DFLAG=0 WITH AFLAG=1 TELLS THE PQC SUBROUTINE THAT THE
C     CALLING MACHINE MIGHT NEED AN OPERATOR.
C
      DFLAG=0
      AFLAG=1
      PFLAG=0
C
      CALL PQC(AFLAG,DFLAG,PFLAG,MBLK(I,J))
      IF (PFLAG.EQ.0) THEN
         GO TO 5590
      ENDIF

5580  NIDQ=MBLK(I,J)+MAXM
C
      CALL MACHIN(MBLK(I,J),NIDQ)
C
5590  CONTINUE

      RETURN
      END
C
C ************************************************************************
C
      SUBROUTINE GATHER
C
      INCLUDE '/mceu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MAMRSC(50),
     1 MDEPUC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLEMON(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
```



```
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),MSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
      COMMON/UCOM27/NOP
      COMMON/UCOM34/NOBOP(50,14),NOBMA(50,40),PERCOP(50,14)
     1,PERCMA(50,14)
      COMMON/UCOM51/SUMWIP(40,50),NUMWIP(40,50)
      COMMON/UCOM52/WIP(40,50)
      COMMON/UCOM83/MAXM
C
      DO 5644 I=1,NOP
C
      IF (NOPSTA(I).EQ.0) THEN
         NOBOP(I,14)=NOBOP(I,14)+1
         GO TO 5644
      ENDIF
C
      GO TO (5621,5622,5623,5624,5625,5626,5627,5628,5629,5630,5631
     1,5642,5643) NOPSTA(I)
C
5621  NOBOP(I,1)=NOBOP(I,1)+1
      GO TO 5644
C
5622  NOBOP(I,2)=NOBOP(I,2)+1
      GO TO 5644
C
5623  NOBOP(I,3)=NOBOP(I,3)+1
      GO TO 5644
C
5624  NOBOP(I,4)=NOBOP(I,4)+1
      GO TO 5644
C
5625  NOBOP(I,5)=NOBOP(I,5)+1
      GO TO 5644
C
5626  NOBOP(I,6)=NOBOP(I,6)+1
      GO TO 5644
C
5627  NOBOP(I,7)=NOBOP(I,7)+1
      GO TO 5644
C
5628  NOBOP(I,8)=NOBOP(I,8)+1
      GO TO 5644
C
5629  NOBOP(I,9)=NOBOP(I,9)+1
      GO TO 5644
C
5630  NOBOP(I,10)=NOBOP(I,10)+1
      GO TO 5644
C
5631  WRITE(6,5632)
5632  FORMAT(1X,'ERROR NOPSTA CANNOT BE 11 AT GATHER')
      CALL MESSAGE(1)
      GO TO 5644
C
5642  NOBOP(I,12)=NOBOP(I,12)+1
      GO TO 5644
C
5643  NOBOP(I,13)=NOBOP(I,13)+1
C
5644  CONTINUE
C
C
      DO 5666 I=1,MAXM
C
      IF (MSTATU(I).EQ.0) THEN
         NOBMA(I,14)=NOBMA(I,14)+1
         GO TO 5666
      ENDIF
C
      GO TO (5651,5652,5653,5654,5655,5656,5657,5658,5659,5660,5661
     1,5662,5663) MSTATU(I)
C
5651  NOBMA(I,1)=NOBMA(I,1)+1
      GO TO 5666
C
5652  NOBMA(I,2)=NOBMA(I,2)+1
      GO TO 5666
C
5653  NOBMA(I,3)=NOBMA(I,3)+1
      GO TO 5666
C
5654  NOBMA(I,4)=NOBMA(I,4)+1
      GO TO 5666
C
5655  NOBMA(I,5)=NOBMA(I,5)+1
      GO TO 5666
C
```

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5656  NOBMA(I,6)=NOBMA(I,6)+1
      GO TO 5664
C
5657  NOBMA(I,7)=NOBMA(I,7)+1
      GO TO 5664
C
5658  NOBMA(I,8)=NOBMA(I,8)+1
      GO TO 5664
C
5659  NOBMA(I,9)=NOBMA(I,9)+1
      GO TO 5664
C
5660  NOBMA(I,10)=NOBMA(I,10)+1
      GO TO 5664
C
5661  NOBMA(I,11)=NOBMA(I,11)+1
      GO TO 5664
C
5662  NOBMA(I,12)=NOBMA(I,12)+1
      GO TO 5664
C
5663  NOBMA(I,13)=NOBMA(I,13)+1
C
5664  CONTINUE
C
      CALL SCHDL(17,5.0,ATRIB)
C
      DO 5670 I=1,NMAIN
      DO 5665 K=1,NPN
5665  WIP(K,I)=0
C
C     SEARCH FOR WIP IN MAIN QUEUE
C
      IF (NNQ(I).GT.0) THEN
         DO 5666 J=1,NNQ(I)
         CALL COPY(J,I,ATRIB)
         IA2=ATRIB(2)
         IA10=ATRIB(10)
5666     WIP(IA2,I)=WIP(IA2,I)+IA10
      ENDIF
C
C     SEARCH FOR WIP AT NIDQ
C
      NIDQ=I+NMAIN
      IF (NNQ(NIDQ).GT.0 .AND. MTYPE(I).NE.3) THEN
         DO 5667 J=1,NNQ(I)
         CALL COPY(J,I,ATRIB)
         IA2=ATRIB(2)
         IA11=ATRIB(11)
         IF (IA11.EQ.1) THEN
            WIP(IA2,I)=WIP(IA2,I)+1
         ENDIF
5667     CONTINUE
      ENDIF

5670  CONTINUE
C
C     SEARCH FOR WIP IN TRANSIT
C
      IF (NNQ(NCLNR).GT.0) THEN
         DO 5675 I=1,NNQ(NCLNR)
         CALL COPY(I,NCLNR,ATRIB)
         IA21=ATRIB(21)
         IF (IA21.EQ.7) THEN
            IA2=ATRIB(2)
            IA7=ATRIB(7)
            WIP(IA2,IA7)=WIP(IA2,IA7)+ATRIB(10)
         ENDIF
5675     CONTINUE
      ENDIF
C
      DO 5676 I=1,NMAIN
      DO 5676 J=1,NPN
      SUMWIP(J,I)=SUMWIP(J,I)+WIP(J,I)
      NOBWIP(J,I)=NOBWIP(J,I)+1
5676  CONTINUE
C
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE BREAKS(I,RT)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM37/TBFDIS(50),TBFP1(50),TBFP2(50),TBFP3(50),NBRKD(50)
      COMMON/UCOM38/TTRDIS(50),TTRP1(50),TTRP2(50),TTRP3(50),SCRAM
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      common/ucomd/iffl
C
      GO TO (5681,5682,5683,5684,5685,5686,5687,5688,5689,5690
     1) TBFDIS(I)
C
5681  RT=EXPON(TBFP1(I),12)
      GO TO 5691
C
5682  RT=UNFRM(TBFP1(I),TBFP2(I),12)
      GO TO 5691
C
5683  RT=WEIBL(TBFP1(I),TBFP2(I),12)
      GO TO 5691
C
5684  RT=TRIAG(TBFP1(I),TBFP2(I),TBFP3(I),12)
      GO TO 5691
C
5685  RT=RNORM(TBFP1(I),TBFP2(I),12)
      GO TO 5691
C
5686  RT=RLOGN(TBFP1(I),TBFP2(I),12)
      GO TO 5691
C
5687  RT=ERLNG(TBFP1(I),TBFP2(I),12)
      GO TO 5691
C
5688  RT=GAMA(TBFP1(I),TBFP2(I),12)
      GO TO 5691
C
5689  RT=BETA(TBFP1(I),TBFP2(I),12)
      GO TO 5691
C
5690  RT=TBFP1(I)
C
5691  RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE REPAIR(I,RT)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM37/TBFDIS(50),TBFP1(50),TBFP2(50),TBFP3(50),NBRKD(50)
      COMMON/UCOM38/TTRDIS(50),TTRP1(50),TTRP2(50),TTRP3(50),SCREW
      COMMON/UCOM39/TOTRT

      common/ucomd/iffl
C
      GO TO (5701,5702,5703,5704,5705,5706,5707,5708,5709,5710
     1) TTRDIS(I)
C
5701  RT=EXPON(TTRP1(I),13)
      GO TO 5711
C
5702  RT=UNFRM(TTRP1(I),TTRP2(I),13)
      GO TO 5711
C
5703  RT=WEIBL(TTRP1(I),TTRP2(I),13)
      GO TO 5711
C
5704  RT=TRIAG(TTRP1(I),TTRP2(I),TTRP3(I),13)
      GO TO 5711
C
5705  RT=RNORM(TTRP1(I),TTRP2(I),13)
      GO TO 5711
C
5706  RT=RLOGN(TTRP1(I),TTRP2(I),13)
      GO TO 5711
C
5707  RT=ERLNG(TTRP1(I),TTRP2(I),13)
      GO TO 5711
C
5708  RT=GAMA(TTRP1(I),TTRP2(I),13)
      GO TO 5711
C
5709  RT=BETA(TTRP1(I),TTRP2(I),13)
      GO TO 5711
C
5710  RT=TTRP1(I)
C
5711  TOTRT=TOTRT+RT

      RETURN
      END
C
C ********************************************************************
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C
      SUBROUTINE BREAKD
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MSCLXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWRP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM37/TBFDIS(50),TBFP1(50),TBFP2(50),TBFP3(50),NBRKD(50)
      COMMON/UCOM40/REMPT(50)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM82/MAXN
C
      IA7=ATRIB(7)
      NBRKD(IA7)=NBRKD(IA7)+1
C
C     SCHEDULE THE NEXT BREAKDOWN USING THE CURRENT ATTRIBUTES IF THE
C     BREAKDOWN SCENARIO IS BASED ON CALENDAR TIME.
C
      IF (BRKDSC.EQ.1) THEN
         RT=0
         CALL BREAKS(IA7,RT)
         CALL SCHDL(10,RT,ATRIB)
      ENDIF
C
      IF (MSTATU(IA7).EQ.0) THEN
C
           MSTATU(IA7)=11
           CALL REPAIR(IA7,RT)
           CALL SCHDL(19,RT,ATRIB)
           GO TO 5750
C
      ENDIF
C
C      IF (MSTATU(IA7).EQ.1) THEN
C
C          FIRST SCHEDULE THE REPAIR SUCH THAT THE ATTRIBUTES OF THE REPAIR
C          ENTITY ARE ALL ZEROS EXCEPT ATRIB(7)=IA7.
C
C           CALL REPAIR(IA7,RT)
C           CALL SCHDL(19,RT,ATRIB)
C
C          NOW REMOVE THE ENTITY BEING PROCESSED FROM THE EVENT CALENDAR AND
C          PLACE IT NUMBER ONE IN THE DUMMY INPUT QUEUE.
C
C           CALL OUT(IA7)
C           MSTATU(IA7)=11
C
C           IF (NOPCD(IA7).EQ.2) THEN
C                IF (IOPCD(IOP(IA7)).EQ.2) THEN
C                     CALL DEPTIN(IA7)
C                ELSE
C                     NOPSTA(IOP(IA7))=0
C                ENDIF
C           ENDIF
C
C           GO TO 5750
C
C      ELSE
C
          NBRKDQ=MAXN*3+1
          CALL FILEM(NBRKDQ,ATRIB)
C
C      ENDIF
C
5750  RETURN
      END
C
C *******************************************************************
C
      SUBROUTINE CREPAI
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MSCLXV)
C
      COMMON QSET(600000)
```

```
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C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWRP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM32/XINBUP(50)
      COMMON/UCOM37/TBFDIS(50),TBFP1(50),TBFP2(50),TBFP3(50),NBRKD(50)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM45/WAITTM(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM60/IPMCD(50),IREP(50)
      COMMON/UCOM63/PULLDQ(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM72/IFAM(40),CAP(50,40),REMCAP(50,40),NUMFAM,CYCLET(50)
      COMMON/UCOM82/MAXN
C
      IA7=ATRIB(7)
C
C     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
C     GIVE PRIORITY TO THOSE.
C
      PFLAG=0
      CALL BRKCK(IA7,PFLAG)
      IF (PFLAG.EQ.0) THEN
         GO TO 5900
      ENDIF
C
C     CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
C     GIVE PRIORITY TO THOSE.
C
      IF (NAUTO.EQ.1) THEN
         PFLAG=0
         CALL AUTOCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 5900
         ENDIF
      ENDIF
C
C     CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C     IF THERE ARE,GIVE PRIORITY TO THOSE.
C
      IF (IREP(IA7).EQ.1) THEN
         PFLAG=0
         CALL RPTCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 5900
         ENDIF
      ENDIF
C
C     TRY TO PROCESS PARTS. VERIFY FIRST FOR PARTS WAITING IN THE DUMMY
C     OUTPUT BUFFER. SECOND PRIORITY IS FOR PARTS WAITING IN THE DUMMY
C     INPUT QUEUE. LAST PRIORITY IS GIVEN TO PARTS WAITING IN THE MAIN BUFFER.
C
      NIDQ=IA7+MAXN
      NODQ=IA7+MAXN*2
      MSTATU(IA7)=0
C
      IF (NNQ(NODQ).GT.0) THEN
C
C        MTYPE=3 IS A SPECIAL CASE WHERE PARTS AT THE OUTPUT BUFFER ARE
C        BEING INSPECTED WHILE THE MACHINE IS BEING REPAIRED.
C
         IF (MTYPE(IA7).EQ.3) THEN
            MSTATU(IA7)=0
            GO TO 5920
         ENDIF
C
         WRITE(6,5760) TNOW,IA7
5760     FORMAT(1X,'WARNING AT CREPAI:NNQ(NODQ)=0 AT T=',F10.2,1X,'M='
     1,I3)
         NTRY=LOCAT(1,NODQ)
         IA2=QSET(NTRY+2)
         IA4=QSET(NTRY+4)
C
C        IF THERE IS A CHANGE IN UNIT LOAD SIZE THE PARTS ARE READY TO GO
C        IF THE NUMBER IN THE BUFFER IS THE SAME AS IDEFUL(IA2,IA7).
C
         IF (IDEFUL(IA2,IA7).GT.0) THEN
            IF (NNQ(NODQ).LT.IDEFUL(IA2,IA7)) THEN
C
C                SEARCH THE DUMMY INPUT QUEUE FOR PARTS TO COMPLETE THE
C                UNIT LOAD. IF THERE ARE PARTS GO TO 5290 WHERE THE MODEL
C                CHECKS FOR NEED OF OPERATOR AND TRIES TO PROCESS PARTS.
C
                 IF (NNQ(NIDQ).GT.0) THEN
```


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```
               GO TO 5920
            ENDIF
C
            IF THERE ARE NO PARTS IN THE DUMMY INPUT QUEUE CHECK THE
C           MAIN QUEUE. IF PARTS ARE FOUND THERE, THEN REMOVE THOSE AT
C           SOURCE BLOCK STARTING AT LINE 5900. IF THERE ARE NO PARTS
C           WAITING IN THE MAIN QUEUE THEN CHANGE MACHINE STATUS TO
C           "10" SUCH THAT THE MACHINE GETS THE PART IT NEEDS TO COMPLETE
C           THE UNIT LOAD.
C
            IF (NNQ(IA7).GT.0) THEN
               GO TO 5940
            ELSE
               MSTATU(IA7)=10
               WAITTM(IA7)=TNOW
               GO TO 5980
            ENDIF
C
         ELSE
C
            REMOVE UNITS FROM OUTPUT BUFFER.
            GO TO 5900

         ENDIF

      ELSE
C
C        THERE IS NOT A CHANGE IN UNIT LOAD SIZE. THEREFORE, THE UNITS
C        ARE READY TO GO ONLY IF THE NUMBER IN THE DUMMY OUTPUT QUEUE
C        IS THE SAME AS THE UNIT LOAD SIZE.
C
         IF (NNQ(NODQ).EQ.IA4) THEN
            GO TO 5900
         ENDIF
C
C        IF THE UNITS IN THE OUTPUT BUFFER AND NOT READY TO GO, THEN
C        THE UNITS NEEDED TO COMPLETE THE UNIT LOAD "SHOULD" BE IN THE
C        DUMMY INPUT BUFFER. THIS IS TRUE SINCE THIS BRANCH IS ONLY FOR
C        THE CASES IN WHICH THERE IS NOT A CHANGE IN UNIT LOAD SIZE.
C
         IF (NNQ(NIDQ).GT.0) THEN
            GO TO 5920
         ELSE
            WRITE(6,5020)
5020        FORMAT(1X,'AT CELL6: IF THERE IS NOT A CHANGE IN')
            WRITE(6,5021)
5021        FORMAT(1X,'UNIT LOAD SIZE, THERE MUST BE PARTS IN')
            WRITE(6,5022)
5022        FORMAT(1X,'THE DUMMY INPUT QUEUE')
            STOP
         ENDIF
C
      ENDIF

      ELSE
C
C        THERE ARE NO PARTS WAITING IN THE DUMMY OUTPUT QUEUE. THEREFORE,
C        VERIFY FOR PARTS WAITING IN THE DUMMY INPUT QUEUE.
C
         GO TO 5920

      ENDIF
C
5900  QFLAG=0
C
C     TRY TO SEND THE PARTS TO THE NEXT WORKSTATION
C
      NQFLAG=1
      CALL TRADQ(IA7,QFLAG,NQFLAG)
      IF (QFLAG.EQ.0) THEN
         GO TO 5980
      ENDIF
C
C     IF THE PARTS IN THE DUMMY OUTPUT BUFFER LEAVE, THEN CHECK
C     FOR PARTS IN THE DUMMY INPUT QUEUE.
C
5920  IF (NNQ(NIDQ).GT.0) THEN
         IF (NOPCD(IA7).EQ.2) THEN
            IF (NOPSTA(IOP(IA7)).EQ.0) THEN
               NOPSTA(IOP(IA7))=1
               LASTMA(IOP(IA7))=IA7
               CALL MACHIN(IA7,NIDQ)
               IF (NTYPE(IA7).EQ.5 .AND. FULLDQ(IA7).GT.0) THEN
                  IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1            XINBUF(IA7).LT.NBUFF(IA7)) THEN
                     CALL CKBLK(IA7)
                  ENDIF
               ENDIF
               GO TO 5980
            ELSE
               MSTATU(IA7)=0
               GO TO 5980
```

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```
               ENDIF
            ELSE
C
C              NTYPE=3 IS A SPECIAL CASE IN WHICH NOPCD=1. HOWEVER, IF PARTS
C              ARE AT NIDQ IT MEANS THEY ARE READY TO BE PROCESSED.
C
               IF (NTYPE(IA7).EQ.3) THEN
                  CALL SCHDL(4,CYCLET(IA7),ATRIB)
                  TLASTP(IA7)=TNOW+CYCLET(IA7)
                  MSTATU(IA7)=1
                  START(IA7)=TNOW
                  GO TO 5980
               ENDIF

               CALL MACHIN(IA7,NIDQ)
               IF (NTYPE(IA7).EQ.5 .AND. FULLDQ(IA7).GT.0) THEN
                  IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1            XINBUF(IA7).LT.NBUFF(IA7)) THEN
                     CALL CKBLK(IA7)
                  ENDIF
               ENDIF
               GO TO 5980
            ENDIF
         ENDIF
C
C     IF THERE ARE NO PARTS WAITING IN NIDQ, THEN CHECK FOR PARTS
C     WAITING IN QUEUE.
C
5940  QFLAG=0
      SFLAG=0
      CALL QPULL(IA7,QFLAG,SFLAG)

      IF (QFLAG.EQ.0) THEN
C
         MSTATU(IA7)=0
         GO TO 5980
C
      ELSE
C
         IF (SFLAG.EQ.1 .AND. ISCHDP(IA7).NE.0) THEN
C
C           PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C           CHOSEN BY THE USER.
C
            CALL SCHEDP(IA7)
C
         ENDIF
C
C        DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C        TO BE PROCESSED.
C
         IF (NTYPE(IA7).EQ.1) THEN
            IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                 NOPSTA(IOP(IA7))=1
                 LASTMA(IOP(IA7))=IA7
                 GO TO 5960
            ELSE
                 GO TO 5980
            ENDIF
         ENDIF
C
         NTRY=MNTYPE(IA7)
         IA2=QSET(NTRY+2)
         IA10=QSET(NTRY+10)
C
C        VERIFY IF A SETUP IS NEEDED
C
         IF (MSUCD(IA7).EQ.1) THEN
            IF (IA2.NE.LASTPN(IA7)) THEN
               NSUPN=IA2
               CALL MSETUP(NSUPN,IA7)
               GO TO 5980
            ENDIF
         ENDIF
C
         IF (IA10.EQ.0) THEN
             IF (NOPCD(IA7).EQ.2) THEN
                IF (NOPSTA(IOP(IA7)).NE.0) THEN
                   GO TO 5980
                ELSE
                   NOPSTA(IOP(IA7))=1
                   LASTMA(IOP(IA7))=IA7
                   GO TO 5960
                ENDIF
             ELSE
                GO TO 5960
             ENDIF
         ENDIF

         DFLAG=1
         AFLAG=0
         PFLAG=0
```

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```
C
C        IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C        PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C        THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C        CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C        THE REMOVAL.
C
         CALL PQC(APLAG,DFLAG,PFLAG,IA7)

         IF (PFLAG.EQ.0) THEN
C
            IF (NSTATU(IA7).EQ.6) THEN
               IF ((KINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1         KINBUF(IA7).LT.NBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
            ENDIF
            GO TO 5980
C
         ELSE
C
5960        NIDQ=IA7+NMAIN

            CALL MACHIN(IA7,NIDQ)
C
            IF ((KINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1      KINBUF(IA7).LT.NBUFF(IA7)) THEN
               CALL CKBLK(IA7)
            ENDIF
C
            GO TO 5980

         ENDIF
C
      ENDIF
C
5980  RETURN
      END
C
C ***********************************************************************
C
      SUBROUTINE BRKCK(IA7,PFLAG)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NEQT),DDL(NEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(NEQT),
     2SSL(NEQT),TNEXT,TNOW,XX(MSCXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NBUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM32/NMAIN
C
      LL=0
      NBRKDQ=NMAIN*3+1
      IF (NNQ(NBRKDQ).EQ.0) THEN
         PFLAG=1
         GO TO 6000
      ELSE
C
C          PULL OUT ALL BREAKDOWNS DELAYED FOR MACHINE IA7. DO NOT
C          PULL ONLY ONE IF THERE IS MORE THAN ONE TO PREVENT ENDING THE
C          SIMULATION WITH MANY DELAYED BREAKDOWNS.
C
C          LL IS AN ACCUMULATOR OF THE NUMBER OF BREAKDOWNS DELAYED AT IA7.
C
           N=1
5990       NRANK=NFIND(N,NBRKDQ,21,0,10.0,0.0)
           IF (NRANK.GT.0) THEN
              NTRY=LOCAT(NRANK,NBRKDQ)
              I7=QSET(NTRY+7)
              IF (I7.NE.IA7) THEN
                 N=NRANK+1
                 IF (N.LE.NNQ(NBRKDQ)) THEN
                    GO TO 5990
                 ELSE
                    GO TO 5995
                 ENDIF
              ELSE
                 CALL RMOVE(NRANK,NBRKDQ,ATRIB)
                 LL=LL+1
                 N=NRANK
                 IF (N.LE.NNQ(NBRKDQ)) THEN
                    GO TO 5990
```



```
                 ELSE
                    GO TO 5995
                 ENDIF
              ENDIF
           ENDIF
C
      ENDIF

5995  IF (LL.EQ.0) THEN
         PFLAG=1
         GO TO 6000
      ELSE
         NSTATU(IA7)=11
         TRT=0
         DO 5996 KK=1,LL
         CALL REPAIR(IA7,RT)
         TRT=TRT+RT
5996     CONTINUE
         CALL SCHDL(19,TRT,ATRIB)
         GO TO 6000
      ENDIF

6000  RETURN
      END
C
C ***********************************************************************
C
      SUBROUTINE UPBRKD(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NEQT),DDL(NEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(NEQT),
     2SSL(NEQT),TNEXT,TNOW,XX(MSCXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NBUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM4/A(100)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
C
      A(1)=0
      A(2)=0
      A(3)=0
      A(4)=0
      A(5)=0
      A(6)=0
      A(7)=IA7
      A(8)=0
      A(9)=0
      A(10)=0
      A(11)=0
      A(12)=0
C
      CALL SCHDL(10,0.0,A)
C
      EXCESS=UPTIME(IA7)-BKNEXT(IA7)
      UPTIME(IA7)=EXCESS
      BT=0
      CALL BREAKS(IA7,BT)
      BKNEXT(IA7)=BT
C
      RETURN
      END
C
C ***********************************************************************
C
      SUBROUTINE AUTOMT
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(NEQT),DDL(NEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(NEQT),
     2SSL(NEQT),TNEXT,TNOW,XX(MSCXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NBUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM4/A(100)
```

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```
      COMMON/UCOM39/TLASTP(50)
      COMMON/UCOM40/REMPT(50)
      COMMON/UCOM47/NEXAUT(50),DAYLTH
      COMMON/UCOM82/MAXN
      COMMON/UCOM87/SHIFT
C
      IA7=ATRIB(7)
      NAUTOQ=MAXN*3+2
C
      IF (MSTATU(IA7).EQ.0) THEN
C
          IF (NOPSTA(IOP(IA7)).EQ.0) THEN
             NOPSTA(IOP(IA7))=4
             LASTMA(IOP(IA7))=IA7
             MSTATU(IA7)=4
             CALL AUTONO(IA7,ATIME)
             CALL SCHDL(16,ATIME,ATRIB)
          ELSE
             CALL FILEM(NAUTOQ,ATRIB)
          ENDIF
C
          GO TO 6040
C
      ENDIF
C
C      IF (MSTATU(IA7).EQ.1) THEN
C
C         IF (NOPCD(IA7).EQ.2 .OR. (NOPCD(IA7).EQ.1 .AND. NOPSTA
C     1    (IOP(IA7)).EQ.0)) THEN
C
C            FIRST SCHEDULE THE CAUTON SUCH THAT THE ATTRIBUTES OF THE
C            ENTITY ARE ALL ZEROS EXCEPT ATRIB(7)=IA7.
C
C             NOPSTA(IOP(IA7))=4
C             LASTMA(IOP(IA7))=IA7
C             MSTATU(IA7)=4
C             CALL AUTONO(IA7,ATIME)
C             CALL SCHDL(16,ATIME,ATRIB)
C
C            NOW REMOVE THE ENTITY BEING PROCESSED FROM THE EVENT CALENDAR
C            AND PLACE IT NUMBER ONE IN THE DUMMY INPUT QUEUE.
C
C             CALL OUT(IA7)
C           ELSE
C             CALL FILEM(NAUTOQ,ATRIB)
C           ENDIF
C      ELSE

          CALL FILEM(NAUTOQ,ATRIB)

C      ENDIF
C
C     SCHEDULE THE NEXT AUTONOMOUS MAINTENANCE
C
6040  A(1)=0
      A(2)=0
      A(3)=0
      A(4)=0
      A(5)=0
      A(6)=0
      A(7)=IA7
      A(8)=0
      A(9)=0
      A(10)=0
      A(11)=0
      A(12)=0

      CALL SCHDL(15,SHIFT,A)

6050  RETURN
      END
C
C *****************************************************************
C
      SUBROUTINE CAUTON
C
      INCLUDE '/nesu/juilsan_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MSUCD(50),MQCD(50),MAXBSC(50),
     1 NOEPSC(50),MBUFF(50),MBUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),MSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPM(50),LASLOT(50),LASTMA(50),MBLASC(50),MBLAMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
```



```
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM32/ZINBUF(50)
      COMMON/UCOM45/WAITTM(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM60/IFMCD(50),IREP(50)
      COMMON/UCOM63/PULLDQ(50)
      COMMON/UCOM82/MAXN
C
      IA7=ATRIB(7)
      NIDQ=IA7+MAXN
      NODQ=IA7+MAXN*2
      MSTATU(IA7)=0
      NOPSTA(IOP(IA7))=0
C
C     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
C     GIVE PRIORITY TO THOSE.
C
      FFLAG=0
      CALL BRKCK(IA7,FFLAG)
      IF (FFLAG.EQ.0) THEN
         IF (IOPCD(IOP(IA7)).EQ.3) THEN
            CALL DESTIN(IA7)
         ENDIF
         GO TO 6110
      ENDIF
C
C     CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C     IF THERE ARE,GIVE PRIORITY TO THOSE.
C
      IF (IREP(IA7).EQ.1) THEN
         FFLAG=0
         CALL RSTCK(IA7,FFLAG)
         IF (FFLAG.EQ.0) THEN
            GO TO 6110
         ENDIF
      ENDIF
C
C     TRY TO PROCESS PARTS. VERIFY FIRST FOR PARTS WAITING IN THE DUMMY
C     OUTPUT BUFFER. SECOND PRIORITY IS FOR PARTS WAITING IN THE DUMMY
C     INPUT QUEUE. LAST PRIORITY IS GIVEN TO PARTS WAITING IN THE MAIN BUFFER.
C
      IF (NNQ(NODQ).GT.0) THEN

         WRITE(6,6055) TNOW,IA7
6055     FORMAT(1X,'WARNING AT CAUTON:NNQ(NODQ)=0 AT T=',F10.2,'M='
     1,I3)
         NTRY=LOCAT(1,NODQ)
         IA2=QSET(NTRY+2)
         IA4=QSET(NTRY+4)
C
C        IF THERE IS A CHANGE IN UNIT LOAD SIZE THE PARTS ARE READY TO GO
C        IF THE NUMBER IN THE BUFFER IS THE SAME AS IDEFUL(IA2,IA7).
C
         IF (IDEFUL(IA2,IA7).GT.0) THEN
              IF (NNQ(NODQ).LT.IDEFUL(IA2,IA7)) THEN
C
C               SEARCH THE DUMMY INPUT QUEUE FOR PARTS TO COMPLETE THE
C               UNIT LOAD.
C
                IF (NNQ(NIDQ).GT.0) THEN
                   GO TO 6075
                ENDIF
C
C               IF THERE ARE NO PARTS IN THE DUMMY INPUT QUEUE CHECK THE
C               MAIN QUEUE. IF PARTS ARE FOUND THERE, THEN REMOVE THOSE AT
C               SOURCE BLOCK STARTING AT LINE 6065. IF THERE ARE NO PARTS
C               WAITING IN THE MAIN QUEUE THEN CHANGE MACHINE STATUS TO
C               '10' SUCH THAT THE MACHINE GETS THE PART IT NEEDS TO COMPLETE
C               THE UNIT LOAD.
C
                IF (NNQ(IA7).GT.0) THEN
                   GO TO 6080
                ELSE
                   MSTATU(IA7)=10
                   WAITTM(IA7)=TNOW
C
                   IF (IOPCD(IOP(IA7)).EQ.3) THEN
                      CALL DESTIN(IA7)
                   ENDIF
C
                   GO TO 6110
                ENDIF
              ELSE
C
C               REMOVE UNITS FROM OUTPUT BUFFER.
C
                GO TO 6065
              ENDIF

         ELSE
C
C              THERE IS NOT A CHANGE IN UNIT LOAD SIZE. THEREFORE, THE UNITS
```

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C           ARE READY TO GO ONLY IF THE NUMBER IN THE DUMMY OUTPUT QUEUE
C           IS THE SAME AS THE UNIT LOAD SIZE.
C
            IF (NNQ(NODQ).EQ.IA6) THEN
               GO TO 6065
            ENDIF
C
C           IF THE UNITS IN THE OUTPUT BUFFER AND NOT READY TO GO, THEN
C           THE UNITS NEEDED TO COMPLETE THE UNIT LOAD 'SHOULD' BE IN THE
C           DUMMY INPUT BUFFER. THIS IS TRUE SINCE THIS BRANCH IS ONLY FOR
C           THE CASES IN WHICH THERE IS NOT A CHANGE IN UNIT LOAD SIZE.
C
            IF (NNQ(NIDQ).GT.0) THEN
               GO TO 6075
            ELSE
               WRITE(6,6060)
6060           FORMAT(1X,'AT CAUTON/CKEPLEN IF THERE IS NOT A CHANGE')
               WRITE(6,6061)
6061           FORMAT(1X,' IN UNIT LOAD SIZE, THERE MUST BE PARTS IN')
               WRITE(6,6062) TNOW,IA7
6062           FORMAT(1X,'THE DUMMY INPUT QUEUE:TNOW=',F10.2,1X,'N='
     1,I3)
               STOP
            ENDIF
C
         ENDIF
C
      ELSE
C
C        THERE ARE NO PARTS WAITING IN THE DUMMY OUTPUT QUEUE. THEREFORE,
C        VERIFY FOR PARTS WAITING IN THE DUMMY INPUT QUEUE.
C
         GO TO 6075
C
      ENDIF
C
6065  QFLAG=0
C
C     TRY TO SEND THE PARTS TO THE NEXT WORKSTATION
C
      NQFLAG=1
      CALL TRADQ(IA7,QFLAG,NQFLAG)
      IF (QFLAG.EQ.0) THEN
C
         IF (IOPCD(IOP(IA7)).EQ.2) THEN
             CALL DESTIN(IA7)
         ENDIF
C
         GO TO 6110
C
      ENDIF
C
C     IF THE PARTS IN THE DUMMY OUTPUT BUFFER LEAVE, THEN CHECK
C     FOR PARTS IN THE DUMMY INPUT QUEUE.
C
      IF (NOPSTA(IOP(IA7)).NE.0) THEN
         GO TO 6110
      ENDIF
C
6075  IF (NNQ(NIDQ).GT.0) THEN
         IF (NOPCD(IA7).EQ.2) THEN
            NOPSTA(IOP(IA7))=1
            LASTMA(IOP(IA7))=IA7
            CALL MACHIN(IA7,NIDQ)
            IF (MTYPE(IA7).EQ.5 .AND. FULLDQ(IA7).GT.0) THEN
               IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1         XINBUF(IA7).LT.MBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
            ENDIF
         ELSE
            CALL MACHIN(IA7,NIDQ)
            IF (MTYPE(IA7).EQ.5 .AND. FULLDQ(IA7).GT.0) THEN
               IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1         XINBUF(IA7).LT.MBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
            ENDIF
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
                CALL DESTIN(IA7)
            ENDIF
         ENDIF
         GO TO 6110
      ENDIF
C
C     IF THERE ARE NO PARTS WAITING IN NIDQ, THEN CHECK FOR PARTS
C     WAITING IN QUEUE.
C
6080  QFLAG=0
      SFLAG=0
      CALL QPULL(IA7,QFLAG,SFLAG)
```

```
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      IF (QFLAG.EQ.0) THEN
C
         MSTATU(IA7)=0
         IF (IOPCD(IOP(IA7)).EQ.2) THEN
             CALL DESTIN(IA7)
         ENDIF
         GO TO 6110
C
      ELSE
C
         IF (SFLAG.EQ.1 .AND. ISCHDP(IA7).NE.0) THEN
C
C           PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C           CHOSEN BY THE USER.
C
            CALL SCHEDP(IA7)
C
         ENDIF
C
C        DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C        TO BE PROCESSED.
C
         IF (MTYPE(IA7).EQ.3) THEN
            NOPSTA(IOP(IA7))=1
            LASTMA(IOP(IA7))=IA7
            GO TO 6100
         ENDIF
C
         NTRY=MMFE(IA7)
         IA2=QSET(NTRY+2)
         IA10=QSET(NTRY+10)
C
C        VERIFY IF A SETUP IS NEEDED
C
         IF (MSUCD(IA7).EQ.1) THEN
            IF (IA2.NE.LASTPN(IA7)) THEN
               NSUPN=IA2
               CALL MSETUP(NSUPN,IA7)
               IF (NOPSTA(IOP(IA7)).EQ.0) THEN
                  IF (IOPCD(IOP(IA7)).EQ.2) THEN
                     CALL DESTIN(IA7)
                  ENDIF
               ENDIF
               GO TO 6110
            ENDIF
         ENDIF
C
         IF (IA10.EQ.0) THEN
             IF (NOPCD(IA7).EQ.2) THEN
                NOPSTA(IOP(IA7))=1
                LASTMA(IOP(IA7))=IA7
                GO TO 6100
             ELSE
                GO TO 6100
             ENDIF
         ENDIF
C
         DFLAG=1
         AFLAG=0
         FFLAG=0
C
C        IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C        PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C        THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C        CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C        THE REMOVAL.
C
         CALL FQC(AFLAG,DFLAG,FFLAG,IA7)
C
         IF (FFLAG.EQ.0) THEN
C
            IF (MSTATU(IA7).EQ.6) THEN
               IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1         XINBUF(IA7).LT.MBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
            ENDIF
            GO TO 6110
C
         ELSE
C
6100        NIDQ=IA7+MAXN
C
            CALL MACHIN(IA7,NIDQ)
C
            IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1      XINBUF(IA7).LT.MBUFF(IA7)) THEN
                CALL CKBLK(IA7)
            ENDIF
C
            IF (NOPSTA(IOP(IA7)).EQ.0) THEN
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
```

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```
                CALL DESTIN(IA7)
              ENDIF
           ENDIF

         ENDIF
C
      ENDIF
C
6110  RETURN
      END
C
C ***********************************************************************

      SUBROUTINE AUTOCK(IA7,FFLAG)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NANRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM32/MAXN
C
      FFLAG=0
      IF (NOPSTA(IOP(IA7)).NE.0) THEN
         FFLAG=1
         GO TO 6140
      ENDIF
C
      LL=0
      NAUTOQ=NMACH*3+2
      IF (NNQ(NAUTOQ).EQ.0) THEN
         FFLAG=1
         GO TO 6140
      ELSE
C
C           PULL OUT ALL AUTO.MAINT. DELAYED FOR MACHINE IA7. DO NOT
C           PULL ONLY ONE IF THERE IS MORE THAN ONE TO PREVENT ENDING THE
C           SIMULATION WITH MANY DELAYED AUTO.MAINT.
C
C           LL IS AN ACCUMULATOR OF THE NUMBER OF AUTO.MAINT. DELAYED AT IA7.
C
           N=1
6120       NRANK=NFIND(N,NAUTOQ,21,0,15.0,0.0)
           IF (NRANK.GT.0) THEN
              NTRY=LOCAT(NRANK,NAUTOQ)
              I7=QSET(NTRY+7)
              IF (I7.NE.IA7) THEN
                 N=NRANK+1
                 IF (N.LE.NNQ(NAUTOQ)) THEN
                    GO TO 6120
                 ELSE
                    GO TO 6130
                 ENDIF
              ELSE
                 CALL RMOVE(NRANK,NAUTOQ,ATRIB)
                 LL=LL+1
                 N=NRANK
                 IF (N.LE.NNQ(NAUTOQ)) THEN
                    GO TO 6120
                 ELSE
                    GO TO 6130
                 ENDIF
              ENDIF
           ENDIF
C
      ENDIF

6130  IF (LL.EQ.0) THEN
         FFLAG=1
         GO TO 6140
      ELSE
         NSTATU(IA7)=4
         NOPSTA(IOP(IA7))=4
         LASTMA(IOP(IA7))=IA7
         TAT=0
         DO 6135 KK=1,LL
         CALL AUTOMO(IA7,ATIME)
         TAT=TAT+ATIME
6135     CONTINUE
         CALL SCHDL(16,TAT,ATRIB)
      ENDIF
```



```
6140  RETURN
      END
C
C ***********************************************************************
C
      SUBROUTINE AUTOMO(I,ATIME)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM46/NAUTOD(50),AUTOP1(50),AUTOP2(50),AUTOP3(50),TOTAUT

      common/ucomd/iffl
C
      GO TO (6151,6152,6153,6154,6155,6156,6157,6158,6159,6160
     1) NAUTOD(I)
C
6151  ATIME=EXPON(AUTOP1(I),14)
      GO TO 6161
C
6152  ATIME=UNFRM(AUTOP1(I),AUTOP2(I),14)
      GO TO 6161
C
6153  ATIME=WEIBL(AUTOP1(I),AUTOP2(I),14)
      GO TO 6161
C
6154  ATIME=TRIAG(AUTOP1(I),AUTOP2(I),AUTOP3(I),14)
      GO TO 6161
C
6155  ATIME=RNORM(AUTOP1(I),AUTOP2(I),14)
      GO TO 6161
C
6156  ATIME=RLOGN(AUTOP1(I),AUTOP2(I),14)
      GO TO 6161
C
6157  ATIME=ERLNG(AUTOP1(I),AUTOP2(I),14)
      GO TO 6161
C
6158  ATIME=GAMA(AUTOP1(I),AUTOP2(I),14)
      GO TO 6161
C
6159  ATIME=BETA(AUTOP1(I),AUTOP2(I),14)
      GO TO 6161
C
6160  ATIME=AUTOP1(I)
C
6161  TOTAUT=TOTAUT+ATIME

      RETURN
      END
C
C ***********************************************************************
C
      SUBROUTINE CSCRAP
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NANRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELOL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NOTMA,WALKLO
      COMMON/UCOM8/SUTHE,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLON(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANGE,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
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      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
C
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      COMMON/UCOM26/NP3,NP4
      COMMON/UCOM27/NOP
      common/ucomd/iffl

      COMMON/UCOM28/SESCP,SUSCP,SERWP,SURWP
      COMMON/UCOM29/MINITR,NDESTR
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM31/NLONG(10),NUNITS(50)
c
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
      CCMMON/UCOM34/NOBOP(50,14),NOBMA(50,40),PERCOP(50,14)
     1,PERCMA(50,14)
C
      COMMON/UCOM35/IBLKSC(50),NNABLK(50),NBLK(50,50)
      COMMON/UCOM36/TRAIN,WCIN
      COMMON/UCOM37/TBPDIS(50),TBPP1(50),TBPP2(50),TBPP3(50),NBGKD(50)
      COMMON/UCOM38/TTRDIS(50),TTRP1(50),TTRP2(50),TTRP3(50),SCREW
      COMMON/UCOM39/TOTNT
      COMMON/UCOM40/REMPT(50)
      COMMON/UCOM41/NBRKW(50)
      COMMON/UCOM42/NTL(40,500),TL(40,500),NL(40,50),NPL(40,50)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTM(50)
      COMMON/UCOM45/WAITTM(50)
      COMMON/UCOM46/NAUTOD(50),AUTOP1(50),AUTOP2(50),AUTOP3(50),TOTAUT
      COMMON/UCOM47/NEXAUT(50),DAYLTM
      COMMON/UCOM48/NAUTO
      COMMON/UCOM49/PGICC(40),CR
      COMMON/UCOM50/RA,CUSLT,NLO,DPCLO,RLENGN
      COMMON/UCOM58/PGINV(40),MAXPG(40),PGCAP(40),PGCC(40)
      COMMON/UCOM63/PULLDQ(50)
      COMMON/UCOM79/NFACT,IREP
      COMMON/UCOM82/MAXN

C
      IA2=ATRIB(2)
      IA3=ATRIB(3)
      IA8=ATRIB(8)
C
      IPG=MAXN+1
      NPARTS=NPARTS+LSCRAP(IA2,IA3)
      NP(IA2)=NP(IA2)+LSCRAP(IA2,IA3)
      TOTAL(IA2,IA3)=TOTAL(IA2,IA3)+LSCRAP(IA2,IA3)
C
C     EVALUATE MAXIMUM UNITS OF PG IN INV
C
      PGINV(IA2)=PGINV(IA2)+LSCRAP(IA2,IA3)
      IF (PGINV(IA2).GT.MAXPG(IA2)) THEN
          MAXPG(IA2)=PGINV(IA2)
      ENDIF
C
      PLEADT=TNOW-ATRIB(1)
      CALL COLCT(PLEADT,1)
      TOTLOT=TOTLOT+1
      IF (ATRIB(5).GT.TNOW) THEN
C
C         THE LOT WILL STAY IN INVENTORY FOR A WHILE. THEREFORE,
C         CALCULATE CARRYING COST.
C
          PGICC(IA2)=PGICC(IA2)+(ATRIB(5)-TNOW)*PNCOST(IA2,IPG)*
     1                 IA8*CR
      ELSE
C
C         THE LOT IS LATE, CALCULATE LATENESS COST.
C
          NLO=NLO+1
          TLATE=TNOW-ATRIB(5)
          RATE=EXP((.6931/RA)*(TLATE/CUSLT))-1
          IF (RATE.GT.1) THEN
             RATE=1
          ENDIF
          DPCLO=DPCLO+RATE*PNCOST(IA2,IPG)*IA8
C
      ENDIF
C
C     REDUCE PGINV BY LOT SIZE
C
      PGINV(IA2)=PGINV(IA2)-IA8
C
```



```
C     REMOVE LOT FROM QUEUE OF RELEASED ORDERS IN PROCESS.
C
      LOTQ=MAXN*3+3
      N=1
      A2=IA2
6100  NRANK=NFIND(N,LOTQ,2,4,A2,0.0)
      NTRY=LOCAT(NRANK,LOTQ)
      IPN=QSET(NTRY+2)
      ILOT=QSET(NTRY+3)
      IF (IPN.EQ.IA2 .AND. ILOT.EQ.IA3) THEN
          CALL RMOVE(NRANK,LOTQ,ATRIB)
      ELSE
          N=N+1
          GO TO 6100
      ENDIF
C
      RETURN
      END
C
C ******************************************************************
C
      SUBROUTINE CLRSTA
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NPUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTTP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
C
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      COMMON/UCOM26/NP3,NP4
      COMMON/UCOM27/NOP
      common/ucomd/iffl

      COMMON/UCOM28/SESCP,SUSCP,SERWP,SURWP
      COMMON/UCOM29/MINITR,NDESTR
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM31/NLONG(10),NUNITS(50)
c
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
      COMMON/UCOM34/NOBOP(50,14),NOBMA(50,40),PERCOP(50,14)
     1,PERCMA(50,14)
C
      COMMON/UCOM35/IBLKSC(50),NNABLK(50),NBLK(50,50)
      COMMON/UCOM36/TRAIN,WCIN
      COMMON/UCOM37/TBPDIS(50),TBPP1(50),TBPP2(50),TBPP3(50),NBGKD(50)
      COMMON/UCOM38/TTRDIS(50),TTRP1(50),TTRP2(50),TTRP3(50),SCREW
      COMMON/UCOM39/TOTNT
      COMMON/UCOM40/REMPT(50)
      COMMON/UCOM41/NBRKW(50)
      COMMON/UCOM42/NTL(40,500),TL(40,500),NL(40,50),NPL(40,50)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTM(50)
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```
      COMMON/UCOM45/WAITTM(50)
      COMMON/UCOM46/NAUTOD(50),AUTOP1(50),AUTOP2(50),AUTOP3(50),TOTAUT
      COMMON/UCOM47/NEXAUT(50),DAYLTH
      COMMON/UCOM48/NAUTO
      COMMON/UCOM49/PGICC(40),CR
      COMMON/UCOM50/RA,CUSLT,NLO,DPCLO,RLENGH
      COMMON/UCOM51/SUMWIP(40,50),NOBWIP(40,50)
      COMMON/UCOM52/WIP(40,50)
      COMMON/UCOM54/NYRS,SUINV,PNINV,NEINV,QAINV,RELAY,PSPACE
      COMMON/UCOM55/WQ,OWQ,NSUCNW,SUWQ,NSUSC,SUTRAI,SUTWRK,NWEEKS,AIR
      COMMON/UCOM56/PNTRAI,PNCOST,SWQ,PC(50),NPENP
      COMMON/UCOM57/TRWK(40,50),QAWQ,RWKC(40,50),QATRAI
      COMMON/UCOM58/PGINV(40),MAXPG(40),PGCAP(40),PGCC(40)
      COMMON/UCOM59/NCOPG(40)
      COMMON/UCOM63/PULLOQ(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM83/MAXN
C
      DO 6200 I=1,MAXN
      NBRLD(I)=0
      TOTUP(I)=0
      IF (NSTATU(I).EQ.1) THEN
         START(I)=TNOW
      ENDIF
      IF (NSTATU(I).EQ.10) THEN
         WAITTM(I)=TNOW
      ENDIF
      IF (NSTATU(I).EQ.2) THEN
         BLATM(I)=TNOW
      ENDIF
6200  CONTINUE
C
      TOTRT=0
C
      DO 6205 I=1,NPN
      NP(I)=0
      MAXPG(I)=0
      SCRAP(I)=0
6205  CONTINUE
C
      NPARTS=0
      TOTLOT=0
      NOBSCA=0
      MAXCA=0
      ICASUM=0
C
      DO 6210 I=1,NPN
      DO 6210 J=1,MAXN
      TOTSCR(I,J)=0
      SUMWIP(I,J)=0
      NOBWIP(I,J)=0
      TRWK(I,J)=0
6210  CONTINUE
C
      DO 230 I=1,NCONF
      NOBSCO(I)=0
      ICOSUM(I)=0
      MAXCO(I)=0
230   CONTINUE

      OPNDT=0
      NOTMA=0
      SUTEX=0
      SUTIN=0
      TRAIN=0
      WCIN=0
      TSUCIN=0
      TSELIN=0
      TSUCMA=0
      TSELMA=0
      TOTQA=0
      TQARWK=0
      TOTAUT=0
C
      DO 6215 I=1,NOP
      DO 6215 J=1,14
      NOBOP(I,J)=0
6215  CONTINUE
C
      DO 6220 I=1,MAXN
      DO 6220 J=1,14
      NOBMA(I,J)=0
6220  CONTINUE
C
      DPCLO=0
      NLO=0
C
      RETURN
      END
C
C ****************************************************************
C
```

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```
      SUBROUTINE MINSTP
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),MNOCD(50),NQCD(50),MANRSC(50),
     1 NOEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWEP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPOL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLESC(50),NBLEMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM3/NMACH
      COMMON/UCOM4/A(100)
      COMMON/UCOM38/TLASTP(50)
      COMMON/UCOM40/REDPT(50)
      COMMON/UCOM47/NEXAUT(50),DAYLTH
      COMMON/UCOM61/TBRDIS(50),TBRP1(50),TBRP2(50),TBRP3(50)
      COMMON/UCOM62/TTREP(50),TREP1(50),TREP2(50),TREP3(50)
      COMMON/UCOM83/MAXN
C
      IA7=ATRIB(7)
      NMSTPQ=MAXN*3+4
C
      IF (NSTATU(IA7).EQ.0) THEN
C
         IF (NOPSTA(IOP(IA7)).EQ.0) THEN
            NOPSTA(IOP(IA7))=12
            LASTMA(IOP(IA7))=IA7
            NSTATU(IA7)=12
            CALL NSTPT(IA7,STPT)
            CALL SCHDL(23,STPT,ATRIB)
         ELSE
            CALL FILEM(NMSTPQ,ATRIB)
         ENDIF
C
         GO TO 6255
C
      ENDIF
C
C      IF (NSTATU(IA7).EQ.1) THEN
C
C         IF (NOPCD(IA7).EQ.2 .OR. (NOPCD(IA7).EQ.1 .AND. NOPSTA
C     1    (IOP(IA7)).EQ.0)) THEN
C
C            FIRST SCHEDULE THE CHSTP SUCH THAT THE ATTRIBUTES OF THE
C            ENTITY ARE ALL ZEROS EXCEPT ATRIB(7)=IA7.
C
C             NOPSTA(IOP(IA7))=12
C             LASTMA(IOP(IA7))=IA7
C             NSTATU(IA7)=12
C             CALL NSTPT(IA7,STPT)
C             CALL SCHDL(23,STPT,ATRIB)
C
C            NOW REMOVE THE ENTITY BEING PROCESSED FROM THE EVENT CALENDAR
C            AND PLACE IT NUMBER ONE IN THE DUMMY INPUT QUEUE.
C
C             CALL OUT(IA7)
C           ELSE
C             CALL FILEM(NMSTPQ,ATRIB)
C           ENDIF
C       ELSE
           CALL FILEM(NMSTPQ,ATRIB)
C       ENDIF
C
C      SCHEDULE THE NEXT MINOR STOPPAGE
C
6255  A(1)=0
      A(2)=0
      A(3)=0
      A(4)=0
      A(5)=0
      A(6)=0
      A(7)=IA7
      A(8)=0
      A(9)=0
      A(10)=0
      A(11)=0
      A(12)=0

      NT=0
      CALL MINREP(IA7,NT)
      CALL SCHDL(22,NT,A)

6260  RETURN
      END
C
```

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```
C ******************************************************************
      SUBROUTINE MSTCK(IA7,FFLAG)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLEMON(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IOL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM61/TBRDIS(50),TBRP1(50),TBRP2(50),TBRP3(50)
      COMMON/UCOM62/TTREP(50),TREP1(50),TREP2(50),TREP3(50)
      COMMON/UCOM92/MAXB
C
      IF (NOPSTA(IOP(IA7)).NE.0) THEN
         FFLAG=1
         GO TO 6290
      ENDIF
C
      LL=0
      NMSTPQ=MAINT*3+4
      IF (NNQ(NMSTPQ).EQ.0) THEN
         FFLAG=1
         GO TO 6290
      ELSE
C
C           PULL OUT ALL MINOR STOPPAGES DELAYED FOR MACHINE IA7. DO NOT
C           PULL ONLY ONE IF THERE IS MORE THAN ONE TO PREVENT ENDING THE
C           SIMULATION WITH MANY DELAYED AUTO.MAINT.
C
C           LL IS AN ACCUM. OF THE NUMBER OF MINOR STOPPAGES DELAYED AT IA7
C
            N=1
6270        NRANK=NFIND(N,NMSTPQ,21,0,22.0,0.0)
            IF (NRANK.GT.0) THEN
               NTRY=LOCAT(NRANK,NMSTPQ)
               I7=QSET(NTRY+7)
               IF (I7.NE.IA7) THEN
                  N=NRANK+1
                  IF (N.LE.NNQ(NMSTPQ)) THEN
                     GO TO 6270
                  ELSE
                     GO TO 6280
                  ENDIF
               ELSE
                  CALL RMOVE(NRANK,NMSTPQ,ATRIB)
                  LL=LL+1
                  N=NRANK
                  IF (N.LE.NNQ(NMSTPQ)) THEN
                     GO TO 6270
                  ELSE
                     GO TO 6280
                  ENDIF
               ENDIF
            ENDIF
C
      ENDIF

6280  IF (LL.EQ.0) THEN
         FFLAG=1
         GO TO 6290
      ELSE
         NSTATU(IA7)=12
         NOPSTA(IOP(IA7))=12
         LASTMA(IOP(IA7))=IA7
         TMSTT=0
         DO 6285 KK=1,LL
         CALL MSTPT(IA7,STPT)
         TMSTT=TMSTT+STPT
6285     CONTINUE
         CALL SCHDL(23,TMSTT,ATRIB)
      ENDIF

6290  RETURN
      END
C
C ******************************************************************
C
      SUBROUTINE MSTPT(I,RT)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
```



```
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM46/MAUTOD(50),AUTOP1(50),AUTOP2(50),AUTOP3(50),TOTAUT
      COMMON/UCOM61/TBRDIS(50),TBRP1(50),TBRP2(50),TBRP3(50)
      COMMON/UCOM62/TTREP(50),TREP1(50),TREP2(50),TREP3(50)

      common/ucomd/iffl
C
      GO TO (6301,6302,6303,6304,6305,6306,6307,6308,6309,6310
     1) TTREP(I)
C
6301  RT=EXPON(TREP1(I),16)
      GO TO 6311
C
6302  RT=UNFRM(TREP1(I),TREP2(I),16)
      GO TO 6311
C
6303  RT=WEIBL(TREP1(I),TREP2(I),16)
      GO TO 6311
C
6304  RT=TRIAG(TREP1(I),TREP2(I),TREP3(I),16)
      GO TO 6311
C
6305  RT=RNORM(TREP1(I),TREP2(I),16)
      GO TO 6311
C
6306  RT=RLOGN(TREP1(I),TREP2(I),16)
      GO TO 6311
C
6307  RT=ERLNG(TREP1(I),TREP2(I),16)
      GO TO 6311
C
6308  RT=GAMA(TREP1(I),TREP2(I),16)
      GO TO 6311
C
6309  RT=BETA(TREP1(I),TREP2(I),16)
      GO TO 6311
C
6310  RT=TREP1(I)
C
6311  RETURN

      END
C
C ******************************************************************
C
      SUBROUTINE MBRKDP(I,RT)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM46/MAUTOD(50),AUTOP1(50),AUTOP2(50),AUTOP3(50),TOTAUT
      COMMON/UCOM61/TBRDIS(50),TBRP1(50),TBRP2(50),TBRP3(50)
      COMMON/UCOM62/TTREP(50),TREP1(50),TREP2(50),TREP3(50)

      common/ucomd/iffl
C
      GO TO (6321,6322,6323,6324,6325,6326,6327,6328,6329,6330
     1) TBRDIS(I)
C
6321  RT=EXPON(TBRP1(I),15)
      GO TO 6331
C
6322  RT=UNFRM(TBRP1(I),TBRP2(I),15)
      GO TO 6331
C
6323  RT=WEIBL(TBRP1(I),TBRP2(I),15)
      GO TO 6331
C
6324  RT=TRIAG(TBRP1(I),TBRP2(I),TBRP3(I),15)
      GO TO 6331
C
6325  RT=RNORM(TBRP1(I),TBRP2(I),15)
      GO TO 6331
C
6326  RT=RLOGN(TBRP1(I),TBRP2(I),15)
      GO TO 6331
C
6327  RT=ERLNG(TBRP1(I),TBRP2(I),15)
      GO TO 6331
C
6328  RT=GAMA(TBRP1(I),TBRP2(I),15)
      GO TO 6331
C
6329  RT=BETA(TBRP1(I),TBRP2(I),15)
      GO TO 6331
C
```

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```
6330  RT=TBRP1(I)
C
6331  RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE AIMS(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(NATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1NSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MSUCD(50),MQCD(50),MASRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLEMON(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWLP1,TRWLP2,TRWLP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM19/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
C
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTM(50)
      COMMON/UCOM45/WAITTM(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM60/IPWCD(50),IREP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM64/CAPAV(50)
      COMMON/UCOM82/MAXN
C
      IA2=ATRIB(2)
      IA4=ATRIB(4)
      IA10=ATRIB(10)
C
      IF (MSTATU(IA7).EQ.10 .AND. IA2.EQ.LASTPN(IA7)) THEN
C
C         IF THE MACHINE IS WAITING FOR THIS PART NUMBER DO NOT
C         CHECK QUEUE STATUS. GIVE PRIORITY TO THIS PART.
C
          CALL FILEM(IA7,ATRIB)
C
          IF (NNQ(IA7).GT.1) THEN
             DO 6340 I=1,NNQ(IA7)-1
             CALL RMOVE(1,IA7,ATRIB)
             CALL FILEM(IA7,ATRIB)
6340         CONTINUE
          ENDIF
C
C         SAVE UPTIME AND DETERMINE IF IT IS TIME TO SCHEDULE THE NEXT BRKDWN.
C
          TTBLK=TNOW-WAITTM(IA7)
          UPTIME(IA7)=UPTIME(IA7)+TTBLK
          TOTUP(IA7)=TOTUP(IA7)+TTBLK
          WAITTM(IA7)=0
C
          IF (BRKDSC.EQ.2) THEN
             IF (UPTIME(IA7).GT.BKNEXT(IA7)) THEN
```



```
                CALL UPBKD(IA7)
             ENDIF
          ENDIF
C
C         CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE
C         ARE, THEN GIVE PRIORITY TO THOSE.
C
          PFLAG=0
          MSTATU(IA7)=0
C
          CALL BRKCK(IA7,PFLAG)
          IF (PFLAG.EQ.0) THEN
             IF (NOPCD(IA7).EQ.2) THEN
                IF (IOPCD(IOP(IA7)).EQ.2) THEN
                   CALL DESTIN(IA7)
                ENDIF
             ENDIF
             GO TO 6360
          ENDIF
C
C         CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED.
C         IF THERE ARE,GIVE PRIORITY TO THOSE.
C
          PFLAG=0
          CALL AUTOCK(IA7,PFLAG)
          IF (PFLAG.EQ.0) THEN
C
             GO TO 6360
          ENDIF
C
C         CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C         IF THERE ARE,GIVE PRIORITY TO THOSE.
C
          IF (IREP(IA7).EQ.1) THEN
             PFLAG=0
             CALL MSTCK(IA7,PFLAG)
             IF (PFLAG.EQ.0) THEN
                GO TO 6360
             ENDIF
          ENDIF
C
          GO TO 6351
C
      ENDIF
C
      IF (NNQ(IA7) .GT. 0 .OR. CAPAV(IA7) .EQ. 0) THEN
         CALL FILEM(IA7,ATRIB)
      RETURN
      ENDIF
C
      IF (MSTATU(IA7).EQ.0 .OR. MSTATU(IA7).EQ.1) THEN
C
C        DETERMINE IF THE UNIT REQUIRES A MACHINE SETUP
C
         IF (IA2 .NE. LASTPN(IA7)) THEN
C
            IF (MSUCD(IA7) .EQ. 1) THEN
               NSUPN=IA2
C
C              PUT THE ENTITY IN QUEUE SUCH THAT AT TRADSU OR MCSU THE QUEUE
C              IS SEARCHED FOR THE ATTRIBUTES OF THE ENTITY THAT ARRIVED
C              OR THE ONE THAT WAS ALREADY IN QUEUE
C
               CALL FILEM(IA7,ATRIB)
C
C              IF DIFFERENT PARTS ARE BEING PROCESSED, THEN LEAVE THE UNIT
C              LOAD IN QUEUE UNTIL THE MACHINE IS EMPTY.
C
               IF (CAPAV(IA7).EQ.MCAP(IA7)) THEN
                  CALL MSETUP(NSUPN,IA7)
               ENDIF
C
               RETURN
            ENDIF
         ENDIF
C
C        THERE WILL BE NO INSPECTION AT THIS STATION. INSPECTION IS MODELLED
C        AS A SEPARATE OPERATION BEFORE AND/OR AFTER THIS STATION.
C
6350     CALL FILEM(IA7,ATRIB)
6351     NIDQ=IA7+MAXN
         CALL MACHIN(IA7,NIDQ)
C
        IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND. XINBUF(IA7)
     1  .LT.MBUFF(IA7)) THEN
           CALL CRBLK(IA7)
         ENDIF
C
         GO TO 6360
      ENDIF
C
      CALL FILEM(IA7,ATRIB)
```

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```
C
6360  RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE M5(IA7,NIDQ)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MSCXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/MALKEN,NAVNT,OPNDT,NDTMA,MALKLO
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQAREK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
      COMMON/UCOM30/TLASTP(50)
C
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM40/RENPT(50)
      COMMON/UCOM43/BRKDOC,BRNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM64/CAPAV(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM82/MAXN
C
      NODQ=IA7+MAXN*2
C
C     M5 CAN BE CALLED TO PROCESS UNITS REMOVED FOR A MACHINE STOPPAGE OR
C     AFTER A DEPARTURE TO PULL UNITS FROM QUEUE OR FROM THE ARRIVAL OF A
C     UNIT. IN THE FIRST CASE PARTS ARE REMOVED FROM THE DUMMY INPUT QUEUE.
C     HOWEVER, THERE COULD BE ENOUGH CAPACITY FOR OTHERS THAT ARRIVED WHILE
C     THE MACHINE WAS STOPPED.
C
C     IT COULD ALSO BE CALLED FROM CMCSU OR CTRASU IN WHICH CASE THE FIRST
C     PART NUMBER IN QUEUE WILL BE THE SAME AS LASTPN(IA7).
C
C     AT MACHINES TYPE 5, NIDQ HAS BEEN RESERVED FOR PARTS REMOVED FROM
C     PROCESSING FOR MACHINE STOPS.THEREFORE, THERE SHOULD BE ENOUGH
C     CAPACITY TO PROCESS ALL PARTS IN NIDQ.
C
      IF (NNQ(NIDQ).GT.0) THEN
         DO 6370 J=1,NNQ(NIDQ)
         CALL RMOVE(1,NIDQ,ATRIB)
         DEP=ATRIB(13)
         ATRIB(13)=0
         CALL SCHDL(4,DEP,ATRIB)
6370     CONTINUE
         LASLOT(IA7)=ATRIB(3)
         LASTPN(IA7)=ATRIB(2)
         START(IA7)=TNOW
      ENDIF
C
C     IF THERE IS CAPACITY AVAILABLE, CHECK FOR PARTS WAITING IN QUEUE
C
      FULLDQ(IA7)=0
```



```
6375  IF (CAPAV(IA7).EQ.0.OR.(CAPAV(IA7).GT.0.AND.NNQ(IA7).EQ.0)) THEN
         GO TO 6385
      ENDIF

      NTRY=MMFE(IA7)
      IA2=QSET(NTRY+2)
      IA3=QSET(NTRY+3)
      IA11=QSET(NTRY+11)
C
C     IF THE PART REPRESENTS A SCRAPPED UNIT, THEN IT SHOULD JUMP
C     THE MACHINE OPERATION EVEN IF IT IS OF A DIFFERENT PN.
C
      IF (IA11.EQ.0) THEN
         GO TO 6380
      ENDIF
C
      IF (IA2.EQ.LASTPN(IA7) .OR. MSUCD(IA7).EQ.0) THEN
C
         LASLOT(IA7)=IA3
         LASTPN(IA7)=IA2

6380     CALL RMOVE(1,IA7,ATRIB)
         IF (CAPAV(IA7).EQ.MCAP(IA7)) THEN
            START(IA7)=TNOW
         ENDIF
         IA2=ATRIB(2)
         IA4=ATRIB(4)
         IA6=ATRIB(6)
         IA10=ATRIB(10)
C
         FULLDQ(IA7)=FULLDQ(IA7)+ATRIB(4)
C
         IF (NNQ(NODQ).EQ.0.AND.IA7.NE.MSEQ(MACHS(IA2),IA2)) THEN
            CALL CKCONT(IA2,IA4,IA6,IA7)
         ENDIF
C

         DEP=0
C
C        CALL FOR A PROCESSING TIME ONLY IF THE PART IS GOOD
C
         IF (ATRIB(11).EQ.1) THEN
            CALL PROCES(IA2,IA7,DEP)
         ENDIF

         ATRIB(13)=0
         CALL SCHDL(4,DEP,ATRIB)
         CAPAV(IA7)=CAPAV(IA7)-ATRIB(4)
         GO TO 6375

      ENDIF
C
6385  MSTATU(IA7)=1
      TLASTP(IA7)=TNOW+DEP

      XINBUF(IA7)=XINBUF(IA7)-FULLDQ(IA7)
C
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE D1M5(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MSCXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/MALKEN,NAVNT,OPNDT,NDTMA,MALKLO
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
```


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mdirizar@c50030-201ps.1          cell6.f          .0/17/96  13:57   171/220
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDAJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/MSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/MSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/MPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
      COMMON/UCOM29/MINITR,MDRSTR
      COMMON/UCOM32/KINBUP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM64/CAPAV(50)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM82/MAXN
C
      QFLAG=0
      NQFLAG=0
C
C     MNFLAG=1 IS USED AT THE PYQ SUBROUTINE TO POINT OUT THAT THE
C     THE POKA YOKE SUB IS BEING CALLED FROM A DEPARTURE SCENARIO
C     IN WHICH THE DEPARTING UNIT SHOULD BE ALLOWED TO MOVE TO THE
C     NEXT MACHINE IN THE PART'S ROUTING.
C
      MNFLAG=1
      NIDQ=IA7+MAXN

      ATRIB(12)=IA7
      CAPAV(IA7)=CAPAV(IA7)+ATRIB(4)
      CALL DQC(IA7,QFLAG,NQFLAG)
C
C     QFLAG=1 MEANS THE QUEUE OR DUMMY INPUT BUFFER OF MACHINE IA7
C     SHOULD BE CHECKED FOR PARTS WAITING TO BE PROCESSED.
C
      IF (QFLAG.NE.1) THEN
         RETURN
      ENDIF
C
C     DO NOT FREE CONTAINERS IN THIS SUBROUTINE SINCE HERE PARTS ARRIVE
C     AND LEAVE IN UNIT LOAD SIZE OF ONE.
C
C     VERIFY IF PARTS ARE WAITING IN QUEUE AND IF THERE IS MORE
C     THAN ONE UNIT LOAD IN QUEUE (I.E. SFLAG=1)
C
      QFLAG=0
      CALL QFULL(IA7,QFLAG,SFLAG)
C
      IF (QFLAG.EQ.0) THEN
         IF (CAPAV(IA7).EQ.NCAP(IA7)) THEN
            NSTATU(IA7)=0
            UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
            TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
            START(IA7)=900000

            IF (BRKDSC.EQ.2) THEN
               IF (UPTIME(IA7).GT.BKNEXT(IA7)) THEN
                  CALL UPBRKD(IA7)
               ENDIF
            ENDIF

         ENDIF
         RETURN
      ENDIF

      IF (SFLAG.EQ.1  .AND. ISCHDP(IA7).NE.0) THEN
C
C        PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C        CHOSEN BY THE USER.
C
         CALL SCHEDP(IA7)
C
      ENDIF
C
C     DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C     TO BE PROCESSED.
C
      NTRY=MMFE(IA7)
      IA2=QSET(NTRY+2)
      IA10=QSET(NTRY+10)
C
C     VERIFY IF A SETUP IS NEEDED
C
      IF (MSUCD(IA7).EQ.1) THEN
          IF (IA2.NE.LASTPN(IA7)) THEN
```

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               IF (CAPAV(IA7).EQ.NCAP(IA7)) THEN
                  NSTATU(IA7)=0
                  CALL MSETUP(IA2,IA7)
               ENDIF
               RETURN
            ENDIF
      ENDIF
C
6390  NIDQ=IA7+MAXN
      CALL MACHIN(IA7,NIDQ)
C
      IF ((KINBUP(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7)  .AND.
     1KINBUP(IA7).LT.MBUFF(IA7)) THEN
         CALL CKBLK(IA7)
      ENDIF
C
      RETURN
      END
C
C ***************************************************************************
C
      SUBROUTINE OUT(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MANRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKNA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM40/REMPT(50)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM64/CAPAV(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM82/MAXN

      IF (NTYPE(IA7).EQ.1) THEN
          N=1
6400      NRANK=NFIND(N,NCLNR,21,0,4.0,0.0)
          NTRY=LOCAT(NRANK,NCLNR)
          I7=QSET(NTRY+7)
          IF (I7.NE.IA7) THEN
             N=NRANK+1
             GO TO 6400
          ELSE
             CALL RMOVE(NRANK,NCLNR,ATRIB)
             REMPT(IA7)=1
             ATRIB(13)=ATRIB(22)-TNOW
             UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
             TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
             START(IA7)=900000

             IF (BRKDSC.EQ.2) THEN
                IF (UPTIME(IA7).GT.BKNEXT(IA7)) THEN
                   CALL UPBRKD(IA7)
                ENDIF
             ENDIF

             NIDQ=IA7+MAXN
             CALL FILEM(NIDQ,ATRIB)
             IF (NNQ(NIDQ).GT.1) THEN
                DO 6410 I=1,NNQ(NIDQ)-1
                CALL RMOVE(1,NIDQ,ATRIB)
                CALL FILEM(NIDQ,ATRIB)
6410            CONTINUE
             ENDIF
          ENDIF
          GO TO 6460
      ENDIF
C
      IF (NTYPE(IA7).EQ.5) THEN
C
C         CAPACITY AVAILABLE SHOULD NOT BE SET TO ZERO WHEN PARTS ARE REMOVED
C         FOR MACHINE STOPS. THAT VARIABLE CAN BE USED FOR DEBUGGING PURPOSES.
C
C         NREM=NUMBER OF UNITS TO BE REMOVED FROM NIDQ
C         NR=NUMBER OF UNITS ACTUALLY REMOVED FROM NIDQ
C
          NREM=NCAP(IA7)-CAPAV(IA7)
          N=1
          NR=0
          NIDQ=IA7+MAXN
```

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```
6420     NRANK=NFIND(N,NCLNR,21,0,4.0,0.0)
         IF (NRANK.NE.0) THEN
            NTRY=LOCAT(NRANK,NCLNR)
            I7=QSET(NTRY+7)
            IF (I7.NE.IA7) THEN
               N=NRANK+1
               GO TO 6420
            ELSE
               CALL RMOVE(NRANK,NCLNR,ATRIB)
               NR=NR+1
               ATRIB(13)=ATRIB(22)-TNOW
               CALL FILEM(NIDQ,ATRIB)
            ENDIF
            GO TO 6420
         ENDIF
         UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
         TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
         START(IA7)=900000

         IF (BRKDSC.EQ.2) THEN
             IF (UPTIME(IA7).GT.BRKENT(IA7)) THEN
                CALL UPBRKD(IA7)
             ENDIF
         ENDIF

         REMPT(IA7)=1
         IF (NR.NE.NREM) THEN
            WRITE(6,6425)
6425        FORMAT(1X,'ERROR:NUMBER OF UNITS RETURNED TO PROCESS')
            WRITE(6,6426) IA7,TNOW
6426        FORMAT(1X,'> NUMBER OF UNITS REMOVED AT M=',I3,1X,'T='
     1,F10.2)
            STOP
         ENDIF
         GO TO 6460
      ENDIF
C
6460  RETURN
      END
C
C ***********************************************************************
C
      SUBROUTINE DSN1(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MSCLV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MSUCD(50),MQCD(50),NABRSC(50),
     1 MOEPSC(50),MBUFF(50),MBUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),RIWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPM(50),LASLOT(50),LASTMA(50),NBLRSC(50),NBLRMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/XP(40),TOTAL(40,500),NPS,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUD10(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/MALREN,NAVNT,OPNDT,NDTNR,MALRLO
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NORECO(50),NORECA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANNL,PRCOST(40,51)
      COMMON/UCOM14/ RANFLP
      COMMON/UCOM15/QAIMND,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDNMD,TRMLP1,TRMLP2,TRMLP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELOIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURND(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERND(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iff1
      COMMON/UCOM29/MINITR,MOSTTR
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM43/BRKDSC,BRKENT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM45/WAITTM(50)
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```
      COMMON/UCOM53/FULLDQ(50)
      COMMON/UCOM40/NAUTO
      COMMON/UCOM60/IPNCD(50),IREP(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM67/NEXC(50)
      COMMON/UCOM68/ASECO(50),RELCO(50)
      COMMON/UCOM69/ASECA(50),RELCA(50)
      COMMON/UCOM75/NEMUL(40,50)
      COMMON/UCOM82/MAXN
C
      QFLAG=0
      NQFLAG=1
C
C     NXFLAG=0 IS USED AT THE FYQ SUBROUTINE TO POINT OUT THAT THE
C     THE POKA YOKE SUB IS BEING CALLED FROM A DEPARTURE SCENARIO
C     IN WHICH THE DEPARTING UNIT SHOULD NOT BE ALLOWED TO MOVE TO THE
C     NEXT MACHINE IN THE PART'S ROUTING.
C
      NXFLAG=0
      NODQ=IA7+MAXN*2
      NIDQ=IA7+MAXN
      IA2=ATRIB(2)
C
      IF (MQCD(IA7).EQ.3) THEN
C
C     PENDING !!!!!!!!
C
      ELSE
C
         UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
         TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
         START(IA7)=900000

         IF (BRKDSC.EQ.2) THEN
            IF (UPTIME(IA7).GT.BRKENT(IA7)) THEN
               CALL UPBRKD(IA7)
            ENDIF
         ENDIF
C
C        PUT UNIT IN OUTPUT DUMMY BUFFER, VERIFY IF THE DESIRED QTY (BASED
C        ON IDEFUL(IA2,IA7) UNDER THIS SCENARIO) HAS BEEN REACHED. IF NOT THEN
C        PULL FROM NIDQ. IF YES, THEN REMOVE UNITS FROM DUMMY OUTPUT
C        BUFFER AND CALL DQC TO SCHEDULE NEXT OPERATION OF DEPARTING
C        UNITS.
C
C        THIS IS AN SCENARIO IN WHICH THE DEPARTING ENTITY SPLITS INTO
C        MORE THAN ONE END ITEM. FOR EXAMPLE A PANEL INTO SEVERAL IMAGES OR
C        BOARDS.
C
         IF (ATRIB(11).EQ.1) THEN
            ATRIB(10)=IBI(IA2)
         ELSE
            ATRIB(10)=0
         ENDIF
C
         CALL FILEM(NODQ,ATRIB)
         QTY=NNQ(NODQ)*IBI(IA2)+NEXC(IA7)

         IF (QTY.LT.NEMUL(IA2,IA7)) THEN
C
            IF (NNQ(NIDQ).GT.0) THEN
               CALL MACHIN(IA7,NIDQ)
               GO TO 6515
            ELSE
               WRITE(6,6485)
6485           FORMAT(1X,'ERROR: DSN1 SHOULD HAVE NNQ(NIDQ)>0 IF THE')
               WRITE(6,6490)
6490           FORMAT(1X,'DESIRED QUANTITY HAS NOT BEEN REACHED')
               CALL MESSAGE(IA7)
            ENDIF
C
         ELSE
C
C           FREE CONTAINERS AND CARTS ONLY IF THERE ARE NO PARTS AT THE
C           DUMMY INPUT QUEUE. IN THIS SCENARIO, THE ENTITY AT NIDQ MAY
C           REPRESENT MORE THAN ONE DEPARTING ENTITY.
C
            IF (IA7.GE.2.AND.RELCO(IA7).EQ.1.AND.NNQ(NIDQ)
     1      .EQ.0) THEN
               CALL FREECO(IA2,IA7)
            ENDIF
C
            IF (IA7.GE.2 .AND. NNQ(NIDQ).EQ.0 .AND.RELCA(IA7).EQ.1)
     1      THEN
               CALL FREECA(IA2,IA7)
            ENDIF
C
            IF (NOPCD(IA7).EQ.2) THEN
               NOPSTA(IOP(IA7))=0
            ENDIF
C
```

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mdirisar@c50030-201ps.1            call6.f            .0/17/96  13:57   175/220
            MSTATU(IA7)=0
C
            CALL DQC(IA7,QFLAG,NQFLAG)

         ENDIF
C
C        QFLAG=1 MEANS THE QUEUE OR DUMMY INPUT BUFFER OF MACHINE IA7
C        SHOULD BE CHECKED FOR PARTS WAITING TO BE PROCESSED.
C
         IF (QFLAG.NE.1) THEN

           IF (NOPCD(IA7).EQ.2) THEN
C
C             IF HIS STATUS IS STILL ZERO IT MEANS HE WAS NOT INVOLVED IN
C             MATERIAL HANDLING ACTIVITIES
C
              IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7)).EQ.2)
     1        THEN
                 CALL DESTIN(IA7)
              ENDIF

           ENDIF

           GO TO 6515
         ENDIF
C
C        THE ABOVE IF (QFLAG.NE.1) DOES NOT CONTEMPLATE THE FOLLOWING
C        CASE: QFLAG=1, NOPCD=2 (I.E. OPERATOR NEEDED
C        AT ALL TIMES, HOWEVER MATERIAL HANDLING IS MANUAL. CHECK IF THE
C        OPERATOR IS HANDLING THE PROCESSED PART. IF THAT IS THE CASE,
C        THEN SET MACHINE STATUS TO 0.
C
         IF (NOPCD(IA7).EQ.2) THEN
            IF (NOPSTA(IOP(IA7)).EQ.3 .AND. LASTMA(IOP(IA7)).EQ.IA7)
     1      THEN
               GO TO 6515
            ENDIF
         ENDIF
C
C        CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
C        GIVE PRIORITY TO THOSE.
C
         PFLAG=0
         CALL BRKCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            IF (NOPCD(IA7).EQ.2) THEN
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  CALL DESTIN(IA7)
               ENDIF
            ENDIF
            GO TO 6515
         ENDIF
C
C        CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
C        GIVE PRIORITY TO THOSE.
C
         IF (NAUTO.EQ.1) THEN
            PFLAG=0
            CALL AUTOCK(IA7,PFLAG)
            IF (PFLAG.EQ.0) THEN
               GO TO 6515
            ENDIF
         ENDIF
C
C        CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C        IF THERE ARE,GIVE PRIORITY TO THOSE.
C
         IF (IREP(IA7).EQ.1) THEN
            PFLAG=0
            CALL MRTCK(IA7,PFLAG)
            IF (PFLAG.EQ.0) THEN
               GO TO 6515
            ENDIF
         ENDIF
C
C       THE FOLLOWING "IF" COVERS FIRST THE CASE IN WHICH THE MACHINE
C       REQUIRES AN OPERATOR TO PROCESS THE PART (I.E. NOPCD=2). THE
C       "ELSE" COVERS THE CASE IN WHICH AN OPERATOR IS NOT NEEDED TO
C       PROCESS A PART.
C
        QFLAG=0
        SFLAG=0
C
        IF (NOPCD(IA7).EQ.2) THEN

           IF (NNQ(NIDQ).GT.0) THEN
              NOPSTA(IOP(IA7))=1
              LASTMA(IOP(IA7))=IA7
              CALL MACHIN(IA7,NIDQ)
              GO TO 6515
           ENDIF
C
```

```
mdirisar@c50030-201ps.1            call6.f            .0/17/96  13:57   176/220
            CALL QPULL(IA7,QFLAG,SFLAG)
C
            IF (QFLAG.EQ.0) THEN
C
C              SEND OPERATOR TO ANOTHER MACHINE IF HE IS A SHARED OPERATOR
C              OR FREE HIM IF HE IS A DEDICATED OPERATOR.
C
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  CALL DESTIN(IA7)
               ENDIF
               GO TO 6515
C
            ELSE
C
C              VERIFY IF THE OPERATOR WILL STAY AT THAT MACHINE OR NEEDS
C              TO MOVE TO ANOTHER MACHINE
C
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  MOVE=0
                  CALL MOVEMT(IA7,MOVE)
                  IF (MOVE.EQ.1) THEN
                     GO TO 6515
                  ENDIF
               ENDIF
C
               IF (SFLAG.EQ.1  .AND. ISCHDP(IA7).NE.0) THEN
C
C                 PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C                 CHOSEN BY THE USER.
C
                  CALL SCHEDP(IA7)
C
               ENDIF
C
C              DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C              TO BE PROCESSED.
C
               NTRY=NNPE(IA7)
               IA2=QSET(NTRY+2)
               IA10=QSET(NTRY+10)
C
C              VERIFY IF A SETUP IS NEEDED
C
               IF (NSUCD(IA7).EQ.1) THEN

                  IF (IA2.NE.LASTPN(IA7)) THEN
                     NSUPN=IA2
                     CALL NSETUP(NSUPN,IA7)

                     IF (NOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7))
     1               .EQ.2)THEN
                        CALL DESTIN(IA7)
                     ENDIF

                     GO TO 6515
                  ENDIF
               ENDIF

               IF (IA10.EQ.0) THEN
                  GO TO 6505
               ENDIF
C
C              DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
C              CALLING SUBROUTINE IS A DEPARTURE.
C
               DFLAG=1
               AFLAG=0
               PFLAG=0
C
C              IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C              PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C              THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C              CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C              THE REMOVAL.
C
               CALL PQC(AFLAG,DFLAG,PFLAG,IA7)

                IF (PFLAG.EQ.0) THEN
                   IF (NOPSTA(IOP(IA7)).NE.6) THEN
                      WRITE(6,6500)
6500                  FORMAT(1X,'ERROR:AT DEM1 W/NOPCD=2, PFLAG WILL BE
     1                ZERO ONLY IF HE IS DOING INSPECTION')
                    CALL MESSAGE(IA7)
                    ENDIF
C
                  IF ((ZINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1            ZINBUF(IA7).LT.NBUFF(IA7)) THEN
                     CALL CHBLK(IA7)
                  ENDIF
C
                ELSE
6505              NIDQ=IA7+MAXM
```


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```
              NOPSTA(IOP(IA7))=1
              CALL MACHIN(IA7,NIDQ)
C
              IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1        XINBUF(IA7).LT.NBUFF(IA7)) THEN
                 CALL CKBLK(IA7)
              ENDIF
C
            ENDIF
C
         ENDIF
C
      ELSE
C
C        VERIFY IF PARTS ARE WAITING IN NIDQ
C
         IF (NNQ(NIDQ).GT.0) THEN
            CALL MACHIN(IA7,NIDQ)
            GO TO 6515
         ENDIF
C
C        VERIFY IF PARTS ARE WAITING IN MAIN QUEUE AND IF THERE IS MORE
C        THAN ONE UNIT LOAD (I.E. SFLAG=1)
C
         CALL QPULL(IA7,QFLAG,SFLAG)
C
         IF (QFLAG.EQ.0) THEN
            GO TO 6515
         ENDIF
         IF (SFLAG.EQ.1  .AND. ISCHDP(IA7).NE.0) THEN
C
C        PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
C        CHOSEN BY THE USER.
C
            CALL SCHEDP(IA7)
         ENDIF
C
C        DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
C        TO BE PROCESSED.
C
         NTRY=MMFE(IA7)
         IA2=QSET(NTRY+2)
         IA10=QSET(NTRY+10)
C
C        VERIFY IF A SETUP IS NEEDED
C
         IF (NSUCD(IA7).EQ.1) THEN

             IF (IA2.NE.LASTPN(IA7)) THEN
               NSUPN=IA2
               CALL NSETUP(NSUPN,IA7)
               GO TO 6515
            ENDIF
         ENDIF

         IF (IA10.EQ.0) THEN
            GO TO 6510
         ENDIF
C
C        DFLAG=1 WITH AFLAG=0 TELLS THE FQC SUBROUTINE THAT THE
C        CALLING SUBROUTINE IS A DEPARTURE.
C
         DFLAG=1
         AFLAG=0
         FFLAG=0
C
C        IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
C        PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
C        THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
C        CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
C        THE REMOVAL.
C
         CALL FQC(AFLAG,DFLAG,FFLAG,IA7)
         IF (FFLAG.EQ.0) THEN
C
            IF (NSTATU(IA7).EQ.6) THEN
               IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1         XINBUF(IA7).LT.NBUFF(IA7)) THEN
                  CALL CKBLK(IA7)
               ENDIF
            ENDIF
C
            GO TO 6515
         ELSE
6510        NIDQ=IA7+NMAN
            CALL MACHIN(IA7,NIDQ)
C
            IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1      XINBUF(IA7).LT.NBUFF(IA7)) THEN
               CALL CKBLK(IA7)
            ENDIF
```



```
C
               ENDIF
C
            ENDIF
C
         ENDIF
C
6515  RETURN
      END
C
C ***************************************************************************
C
      SUBROUTINE DESC0(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MSCXXV)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NASRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVMT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICONUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
C
      IF (MTYPE(IA7).EQ.1) THEN
         CALL DSM1(IA7)
         RETURN
      ENDIF
C
      END
C
C ***************************************************************************
C
      SUBROUTINE SENDOQ(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MSCXXV)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NASRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVMT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICONUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
```

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```
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANAL,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDPND,TPNLP1,TPNLP2,TPNLP3
      COMMON/UCOM17/TRDAJP(40),TRDNMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNN,TSELNN
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURND(50),SURNP1(50),SURNP2(50),SURNP3(50)
      COMMON/UCOM21/NSERND(50),SERNP1(50),SERNP2(50),SERNP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
C
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      COMMON/UCOM26/NP3,NP4
      COMMON/UCOM27/NOP
      common/ucomd/iff1

      COMMON/UCOM28/SESCP,SUSCP,SENMP,SUNMP
      COMMON/UCOM29/MINITR,MONSTR
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM31/NLONG(10),NUNITS(50)
c
      COMMON/UCOM32/XINPUT(50)
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
      COMMON/UCOM34/NCHOP(50,14),NCHNA(50,40),PERCOP(50,14)
     1,PERCHA(50,14)
C
      COMMON/UCOM35/IBLESC(50),NNABLR(50),NBLK(50,50)
      COMMON/UCOM36/TRAIN,MCIN
      COMMON/UCOM37/TRFDIS(50),TRFP1(50),TRFP2(50),TRFP3(50),NDSED(50)
      COMMON/UCOM38/TTRDIS(50),TTRP1(50),TTRP2(50),TTRP3(50),SCREN
      COMMON/UCOM39/TOTNT
      COMMON/UCOM40/RENPT(50)
      COMMON/UCOM41/NNREW(50)
      COMMON/UCOM42/NTL(40,500),TL(40,500),NL(40,50),NPL(40,50)
      COMMON/UCOM43/BNLDSC,NEXEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTM(50)
      COMMON/UCOM45/WAITTM(50)
      COMMON/UCOM46/NAUTOD(50),AUTOP1(50),AUTOP2(50),AUTOP3(50),TOTAUT
      COMMON/UCOM47/NEXAUT(50),DAYLTN
      COMMON/UCOM48/NAUTO
      COMMON/UCOM49/PGICC(40),CR
      COMMON/UCOM50/RA,CUSLT,NLO,DPCLO,RLENGN
      COMMON/UCOM51/SUMWIP(40,50),NOBWIP(40,50)
      COMMON/UCOM52/WIP(40,50)
      COMMON/UCOM54/NYRS,SUINV,PNINV,NEINV,QAINV,RELAY,PSPACE
      COMMON/UCOM55/NG,ONG,NSUCNN,SUNG,NSUSC,SUTRAI,SUTWRK,NWEEKS,AIR
      COMMON/UCOM56/PNTRAI,PNCOST,SNG,PC(50),NPENP
      COMMON/UCOM57/TWNK(40,50),QANG,NNLC(40,50),QATRAI
      COMMON/UCOM58/PGINV(40),MAXPG(40),PGCAP(40),PGCC(40)
      COMMON/UCOM59/NCOPG(40)
      COMMON/UCOM60/IPNCD(50),INEP(50)
      COMMON/UCOM61/TNRDIS(50),TNRP1(50),TNRP2(50),TNRP3(50)
      COMMON/UCOM62/TTREP(50),TREP1(50),TREP2(50),TREP3(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM64/CAPAV(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM66/TWORK
      COMMON/UCOM67/NEXC(50)
      COMMON/UCOM75/NEWUL(40,50)
      COMMON/UCOM77/ULFLG(50)
      COMMON/UCOM82/MAXN
      COMMON/UCOM84/NLEAVE
      COMMON/UCOM86/NNN

      NIDQ=IA7+MAXN
      NODQ=IA7+MAXN*2
C
      IF ((NDEPSC(IA7).EQ.1 .OR. NDEPSC(IA7).EQ.2) .AND. (NTYPE(IA7).EQ
     1 .1 .OR. NTYPE(IA7).EQ.3)) THEN

          CALL RMOVE(1,NODQ,ATRIB)

          IF (NNQ(NODQ).GT.0) THEN
             WRITE(6,6529)
6529         FORMAT(1X,'ERROR AT REMDOQ')
             CALL MESSAGE(IA7)
          ENDIF

          ATRIB(12)=IA7
          GO TO 6560

      ENDIF

      IF (NDEPSC(IA7).EQ.1 .AND. NTYPE(IA7).EQ.5) THEN
```



```
          IF (NNQ(NODQ).GT.NCAP(IA7)) THEN
             WRITE(6,6533)
6533         FORMAT(1X,'ERROR AT REMDOQ:NNQ(NODQ)>NCAP(NTYPE=5)')
             CALL MESSAGE(IA7)
          ENDIF

          CALL RMOVE(1,NODQ,ATRIB)

          ATRIB(12)=IA7
          GO TO 6560

      ENDIF

C
      IF (NDEPSC(IA7).EQ.3 .AND. NTYPE(IA7).EQ.1) THEN

          IF (NNQ(NODQ).EQ.1) THEN
             CALL RMOVE(1,NODQ,ATRIB)
             ATRIB(12)=IA7
             GO TO 6560
          ENDIF

C         DETERMINE NUMBER OF GOOD UNITS IN THE UNIT LOAD AND
C         REDEFINE ATRIB(10) & (11) BEFORE CALLING DQC.
C
          NGOOD=0
          DO  6535 J=1,NNQ(NODQ)
          CALL RMOVE(1,NODQ,ATRIB)
6535      CONTINUE

          IF (ATRIB(10).GT.0) THEN
              ATRIB(11)=1
          ELSE
              ATRIB(11)=0
          ENDIF

          ATRIB(12)=IA7
          GO TO 6560

      ENDIF

      IF (NDEPSC(IA7).EQ.4 .AND. NTYPE(IA7).EQ.1) THEN

          IF (NNQ(NODQ).EQ.1) THEN
             CALL RMOVE(1,NODQ,ATRIB)
             ATRIB(12)=IA7
             IA2=ATRIB(2)
             NEWUL(IA2,IA7)=IDEFUL(IA2,IA7)
             GO TO 6560
          ENDIF

          NGOOD=0
          DO  6540 J=1,NNQ(NODQ)
          CALL RMOVE(1,NODQ,ATRIB)
          IF (ATRIB(11).EQ.1) THEN
              NGOOD=NGOOD+1
          ENDIF
6540      CONTINUE

          IA2=ATRIB(2)
          ATRIB(4)=NEWUL(IA2,IA7)
          ATRIB(10)=NGOOD
C
          IF (ATRIB(10).GT.0) THEN
              ATRIB(11)=1
          ELSE
              ATRIB(11)=0
          ENDIF

          ATRIB(12)=IA7

          NEWUL(IA2,IA7)=IDEFUL(IA2,IA7)

          GO TO 6560

      ENDIF
C
      IF (NDEPSC(IA7).EQ.6  .AND. NTYPE(IA7).EQ.2) THEN

          CALL RMOVE(1,NODQ,ATRIB)

          IF (NNQ(NODQ).GT.0) THEN
             WRITE(6,6545)
6545         FORMAT(1X,'ERROR AT REMDOQ')
             CALL MESSAGE(IA7)
          ENDIF

          ATRIB(12)=IA7
          GO TO 6560

      ENDIF
C
```

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```
      IF (NDEPSC(IA7).EQ.0 .AND. NTYPE(IA7).EQ.1) THEN
C
C        1. NEWUL SHOULD BE > OR = TO IEI(IA2) (I.E. NO MORE THAN ONE
C           ENTITY PER UNIT IN THE CONTAINER.
C        2. AT ARRIVAL ATRIB(4) IS CHECKED TO DETERMINE IF THERE IS ENOUGH FOR
C           AT LEAST ONE UNIT LOAD BASED ON IDEPUL. IF THERE ARE NOT ENOUGH
C           NEWUL IS CHANGED TO WHAT CAN BE BATCH TOGETHER.
C
         IF (NNQ(NODQ).EQ.1) THEN
C
            CALL RMOVE(1,NODQ,ATRIB)

            IA2=ATRIB(2)
            IA4=ATRIB(4)
c            IF ((IA4*IEI(IA2)+NEXC(IA7)).NE.NEWUL(IA2,IA7)) THEN
c               WRITE(6,6540) IA2
c6540           FORMAT(1X,'ERROR AT REMDOQ W/DEPSC=0 AND TN=',1X,I3)
c               CALL MESSAGE(IA7)
c            ENDIF

            ATRIB(4)=NEWUL(IA2,IA7)
            ATRIB(8)=ATRIB(8)*IEI(IA2)
            ATRIB(12)=IA7
            NLEAVE=NLEAVE+1
            ATRIB(14)=NLEAVE
C
C           IF THE NUMBER OF ENTITIES REMAINING IN NIDQ WILL NOT SUPPLY
C           ENOUGH END ITEMS TO COMPLY WITH IDEPUL, THEN REDEFINE IDEPUL
C           AS THE NUMBER OBTAINABLE FROM THE REMAINING ENTITIES.
C
            IF (NNQ(NIDQ).GT.0 .AND. ULFLG(IA7).EQ.1) THEN
               NREM=NNQ(NIDQ)*IEI(IA2)+NEXC(IA7)
               IF (NREM.LT.NEWUL(IA2,IA7)) THEN
                  NEWUL(IA2,IA7)=NREM
                  ULFLG(IA7)=0
               ENDIF
            ENDIF
C
            IF (NNQ(NIDQ).EQ.0) THEN
               NEWUL(IA2,IA7)=IDEPUL(IA2,IA7)
               ULFLG(IA7)=1
            ENDIF
C
            GO TO 6560
         ENDIF

         NGOOD=0
         Q=NEXC(IA7)
6550     CALL RMOVE(1,NODQ,ATRIB)
         IA2=ATRIB(2)

         NGLAST=ATRIB(10)

         NGOOD=NGOOD+ATRIB(10)
         Q=Q+IEI(IA2)
         IF (Q.LT.NEWUL(IA2,IA7)) THEN
            GO TO 6550
         ENDIF
C
C        REMOVE FROM Q THE UNITS THAT STAYED BEHIND TO KNOW THE EXACT NUMBER
C        OF ENTITIES REMOVED HERE.
C
         Q=Q-NEXC(IA7)
C
         ATRIB(4)=NEWUL(IA2,IA7)
         ATRIB(8)=ATRIB(8)*IEI(IA2)
         ATRIB(10)=NGOOD
C
C        IT IS POSSIBLE THAT THE QTY OF END ITEMS REMOVED EXCEEDS IDEPUL.
C        IF THAT IS THE CASE, DETERMINE THE NUMBER OF UNITS TO STAY BEHIND
C        AND THE NUMBER OF GOOD UNITS IN THOSE THAT STAYED BEHIND.
C
C        IF THERE ARE NO REMAINING UNITS IN NIDQ THEN LET ALL Q UNITS
C        LEAVE TOGETHER.
C
         IF (Q.GT.NEWUL(IA2,IA7)) THEN
            IF (NNQ(NIDQ).NE.0) THEN
               NEXC(IA7)=Q-NEWUL(IA2,IA7)
               IF (NEXC(IA7).LE.NGLAST) THEN
                  NGADD=NEXC(IA7)
                  ATRIB(10)=ATRIB(10)-NGADD
               ELSE
                  NGADD=NGLAST
                  ATRIB(10)=ATRIB(10)-NGADD
               ENDIF
            ELSE
               ATRIB(4)=Q
            ENDIF
         ENDIF
C
C        IF THE NUMBER OF UNITS DEPARTING IS LESS THAN THE DEPARTING UNIT
```



```
C        LOAD SIZE, ADD TO THE DEPARTING ENTITY THE ONES THAT STAYED BEHIND
C        AND ALTER ATTRIBUTE 10 ACCORDINGLY.
C
         IF (Q.LT.NEWUL(IA2,IA7)) THEN
            ATRIB(10)=ATRIB(10)+NGADD
            NGADD=0
            NEXC(IA7)=0
         ENDIF
C
6555     IF (ATRIB(10).GT.0) THEN
            ATRIB(11)=1
         ELSE
            ATRIB(11)=0
         ENDIF

         ATRIB(12)=IA7

         NLEAVE=NLEAVE+1
         ATRIB(14)=NLEAVE
C
C        IF THE NUMBER OF ENTITIES REMAINING IN NIDQ WILL NOT SUPPLY
C        ENOUGH END ITEMS TO COMPLY WITH IDEPUL, THEN REDEFINE IDEPUL
C        AS THE NUMBER OBTAINABLE FROM THE REMAINING ENTITIES.
C
         IF (NNQ(NIDQ).GT.0 .AND. ULFLG(IA7).EQ.1) THEN
            NREM=NNQ(NIDQ)*IEI(IA2)+NEXC(IA7)
            IF (NREM.LT.NEWUL(IA2,IA7)) THEN
               NEWUL(IA2,IA7)=NREM
               ULFLG(IA7)=0
            ENDIF
         ENDIF
C
         IF (NNQ(NIDQ).EQ.0) THEN
C
C           IT IS ASSUMED THAT UNITS FROM DIFFERENT CONTAINERS CANNOT
C           BE MIXED.
C
            NEWUL(IA2,IA7)=IDEPUL(IA2,IA7)
            ULFLG(IA7)=1
         ENDIF

         GO TO 6560

      ENDIF

6560  RETURN
      END
C
C ************************************************************************
C
      SUBROUTINE PUTODQ(IA7)
C
      INCLUDE '/mcsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NNUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NNUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLEMGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKNA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NNZLUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NOTNA,WALKLO
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICONUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2NAXCO(50),NINCO(50),NAXCA,NINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCNDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARNE,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TNDRWD,TNWKP1,TNWKP2,TNWKP3
      COMMON/UCOM17/TNDRJP(40),TNDUMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSUBND(50),SUBMP1(50),SUBMP2(50),SUBMP3(50)
      COMMON/UCOM21/NSEBND(50),SEBMP1(50),SEBMP2(50),SEBMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
```

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mdirizar@c50030-201pe.1          cell6.f          .0/17/96  13:57   183/220
      1,PROP3(40,50)
c
       COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
       COMMON/UCOM26/NP3,NP4
       COMMON/UCOM27/NOP
       common/ucomd/iffl

       COMMON/UCOM28/SESCP,SUSCP,SEMMP,SUMMP
       COMMON/UCOM29/MINITR,NDESTR
       COMMON/UCOM30/TLASTP(50)
       COMMON/UCOM31/MLONG(10),NUNITS(50)
c
       COMMON/UCOM32/XINBUF(50)
       COMMON/UCOM33/NPARLL(50),NRES(10,50)
       COMMON/UCOM34/NOBCP(50,10),NOBMA(50,40),PERCCP(50,10)
      1,PERCMA(50,10)
c
       COMMON/UCOM35/IBLKSC(50),NMABLK(50),NBLK(50,50)
       COMMON/UCOM36/TRAIN,NCIN
       COMMON/UCOM37/TBFDIS(50),TBFP1(50),TBFP2(50),TBFP3(50),NBRKD(50)
       COMMON/UCOM38/TTRDIS(50),TTRP1(50),TTRP2(50),TTRP3(50),SCRBN
       COMMON/UCOM39/TOTRT
       COMMON/UCOM40/REMPT(50)
       COMMON/UCOM41/NBRKN(50)
       COMMON/UCOM42/NTL(40,500),TL(40,500),NL(40,50),NPL(40,50)
       COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
       COMMON/UCOM44/BLKTM(50)
       COMMON/UCOM45/WAITTM(50)
       COMMON/UCOM46/NAUTOD(50),AUTOP1(50),AUTOP2(50),AUTOP3(50),TOTAUT
       COMMON/UCOM47/NEXAUT(50),DAYLTH
       COMMON/UCOM48/NAUTO
       COMMON/UCOM49/PGICC(40),CR
       COMMON/UCOM50/RA,CUSLT,NLO,DPCLO,RLENGH
       COMMON/UCOM51/SUMWIP(40,50),NOBWIP(40,50)
       COMMON/UCOM52/WIP(40,50)
       COMMON/UCOM54/NTRB,SUINV,PNINV,NEINV,QAINV,RELAY,PSPACE
       COMMON/UCOM55/WO,CMG,NSUCNM,SUMG,NSUBC,SUTRAI,SUTWRK,NWEEKS,AIR
       COMMON/UCOM56/PWTRAI,PMCOST,SMG,PC(50),NPEMP
       COMMON/UCOM57/TMWK(40,50),QAMG,NMKC(40,50),QATRAI
       COMMON/UCOM58/PGINV(40),MAXPG(40),PGCAP(40),PGCC(40)
       COMMON/UCOM59/NCOPG(40)
       COMMON/UCOM60/IPNCD(50),INEP(50)
       COMMON/UCOM61/TBRDIS(50),TBRP1(50),TBRP2(50),TBRP3(50)
       COMMON/UCOM62/TTREP(50),TREP1(50),TREP2(50),TREP3(50)
       COMMON/UCOM63/FULLDQ(50)
       COMMON/UCOM64/CAPAV(50)
       COMMON/UCOM65/START(50)
       COMMON/UCOM66/TWORK
       COMMON/UCOM67/NEXC(50)
       COMMON/UCOM82/MAXN

       NODQ=IA7+MAXN*2

       CALL FILEM(NODQ,ATRIB)

       RETURN
       END
C
C *****************************************************************
C
       SUBROUTINE A1M9(IA7)
C
       INCLUDE '/ncsu/jwilson_res/PARAM.INC'
       COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
      1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
      2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
       COMMON QSET(600000)
C
       COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NABRSC(50),
      1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
      2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
      3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
      4 IDEPUL(40,50),NCAP(50),L(50),NSRQ(50,40),NOPSTA(50),NSTATU(50),
      5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
      6 RELT(40,500)
C
       COMMON/UCOM2/NMACH
       COMMON/UCOM3/NUL,NRELUL
       COMMON/UCOM4/A(100)
       COMMON/UCOM5/NP(40),TOTAL(40,500),NPW,NLOTS,NPARTS,TOTLOT
C
       COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
       COMMON/UCOM7/WALKNN,NAVNT,OPNDT,NDTNA,WALKLD
       COMMON/UCOM8/SUTEX,SUTIN
       COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
      1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
      2MAXCO(50),MINCO(50),MAXCA,MINCA
C
       COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
       COMMON/UCOM11/ISCNDP(50)
```

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mdirizar@c50030-201pe.1          cell6.f          .0/17/96  13:57   184/220
       COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
       COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQAWRK,PRCOST(40,51)
       COMMON/UCOM14/SAMPLP
       COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
       COMMON/UCOM16/TRDNWD,TNWLP1,TNWLP2,TNWLP3
       COMMON/UCOM17/TRORJP(40),TRDNWP(40)
       COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
       COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
       COMMON/UCOM20/NSUNWD(50),SUNWP1(50),SUNWP2(50),SUNWP3(50)
       COMMON/UCOM21/NSENWD(50),SENWP1(50),SENWP2(50),SENWP3(50)
       COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
      1,PROP3(40,50)
       common/ucomd/iffl
       COMMON/UCOM30/TLASTP(50)
C
       COMMON/UCOM32/XINBUF(50)
       COMMON/UCOM33/NPARLL(50),NRES(10,50)
       COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
       COMMON/UCOM44/BLKTM(50)
       COMMON/UCOM45/WAITTM(50)
       COMMON/UCOM48/NAUTO
       COMMON/UCOM60/IPNCD(50),IREP(50)
       COMMON/UCOM63/FULLDQ(50)
       COMMON/UCOM65/START(50)
       COMMON/UCOM82/MAXN
C
C      THIS SUB DEALS WITH ARRIVALS TO PURE INSPECTION STATIONS
C
       IA2=ATRIB(2)
       IA4=ATRIB(4)
       IA10=ATRIB(10)
C
       IF (NNQ(IA7) .GT. 0) THEN
          CALL FILEM(IA7,ATRIB)
       RETURN
       ENDIF
C
       IF (NSTATU(IA7) .NE. 0) THEN
          CALL FILEM(IA7,ATRIB)
       RETURN
       ENDIF
C
       IF (NOPSTA(IOP(IA7)).NE.0) THEN
          CALL FILEM(IA7,ATRIB)
       RETURN
       ENDIF
C
       IF (IA10.EQ.0.0) THEN
C
C         IF ALL PARTS IN THE UNIT LOAD ARE BAD, DO NOT CALL FOR AN INSPECTION.
C         PUT THE UNIT LOAD IN THE DUMMY OUTPUT QUEUE AND SCHEDULE CSELIN
C         W/INSPECTION TIME OF ZERO.
C
C         HOWEVER, SINCE THE
C         PART HAS BEEN ADDED TO XINBUF, IF IT WILL BE INSPECTED IT HAS TO
C         BE REMOVED FROM XINBUF (THERE WILL BE NO 'RMOVE' SINCE IT NEVER
C         WENT THROUGH THE MAIN QUEUE).
C
          NODQ=IA7+MAXN*2
          CALL FILEM(NODQ,ATRIB)
          LASTMA(IOP(IA7))=IA7
          NOPSTA(IOP(IA7))=7
          NSTATU(IA7)=7
          TOTINS=0
          CALL SCHDL(5,TOTINS,ATRIB)
          TLASTP(IA7)=TNOW+TOTINS
          UPTIME(IA7)=UPTIME(IA7)+TOTINS
          TOTUP(IA7)=TOTUP(IA7)+TOTINS

          FULLDQ(IA7)=ATRIB(4)
          XINBUF(IA7)=XINBUF(IA7)-FULLDQ(IA7)
          LASTPN(IA7)=ATRIB(2)
C
          IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND.
     1    XINBUF(IA7).LT.NBUFF(IA7)) THEN
             CALL CKBLK(IA7)
          ENDIF
          GO TO 6500

       ENDIF
C
C      PUT THE UNIT LOAD IN THE DUMMY OUTPUT QUEUE AND SCHEDULE THE COMPLETION
C      OF SELF INSPECTION.
C
       NODQ=IA7+MAXN*2
       CALL FILEM(NODQ,ATRIB)

       LASTMA(IOP(IA7))=IA7
       QFLAG=0
       NQFLAG=1
       CALL SELFIQ(IA7,QFLAG,NQFLAG)
```

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```
      FULLDQ(IA7)=ATRIB(4)
      XINBUF(IA7)=XINBUF(IA7)-FULLDQ(IA7)
      LASTPM(IA7)=ATRIB(2)
C
      IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND. XINBUF(IA7)
     1.LT.MBUFF(IA7)) THEN
         CALL CKBLK(IA7)
      ENDIF
C
6500  RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE M9(IA7,NIDQ)
C
      INCLUDE '/nesu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MANRSC(50),
     1 MDEPSC(50),MBUFF(50),MBUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPM(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/MSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKIN,NRVHT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANME,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINED,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMLP1,TRMLP2,TRMLP3
      COMMON/UCOM17/TRDRJP(40),TRDRMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNM,TSELNM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/MSURMD(50),SUMMP1(50),SUMMP2(50),SUMMP3(50)
      COMMON/UCOM21/MSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM24/MPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM30/TLASTP(50)
C
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM40/RENPT(50)
      COMMON/UCOM43/BRKDSC,BRNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM60/IFNCD(50),IREP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM82/MAXN
C
C     THIS SUB IS ONLY CALLED UPON A DEPATURE (CSELIN) FROM THE INSPECTION
C     STATION OR FROM CSELIN.
      FULLDQ(IA7)=0
C
C     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
C     GIVE PRIORITY TO THOSE.
C
      PFLAG=0
      CALL BRKCK(IA7,PFLAG)
      IF (PFLAG.EQ.0) THEN
         IF (MOPCD(IA7).EQ.2) THEN
            IF (IOPCD(IOP(IA7)).EQ.2) THEN
               MOPSTA(IOP(IA7))=0
               CALL DESTIN(IA7)
            ENDIF
         ENDIF
         GO TO 6590
      ENDIF
C
C     CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
```



```
C     GIVE PRIORITY TO THOSE.
C
      IF (MAUTO.EQ.1) THEN
         PFLAG=0
         MOPSTA(IOP(IA7))=0
         CALL AUTOCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 6590
         ENDIF
      ENDIF
C
C     CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
C     IF THERE ARE,GIVE PRIORITY TO THOSE.
C
      IF (IREP(IA7).EQ.1) THEN
         PFLAG=0
         MOPSTA(IOP(IA7))=0
         CALL MSTCK(IA7,PFLAG)
         IF (PFLAG.EQ.0) THEN
            GO TO 6590
         ENDIF
      ENDIF
C
      NODQ=IA7+MAXN*2
      CCKBLK=0
C
      CALL RMOVE(1,IA7,ATRIB)

      IA4=ATRIB(4)
      IA2=ATRIB(2)
      IA10=ATRIB(10)
C
      FULLDQ(IA7)=ATRIB(4)
      XINBUF(IA7)=XINBUF(IA7)-FULLDQ(IA7)
C
      IF (IA10.EQ.0.0) THEN
C
C        IF ALL PARTS IN THE UNIT LOAD ARE BAD, DO NOT CALL FOR AN INSPECTION.
C        PUT THE UNIT LOAD IN THE DUMMY OUTPUT QUEUE AND SCHEDULE CSELIN
C        W/INSPECTION TIME OF ZERO.
C
C        HOWEVER, SINCE THE
C        PART HAS BEEN ADDED TO XINBUF, IF IT WILL BE INSPECTED IT HAS TO
C        BE REMOVED FROM XINBUF (THERE WILL BE NO 'RMOVE' SINCE IT NEVER
C        WENT THROUGH THE MAIN QUEUE).
C
         NODQ=IA7+MAXN*2
         CALL FILEM(NODQ,ATRIB)
         LASTMA(IOP(IA7))=IA7
         MOPSTA(IOP(IA7))=7
         MSTATU(IA7)=7
         TOTINS=0
         CALL SCHDL(5,TOTINS,ATRIB)
         UPTIME(IA7)=UPTIME(IA7)+TOTINS
         TOTUP(IA7)=TOTUP(IA7)+TOTINS
         LASTPM(IA7)=ATRIB(2)
         TLASTP(IA7)=TNOW+TOTINS
         GO TO 6590

      ENDIF
C
C     PUT THE UNIT LOAD IN THE DUMMY OUTPUT QUEUE AND SCHEDULE THE COMPLETION
C     OF SELF INSPECTION.
C
      NODQ=IA7+MAXN*2
      CALL FILEM(NODQ,ATRIB)
      LASTMA(IOP(IA7))=IA7
      LASTPM(IA7)=ATRIB(2)

      QFLAG=0
      NQFLAG=1
      CALL SELFIQ(IA7,QFLAG,NQFLAG)
C
6590  RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE AIN7(IA7)
C
      INCLUDE '/nesu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MANRSC(50),
     1 MDEPSC(50),MBUFF(50),MBUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
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     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM44/BLKTM(50)
      COMMON/UCOM63/FULLDQ(50)
C
      IF (NNQ(IA7) .GT. 0) THEN
         CALL FILEM(IA7,ATRIB)
      RETURN
      ENDIF
C
      IF (NSTATU(IA7) .NE. 0) THEN
         CALL FILEM(IA7,ATRIB)
      RETURN
      ENDIF
C
      NQFLAG=0
C
      BFLAG=0
      IA2=ATRIB(2)
      IA6=ATRIB(6)+1
      NEXTM=MSEQ(IA6,IA2)
      CALL BUFFCK(BFLAG,NEXTM)
C
C     IF THERE IS NOT ENOUGH BUFFER SPACE THEN BLOCK THIS MACHINE.
C     OTHERWISE, MOVE THE PARTS.
C
      IF (BFLAG.EQ.0) THEN
          NSTATU(IA7)=2
          BLKTM(IA7)=TNOW
          NBLKSC(IA7)=1
          NBLKMA(IA7)=NEXTM
          CALL FILEM(IA7,ATRIB)
          GO TO 6600
      ENDIF
C
      CALL M7(IA7,NQFLAG)

      IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND. XINBUF(IA7)
     1.LT.NBUFF(IA7)) THEN
         CALL CKBLK(IA7)
      ENDIF
C
6600  RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE M7(IA7,NQFLAG)
C
      INCLUDE '/ncsu/jwilson_rse/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLEMON(50,50),DIST(50,50),SCRAPP(40,50),REWRKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),MSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM70/TRIP1,TRIP2
      COMMON/UCOM71/TCFLAG
C
      IF (NQFLAG.EQ.1) THEN
         CALL RMOVE(1,IA7,ATRIB)
      ENDIF
      IA2=ATRIB(2)
C
      FULLDQ(IA7)=ATRIB(4)
      XINBUF(IA7)=XINBUF(IA7)-FULLDQ(IA7)

      ATRIB(6)=ATRIB(6)+1
      IA6=ATRIB(6)
      ATRIB(7)=MSEQ(IA6,IA2)
      ATRIB(12)=IA7
C
```



```
      CALL SCHDL (7,TRIP1,ATRIB)
      TCFLAG=1
      NEXTM=ATRIB(7)
      XINBUF(NEXTM)=XINBUF(NEXTM)+ATRIB(4)
      T=TRIP1+TRIP2
      CALL SCHDL (26,T,ATRIB)

      NSTATU(IA7)=1
      TLASTP(IA7)=TNOW+T
      START(IA7)=TNOW
C
      RETURN
      END
C
C ***************************************************************
C
      SUBROUTINE TCRET
C
      INCLUDE '/ncsu/jwilson_rse/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLEMON(50,50),DIST(50,50),SCRAPP(40,50),REWRKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),MSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTM(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM70/TRIP1,TRIP2
C
      IA7=ATRIB(12)
C
      UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
      TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
      START(IA7)=900000
C
      IF (NNQ(IA7).EQ.0) THEN
         NSTATU(IA7)=0
         RETURN
      ENDIF
C
      BFLAG=0
      CALL COPY(1,IA7,ATRIB)
      IA2=ATRIB(2)
      IA6=ATRIB(6)+1
      NEXTM=MSEQ(IA6,IA2)
      CALL BUFFCK(BFLAG,NEXTM)
C
C     IF THERE IS NOT ENOUGH BUFFER SPACE THEN BLOCK THIS MACHINE.
C     OTHERWISE, MOVE THE PARTS.
C
      IF (BFLAG.EQ.0) THEN
          NSTATU(IA7)=2
          BLKTM(IA7)=TNOW
          NBLKSC(IA7)=1
          NBLKMA(IA7)=NEXTM
      ELSE
          NQFLAG=1
          CALL M7(IA7,NQFLAG)
      ENDIF
C
      IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND. XINBUF(IA7)
     1.LT.NBUFF(IA7)) THEN
         CALL CKBLK(IA7)
      ENDIF
C
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE A6M2(IA7)
C
      INCLUDE '/ncsu/jwilson_rse/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
```

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```
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c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,SLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
c
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
      COMMON/UCOM43/BRKDSC,BRKEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTN(50)
      COMMON/UCOM45/WAITTN(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM60/IPNCD(50),INSP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM82/MAXN
c
      IA2=ATRIB(2)
      IA10=ATRIB(10)
      NIDQ=IA7+MAXN
c
      IF (NNQ(IA7) .GT. 0) THEN
         CALL FILEM(IA7,ATRIB)
      RETURN
      ENDIF
c
      IF (NSTATU(IA7) .NE. 0) THEN
         CALL FILEM(IA7,ATRIB)
      RETURN
      ENDIF
c
c     DETERMINE IF THE UNIT REQUIRES A MACHINE SETUP
c
      IF (IA2 .NE. LASTPW(IA7)) THEN
         IF (NSUCD(IA7) .EQ. 1) THEN
            NSUPN=IA2
c              PUT THE ENTITY IN QUEUE SUCH THAT AT TRADSU OR WCSU THE QUEUE
c              IS SEARCHED FOR THE ATTRIBUTES OF THE ENTITY THAT ARRIVED
c              OR THE ONE THAT WAS ALREADY IN QUEUE
            CALL FILEM(IA7,ATRIB)
            CALL MSETUP(NSUPN,IA7)
            GO TO 6655
         ENDIF
      ENDIF
c
c     DETERMINE IF THE UNIT CAN BE PROCESSED OR WILL BE INSPECTED.
c     AFLAG=1 AND DFLAG=0 MEANS PQC IS BEING CALLED FROM AN ARRIVAL
c     SUBROUTINE
c
c     PUT THE UNIT LOAD IN QUEUE. IT WILL BE REMOVED AT PQC IF THE
c     OUTCOME IS SUCCESSIVE INSPECTION.
c
      CALL FILEM(IA7,ATRIB)

      IF (IA10.EQ.0.0) THEN
c
c        IF ALL PARTS IN THE UNIT LOAD ARE BAD, DO NOT CALL FOR A SETUP
c        OR PQC.
```

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         IF (NOPCD(IA7).EQ.2) THEN
            IF (NOPSTA(IOP(IA7)).EQ.0) THEN
               LASTMA(IOP(IA7))=IA7
               NOPSTA(IOP(IA7))=1
               CALL MACHIN(IA7,NIDQ)
               GO TO 6650
            ELSE
               GO TO 6655
            ENDIF
         ELSE
            CALL MACHIN(IA7,NIDQ)
            GO TO 6650
         ENDIF
      ENDIF

c
6640  AFLAG=1
      DFLAG=0
      PFLAG=0

      CALL PQC(AFLAG,DFLAG,PFLAG,IA7)
      IF (PFLAG .EQ.0) THEN
c
c          THE MCANIME MIGHT BE DOING INSPECTION, THEREFORE, A UNIT LOAD
c          MIGHT HAVE BEEN REMOVED FROM QUEUE.
c
           IF (NSTATU(IA7).EQ.6) THEN
              GO TO 6650
           ELSE
              GO TO 6655
           ENDIF
      ENDIF
c
c     IF PFLAG IS ONE, THEN IT MEANS THE UNIT LOAD CAN BE PROCESSED. AT
c     NOINSP IT WAS DETERMINED THAT IF AN OPERATOR WAS NEEDED IT WAS
c     AVAILABLE.
c
      NQFLAG=1
c
      CALL MACHIN(IA7,NIDQ)
c
6650  IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.NBUFF(IA7) .AND. XINBUF(IA7)
     1.LT.NBUFF(IA7)) THEN
         CALL CKBLK(IA7)
      ENDIF
c
6655  RETURN
      END
c
c ************************************************************************
c
      SUBROUTINE M2(IA7,NIDQ)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON QSET(600000)
c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,SLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTMA,WALKLO
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
```

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```
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM30/TLASTP(50)
C
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM40/REMPT(50)
      COMMON/UCOM43/BRKDSC,BRNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM72/IFAM(40),CAP(50,40),REMCAP(50,40),NUMFAM,CYCLET(50)
      COMMON/UCOM82/MAXM
C
C     FIND IF THE UNIT TO BE PROCESSED IS FROM A NEW OR PARTIALLY
C     PROCESSED UNIT LOAD. IF IT IS FROM A NEW UNIT LOAD CALL CONTAI
C     TO DETERMINE IF CONTAINERS OR CARTS ARE NEEDED.
C
C     PARTS WILL BE AT NIDQ ONLY WHEN THIS SUB IS CALLED FROM CSUCIN OR
C     CSUCIR OR AFTER A PREEMPTION. ONLY FROM CSUCIN AND CSUCIR THE MODEL
C     SHOULD REQUEST FOR CONTAINERS.
C
C     IN ALL THREE CASES WHERE PARTS WERE PLACED IN NIDQ, THE UNIT LOAD WAS
C     ALREADY DEDUCTED FROM XINBUF.

      NODQ=IA7+MAXM*2
      CCKBLK=0
C
      IF (NNQ(NIDQ).GT.0) THEN

         CALL RMOVE(1,NIDQ,ATRIB)
         IA2=ATRIB(2)
         IA4=ATRIB(4)
         IA6=ATRIB(6)

         IF (NNQ(NODQ).EQ.0 .AND. IA7.NE.MSEQ(MACHS(IA2),IA2) .AND.
     1   REMPT(IA7).EQ.0) THEN
            CALL CKCONT(IA2,IA4,IA6,IA7)
         ENDIF

      ELSE
C
         CALL RMOVE(1,IA7,ATRIB)
         IA4=ATRIB(4)
         IA2=ATRIB(2)
         IA6=ATRIB(6)
C
         FULLDQ(IA7)=ATRIB(4)
         XINBUF(IA7)=XINBUF(IA7)-FULLDQ(IA7)
C
         CALL CKCONT(IA2,IA4,IA6,IA7)
C
      ENDIF
C
      LASLOT(IA7)=ATRIB(3)
      LASTPN(IA7)=ATRIB(2)
      IPN=ATRIB(2)
      DEP=0
      TT=0

      NSHOTS=INT(ATRIB(4)/CAP(IA7,IPN)+.99)
      DO 6670 J=1,NSHOTS
      CALL PROCES(IPN,IA7,DEP)
      TT=TT+DEP
      DEP=0
6670  CONTINUE
C
      CALL SCHDL (4,TT,ATRIB)
      NSTATU(IA7)=1
      TLASTP(IA7)=TNOW+TT
      START(IA7)=TNOW
C
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE DGM2(IA7)
C
      INCLUDE '/nesu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NBUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEFUL(40,50),NCAP(50),L(50),MSEQ(50,40),NOPSTA(50),NSTATU(50),
```



```
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 NSLOT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVWT,OPNOT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM29/NINITR,NDESTR
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM40/MAUTO
      COMMON/UCOM60/IPMCD(50),IREP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM43/BRKDSC,BRNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM68/ASECO(50),RELCO(50)
      COMMON/UCOM69/ASECA(50),RELCA(50)
      COMMON/UCOM82/MAXM
C
      QFLAG=0
      NQFLAG=0
      NIDQ=IA7+MAXM
      NODQ=IA7+MAXM*2
      IA4=ATRIB(4)
C
C     MKFLAG=0 IS USED AT THE FTQ SUBROUTINE TO POINT OUT THAT THE
C     THE POKA YOKE SUB IS BEING CALLED FROM A DEPARTURE SCENARIO
C     IN WHICH THE DEPARTING UNIT SHOULD NOT BE ALLOWED TO MOVE TO THE
C     NEXT MACHINE IN THE PART'S ROUTING.
C
      MKFLAG=0
C
      IF (NQCD(IA7).EQ.3) THEN
C
C     PENDING !!!!!!!!
C
      ELSE
C
         UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
         TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
         START(IA7)=900000

         IF (BRKDSC.EQ.2) THEN
            IF (UPTIME(IA7).GT.BRNEXT(IA7)) THEN
               CALL UPBRKD(IA7)
            ENDIF
         ENDIF
C
         IA2=ATRIB(2)
C
C        THIS IS A SCENARIO IN WHICH PARTS ARRIVE IN BATCHES AND LEAVE
C        IN BATCHES. THUS, CALL FREECO TO FREE CONTAINERS.
C
         NIDQ=IA7+MAXM
         IF (IA7.GE.2.AND.RELCO(IA7).EQ.1.AND.NNQ(NIDQ)
     1   .EQ.0) THEN
            CALL FREECO(IA2,IA7)
         ENDIF
C
         IF (IA7.GE.2 .AND. NNQ(NIDQ).EQ.0 .AND.RELCA(IA7).EQ.1)
     1   THEN
            CALL FREECA(IA2,IA7)
         ENDIF
C
         IF (NOPCD(IA7).EQ.2) THEN
            NOPSTA(IOP(IA7))=0
         ENDIF
C
```

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          MSTATU(IA7)=0
          ATRIB(12)=IA7
c
          CALL DQC(IA7,QFLAG,NQFLAG)
c
c         QFLAG=1 MEANS THE QUEUE OR DUMMY INPUT BUFFER OF MACHINE IA7
c         SHOULD BE CHECKED FOR PARTS WAITING TO BE PROCESSED.
c
          IF (QFLAG.NE.1) THEN

             IF (MOPCD(IA7).EQ.2) THEN
c
c            IF HIS STATUS IS STILL ZERO IT MEANS HE WAS NOT INVOLVED IN
c             MATERIAL HANDLING ACTIVITIES
c
               IF (MOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7)).EQ.2)
     1         THEN
                  CALL DESTIN(IA7)
               ENDIF

             ENDIF

             RETURN
          ENDIF

c
c         THE ABOVE IF (QFLAG.NE.1) DOES NOT CONTEMPLATE THE FOLLOWING
c         CASE: QFLAG=1, MOPCD=2 (I.E. OPERATOR NEEDED
c         AT ALL TIMES, HOWEVER MATERIAL HANDLING IS MANUAL. CHECK IF THE
c         OPERATOR IS HANDLING THE PROCESSED PART. IF THAT IS THE CASE,
c         THEN SET MACHINE STATUS TO 0.
c
          IF (MOPCD(IA7).EQ.2) THEN
             IF (MOPSTA(IOP(IA7)).EQ.3 .AND. LASTMA(IOP(IA7)).EQ.IA7)
     1       THEN
                  RETURN
             ENDIF
          ENDIF
c
c         CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED. IF THERE ARE, THEN
c         GIVE PRIORITY TO THOSE.
c
          PFLAG=0
          CALL BRKCK(IA7,PFLAG)
          IF (PFLAG.EQ.0) THEN
             IF (MOPCD(IA7).EQ.2) THEN
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  CALL DESTIN(IA7)
               ENDIF
             ENDIF
             GO TO 6705
          ENDIF
c
c         CHECK IF THERE ARE ANY AUTONOMOUS MAINTENANCE DELAYED. IF THERE ARE,
c         GIVE PRIORITY TO THOSE.
c
          IF (NAUTO.EQ.1) THEN
             PFLAG=0
             CALL AUTOCK(IA7,PFLAG)
             IF (PFLAG.EQ.0) THEN
                GO TO 6705
             ENDIF
          ENDIF
c
c         CHECK IF THERE ARE ANY REPLENISHMENTS DELAYED.
c         IF THERE ARE,GIVE PRIORITY TO THOSE.
c
          IF (IREP(IA7).EQ.1) THEN
             PFLAG=0
             CALL RPTCK(IA7,PFLAG)
             IF (PFLAG.EQ.0) THEN
                GO TO 6705
             ENDIF
          ENDIF
c
c        THE FOLLOWING 'IF' COVERS FIRST THE CASE IN WHICH THE MACHINE
c        REQUIRES AN OPERATOR TO PROCESS THE PART (I.E. MOPCD=2). THE
c        'ELSE' COVERS THE CASE IN WHICH AN OPERATOR IS NOT NEEDED TO
c        PROCESS A PART.
c
         QFLAG=0
         SFLAG=0
c
         IF (MOPCD(IA7).EQ.2) THEN
c
            CALL QFULL(IA7,QFLAG,SFLAG)
c
            IF (QFLAG.EQ.0) THEN
c
c              SEND OPERATOR TO ANOTHER MACHINE IF HE IS A SHARED OPERATOR
c              OR FREE HIM IF HE IS A DEDICATED OPERATOR.
c
```

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               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  CALL DESTIN(IA7)
               ENDIF
               RETURN
c
            ELSE
c
c              VERIFY IF THE OPERATOR WILL STAY AT THAT MACHINE OR NEEDS
c              TO MOVE TO ANOTHER MACHINE
c
               IF (IOPCD(IOP(IA7)).EQ.2) THEN
                  MOVE=0
                  CALL MOVENT(IA7,MOVE)
                  IF (MOVE.EQ.1) THEN
                     RETURN
                  ENDIF
               ENDIF
c
              IF (SFLAG.EQ.1  .AND. ISCHDP(IA7).NE.0) THEN
c
c                 PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
c                 CHOSEN BY THE USER.
c
                CALL SCHEDP(IA7)
c
              ENDIF
c
c             DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
c             TO BE PROCESSED.
c
              NTRY=MMFE(IA7)
              IA2=QSET(NTRY+2)
              IA10=QSET(NTRY+10)
c
c              VERIFY IF A SETUP IS NEEDED
c
               IF (MSUCD(IA7).EQ.1) THEN

                  IF (IA2.NE.LASTPN(IA7)) THEN
                     NSUPN=IA2
                     CALL MSETUP(NSUPN,IA7)
                     IF (MOPSTA(IOP(IA7)).EQ.0 .AND. IOPCD(IOP(IA7))
     1               .EQ.2) THEN
                        CALL DESTIN(IA7)
                     ENDIF
                     RETURN
                  ENDIF
               ENDIF

               IF (IA10.EQ.0) THEN
                 GO TO 6695
               ENDIF
c
c              DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
c              CALLING SUBROUTINE IS A DEPARTURE.
c
               DFLAG=1
               AFLAG=0
               PFLAG=0
c
c              IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
c              PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
c              THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
c              CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
c              THE REMOVAL.
c
               CALL PQC(AFLAG,DFLAG,PFLAG,IA7)

                IF (PFLAG.EQ.0) THEN
                   IF (MOPSTA(IOP(IA7)).NE.6) THEN
                      WRITE(6,6690)
6690                  FORMAT(1X,'ERROR:AT D6N2 W/MOPCD=2, PFLAG WILL BE
     1                ZERO ONLY IF HE IS DOING INSPECTION')
                   CALL MESSAGE(IA7)
                   ENDIF
c
                   IF ((KINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1             KINBUF(IA7).LT.MBUFF(IA7)) THEN
                       CALL CKBLK(IA7)
                   ENDIF
c
                ELSE
6695               NIDQ=IA7+MAXM

                   MOPSTA(IOP(IA7))=1
                   CALL MACHIN(IA7,NIDQ)
c
                   IF ((KINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1             KINBUF(IA7).LT.MBUFF(IA7)) THEN
                       CALL CKBLK(IA7)
                   ENDIF
c
```

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                 ENDIF
c
             ENDIF
c
c
         ELSE
c
c            VERIFY IF PARTS ARE WAITING IN QUEUE AND IF THERE IS MORE
c            THAN ONE UNIT LOAD IN QUEUE (I.E. SFLAG=1)
c
             CALL QFULL(IA7,QFLAG,SFLAG)
c
             IF (QFLAG.EQ.0) THEN
                RETURN
             ENDIF
             IF (SFLAG.EQ.1  .AND. ISCHDP(IA7).NE.0) THEN
c
c            PUT FIRST IN QUEUE THE UNIT LOAD WITH THE QUEUE PRIORITY
c            CHOSEN BY THE USER.
c
                CALL SCHEDP(IA7)
             ENDIF
c
c            DETERMINE IF THERE ARE ANY GOOD UNITS IN THE NEXT UNIT LOAD
c            TO BE PROCESSED.
c
             NTRY=MMFE(IA7)
             IA2=QSET(NTRY+2)
             IA10=QSET(NTRY+10)
c
c            VERIFY IF A SETUP IS NEEDED
c
             IF (MSUCD(IA7).EQ.1) THEN

                IF (IA2.NE.LASTPN(IA7)) THEN
                   NSUPN=IA2
                   CALL MSETUP(NSUPN,IA7)
                   RETURN
                ENDIF
             ENDIF

             IF (IA10.EQ.0) THEN
                GO TO 6700
             ENDIF
c
c            DFLAG=1 WITH AFLAG=0 TELLS THE PQC SUBROUTINE THAT THE
c            CALLING SUBROUTINE IS A DEPARTURE.
c
             DFLAG=1
             AFLAG=0
             PFLAG=0
c
c            IF THE NEXT ACTIVITY AT THE MACHINE IS AN INSPECTION OR A
c            PART PROCESSING, A UNIT LOAD WAS REMOVED FROM THE QUEUE.
c            THEREFORE, IT SHOULD BE CHECKED IF THE QUEUE WAS ABOVE BUFFER
c            CAPACITY PRIOR TO REMOVAL AND DROPPED BELOW CAPACITY AFTER
c            THE REMOVAL.
c
             CALL PQC(AFLAG,DFLAG,PFLAG,IA7)
             IF (PFLAG.EQ.0) THEN
c
                IF (MSTATU(IA7).EQ.6) THEN
                   IF ((XINBUP(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1             XINBUP(IA7).LT.MBUFF(IA7)) THEN
                      CALL CEBLK(IA7)
                   ENDIF
                ENDIF
c
                RETURN
             ELSE
6700            NIDQ=IA7+MAXN
                CALL MACHIN(IA7,NIDQ)
c
                IF ((XINBUP(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND.
     1          XINBUP(IA7).LT.MBUFF(IA7)) THEN
                   CALL CEBLK(IA7)
                ENDIF
c
             ENDIF
c
         ENDIF
c
      ENDIF
c
6705  RETURN
      END
c
c ***********************************************************************
c
      SUBROUTINE ARRSC6(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
```

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      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKDM(50),
     6 MBLT(40,500)
c
      IF (MTYPE(IA7).EQ.3) THEN
         CALL A6M3(IA7)
         RETURN
      ENDIF

      END
c
c ***********************************************************************
c
      SUBROUTINE DESC6(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKDM(50),
     6 MBLT(40,500)
c
      common/ucomd/iffl
c
      IF (MTYPE(IA7).EQ.2) THEN
         CALL D6M2(IA7)
      ENDIF

      RETURN
      END
c
c ***********************************************************************
c
      SUBROUTINE ARRSC8(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKDM(50),
     6 MBLT(40,500)
c
      IF (MTYPE(IA7).EQ.3) THEN
         CALL A8M3(IA7)
         RETURN
      ENDIF

      END
c
c ***********************************************************************
c
      SUBROUTINE DESC10(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MSUCD(50),MQCD(50),MARRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),MOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKDM(50),
     6 MBLT(40,500)
c
      common/ucomd/iffl
c
      IF (MTYPE(IA7).EQ.3) THEN
         CALL D10M3(IA7)
      ENDIF
```

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```
      RETURN
      END
c
c ***********************************************************************
c
      SUBROUTINE ASM3(IA7)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON QSET(600000)
c
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MSUCD(50),NQCD(50),MARRSC(50),
     1 NDEPSC(50),MBUFF(50),MSUTYP(50),MMOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),NSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKIN,WAVNT,OPNOT,NDTHA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
c
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM33/NPARLL(50),NRES(10,50)
      COMMON/UCOM43/BRKDSC,BRKEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTM(50)
      COMMON/UCOM45/WAITTM(50)
      COMMON/UCOM49/NAUTO
      COMMON/UCOM60/IPRCD(50),IREP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM64/CAPAV(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM72/IFAM(40),CAP(50,40),REMCAP(50,40),NUMFAM,CYCLET(50)
      COMMON/UCOM82/MAXN
      COMMON/UCOM83/NWAIT(40)
c
      NIDQ=IA7+MAXN
      NODQ=IA7+MAXN*2
c
      CALL FILEM(IA7,ATRIB)
c
      IF (MSTATU(IA7).NE.0) THEN
         RETURN
      ENDIF
c
c     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED
c
      FFLAG=0
      CALL BRKCK(IA7,FFLAG)
      IF (FFLAG.EQ.0) THEN
         RETURN
      ENDIF
c
      IF (NNQ(NODQ).GT.0 .AND. (NOPSTA(IOP(IA7)).NE.7
     1.AND. NOPSTA(IOP(IA7)).NE.9)) THEN
         WRITE(6,6715) NOPSTA(IOP(IA7))
6715     FORMAT(1X,'ERROR AT ASM3: PARTS IN NODQ W/OP.STATUS=',1X,I2)
         CALL MESSAGE(IA7)
      ENDIF
c
c     ***** TEST STRATEGY OF RUNNING WITH WHATEVER IS IN QUEUE
```

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6725  IF (NOPSTA(IOP(IA7)).NE.0) THEN
         RETURN
      ENDIF
c
      NOPSTA(IOP(IA7))=1
      LASTMA(IOP(IA7))=IA7
      CALL M3(IA7,NIDQ)
      START(IA7)=TNOW
c
      IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND. XINBUF(IA7)
     1.LT.MBUFF(IA7)) THEN
         CALL CKBLK(IA7)
      ENDIF
c
      RETURN
      END
c
c ***********************************************************************
c
      SUBROUTINE M3(IA7,NIDQ)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON QSET(600000)
c
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MSUCD(50),NQCD(50),MARRSC(50),
     1 NDEPSC(50),MBUFF(50),MSUTYP(50),MMOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),NSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKIN,WAVNT,OPNOT,NDTHA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM30/TLASTP(50)
c
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM40/REMPT(50)
      COMMON/UCOM43/BRKDSC,BRKEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM64/CAPAV(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM72/IFAM(40),CAP(50,40),REMCAP(50,40),NUMFAM,CYCLET(50)
      COMMON/UCOM82/MAXN
c
c     INITIALIZE THE REMAINING OVEN CAPACITY FOR EACH PRODUCT FAMILY AS
c     THE OVEN CAPACITY FOR THAT PRODUCT FAMILY.
c
      NODQ=IA7+MAXN*2
c
      IF (NNQ(NIDQ).GT.0) THEN
         WRITE(6,6720)
6720     FORMAT(1X,'ERROR W/M3, PARTS AT NIDQ')
         CALL MESSAGE(IA7)
      ENDIF
c
      DO 6730 I=1,NUMFAM
6730  REMCAP(IA7,I)=CAP(IA7,I)
      CAPAV(IA7)=MCAP(IA7)
c
      N=1
```

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6740  NTRY=LOCAT(N,IA7)
      IA2=QSET(NTRY+2)
      IA10=QSET(NTRY+10)

      IF (REMCAP(IA7,IPAM(IA2)).GE.IA10) THEN
C
C        IF THERE IS ENOUGH CAPACITY FOR THAT ENTITY, REMOVE THE ENTITY FROM
C        THE MAIN QUEUE AND PLACE IT AT NIDQ. ONLY FOR THIS MACHINE TYPE,
C        PARTS AT NIDQ REPRESENT THE ONES UNDERGOING THE BURN IN PROCESS. THE
C        DUMMY OUTPUT BUFFER WILL BE USED TO PLACE THE ONES THAT WERE UNLOADED.
C
         CALL RMOVE(N,IA7,ATRIB)
         CALL FILEM(NIDQ,ATRIB)
C
C        REDUCE CAPACITY AVAILABLE ONLY BY THE GOOD PARTS IN THE UNIT LOAD.
C
         CAPAV(IA7)=CAPAV(IA7)-ATRIB(10)
         REMCAP(IA7,IPAM(IA2))=REMCAP(IA7,IPAM(IA2))-ATRIB(10)
C
C        SEARCH FOR THE NEXT ENTITY IN QUEUE (I.E. N STAYS THE SAME SINCE THE
C        NEXT PART IN QUEUE JUMPED TO POSITION N). SEARCH WILL CONTINUE UNTIL
C        ALL ENTITIES IN QUEUE HAVE BEEN CHECKED FOR CAPACITY AVAILABLE AT
C        THE BURN-IN-OVEN.
C
         IF (NNQ(IA7).GE.N .AND. CAPAV(IA7).GE.1) THEN
            GO TO 6740
         ELSE
            GO TO 6750
         ENDIF

      ELSE

         N=N+1
         IF (NNQ(IA7).GE.N .AND. CAPAV(IA7).GE.1) THEN
            GO TO 6740
         ELSE
            GO TO 6750
         ENDIF

      ENDIF

6750  IF (CAPAV(IA7).LT.NCAP(IA7)) THEN
C
C        PARTS WERE LOADED INTO THE OVEN. DETERMINE THE NUMBER OF UNITS THAT
C        WERE LOADED. THE TOTAL LOADING TIME REQUIRED WILL BE THE EXPECTED
C        LOADING TIME PER UNIT TIMES THE NUMBER OF UNITS LOADED.
C
         NSTATU(IA7)=1

         IF (NNQ(NODQ).EQ.0) THEN

            LOADED=SUMQ(10,NIDQ)
            EXPLDT=0
            CALL LOAD(IA7,EXPLDT)
            TLOADT=LOADED*EXPLDT
C
C           SCHEDULE THE COMPLETION OF LOADING
C
            ATRIB(1)=0
            ATRIB(2)=0
            ATRIB(3)=0
            ATRIB(4)=0
            ATRIB(5)=0
            ATRIB(6)=0
            ATRIB(7)=IA7
            ATRIB(8)=0
            ATRIB(9)=0
            ATRIB(10)=0
            ATRIB(11)=0
            ATRIB(12)=0
            ATRIB(13)=0
            ATRIB(14)=0

            CALL SCHDL(25,TLOADT,ATRIB)
            FULLDQ(IA7)=SUMQ(4,NIDQ)
            XINBUF(IA7)=XINBUF(IA7)-FULLDQ(IA7)

         ELSE

            LOADED=SUMQ(10,NIDQ)
            UNLOED=SUMQ(10,NODQ)
            EXPLDT=0
            CALL LOAD(IA7,EXPLDT)
            TLOADT=(LOADED+UNLOED)*EXPLDT
C
C           SCHEDULE THE COMPLETION OF UNLOADING
C
            ATRIB(1)=0
            ATRIB(2)=0
            ATRIB(3)=0
            ATRIB(4)=0
```



```
            ATRIB(5)=0
            ATRIB(6)=0
            ATRIB(7)=IA7
            ATRIB(8)=0
            ATRIB(9)=0
            ATRIB(10)=0
            ATRIB(11)=0
            ATRIB(12)=0
            ATRIB(13)=0
            ATRIB(14)=0

            CALL SCHDL(26,TLOADT,ATRIB)
            FULLDQ(IA7)=SUMQ(4,NIDQ)
            XINBUF(IA7)=XINBUF(IA7)-FULLDQ(IA7)

         ENDIF

      ENDIF

      RETURN
      END
C
C ******************************************************************
C
      SUBROUTINE D10N3(IA7)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),MOPCD(50),MMUCD(50),MQCD(50),MAXRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(60,50),REWKP(60,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPOL(40,50),NCAP(50),L(50),MSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 NELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPS,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICONUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     3MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/IBCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQAREL,PRCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDSMD,TRMEP1,TRMEP2,TRMEP3
      COMMON/UCOM17/TRDRJP(40),TRDSMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURMD(50),SURMP1(50),SURMP2(50),SURMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucom26/ifl
      COMMON/UCOM29/MINITR,NDRPTR
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM35/IBLKSC(50),NUMBLK(50),MBLK(50,50)
      COMMON/UCOM43/BRKDSC,BRKEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTH(50)
      COMMON/UCOM48/NAOTO
      COMMON/UCOM60/IPRCD(50),IREP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM64/CAPAV(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM72/IPAM(40),CAP(50,40),REMCAP(50,40),NUMPAM,CYCLET(50)
      COMMON/UCOM82/MAXM
      COMMON/UCOM83/NWAIT(40)
C
      NIDQ=IA7+MAXM
      NODQ=IA7+MAXM*2
C
      UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
      TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
      START(IA7)=900000
C
      IF (NOPSTA(IOP(IA7)).NE.0) THEN
```


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```
C
C        BLOCK THE MACHINE AND DEFINE THE BLOCKING SOURCE AS 5 (I.E. OPERATOR
C        NOT AVAILABLE TO UNLOAD THE PARTS.
C
         MSTATU(IA7)=2
         MBLKSC(IA7)=5
         BLKTM(IA7)=TNOW

         RETURN

      ENDIF
C
C     REMOVE PARTS FROM NIDQ (I.E. TO BE (IN OR ALREADY) PROCESSED) TO NODQ
C     (READY TO BE UNLOADED). THIS WILL ALLOW PLACING NEW UNITS IN THE OVEN.
C
      NOPSTA(IOP(IA7))=1
      LASTMA(IOP(IA7))=IA7

      DO 6770 J=1,NNQ(NIDQ)
      CALL RMOVE(1,NIDQ,ATRIB)
      ATRIB(12)=IA7
6770  CALL FILEM(NODQ,ATRIB)

      ULDED=SUMQ(10,NODQ)

C     ***** TEST STRATEGY OF RUNNING WITH WHATEVER IS IN QUEUE.

6779  IF (NNQ(IA7).GT.0) THEN

         CALL N3(IA7,NIDQ)

         START(IA7)=TNOW

         IF ((XINBUF(IA7)+FULLDQ(IA7)).GE.MBUFF(IA7) .AND. XINBUF(IA7)
     1   .LT.MBUFF(IA7)) THEN
            CALL CKBLK(IA7)
         ENDIF

      ELSE

         EXPULT=0
         CALL LOAD(IA7,EXPULT)
         TULDT=ULDED*EXPULT
C
C        SCHEDULE THE COMPLETION OF UNLOADING
C
            ATRIB(1)=0
            ATRIB(2)=0
            ATRIB(3)=0
            ATRIB(4)=0
            ATRIB(5)=0
            ATRIB(6)=0
            ATRIB(7)=IA7
            ATRIB(8)=0
            ATRIB(9)=0
            ATRIB(10)=0
            ATRIB(11)=0
            ATRIB(12)=0
            ATRIB(13)=0
            ATRIB(14)=0

         CALL SCHDL(26,TULDT,ATRIB)
         CAPAV(IA7)=MCAP(IA7)
         START(IA7)=TNOW

      ENDIF

      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE CLOAD
C
      INCLUDE '/usr/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MSUCD(50),MQCD(50),MASRSC(50),
     1 MDEPSC(50),MBUFF(50),MSUTYP(50),MNOP(50,50),SPEED(50,50),
     2 CLEMON(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),ISI(40),
     4 IDEPUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),MBLKSC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
```



```
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/MSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKER,NAVHT,OPNDT,NOTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NOSBCO(50),NUSBCA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/START1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHOP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWL,TWCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRORWD,TRWEP1,TRWEP2,TRWEP3
      COMMON/UCOM17/TRORJP(40),TRORWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM29/NINITR,NDESTR
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM60/IPNCD(50),IRSP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM72/IPAN(40),CAP(50,40),REMCAP(50,40),NUMPAN,CYCLET(50)
      COMMON/UCOM82/MAXN
C
      IA7=ATRIB(7)
      NIDQ=IA7+MAXN
      NODQ=IA7+MAXN*2
C
      UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
      TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
      START(IA7)=900000
C
C     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED
C
      FFLAG=0
      CALL BRKCK(IA7,FFLAG)
      IF (FFLAG.EQ.0) THEN
         NOPSTA(IOP(IA7))=0
         IF (IOPCD(IOP(IA7)).EQ.3) THEN
            CALL DESTIN(IA7)
         ENDIF
         RETURN
      ENDIF
C
      IF (NNQ(NODQ).GT.0) THEN
         WRITE(6,6700)
6700     FORMAT(1X,'ERROR AT CLOAD: NODQ=0')
         CALL MESSAGE(IA7)
      ENDIF
C
            ATRIB(1)=0
            ATRIB(2)=0
            ATRIB(3)=0
            ATRIB(4)=0
            ATRIB(5)=0
            ATRIB(6)=0
            ATRIB(7)=IA7
            ATRIB(8)=0
            ATRIB(9)=0
            ATRIB(10)=0
            ATRIB(11)=0
            ATRIB(12)=0
            ATRIB(13)=0
            ATRIB(14)=0

      CALL SCHDL(6,CYCLET(IA7),ATRIB)
      TLASTP(IA7)=TNOW+CYCLET(IA7)
      START(IA7)=TNOW

      NOPSTA(IOP(IA7))=0
      IF (IOPCD(IOP(IA7)).EQ.2) THEN
         CALL DESTIN(IA7)
      ENDIF

      RETURN
      END
C
C ********************************************************************
C
```

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```
      SUBROUTINE CULOAD
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MEQXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NHOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKNA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PHCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
      COMMON/UCOM29/MINITR,MOBSTR
      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM32/XINBUP(50)
      COMMON/UCOM43/BRKDSC,BRNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM48/NAUTO
      COMMON/UCOM60/IPNCD(50),INEP(50)
      COMMON/UCOM63/FULLDQ(50)
      COMMON/UCOM64/CAPAV(50)
      COMMON/UCOM65/START(50)
      COMMON/UCOM72/IPAN(40),CAP(50,40),REMCAP(50,40),NUMPAN,CYCLET(50)
      COMMON/UCOM82/MAXN
C
      IA7=ATRIB(7)
      NIDQ=IA7+MAXN
      NODQ=IA7+MAXN*2
C
      UPTIME(IA7)=UPTIME(IA7)+(TNOW-START(IA7))
      TOTUP(IA7)=TOTUP(IA7)+(TNOW-START(IA7))
      START(IA7)=999999
C
C     AT COMPLETION OF UNLOADING SCHEDULE CHELIN TO DETERMINE HOW MANY UNITS
C     BURNED.
C
      NOPSTA(IOP(IA7))=0
      NQFLAG=1
      QFLAG=0
C
C     THERE ARE MANY DIFFERENT PARTS AT NODQ. THEY MIGHT HAVE DIFFERENT
C     ROUTINGS. HOWEVER, ONE ASSUMPTION IS THAT FROM THIS WORKSTATION TO
C     ALL OTHERS THERE IS ONLY ONE TYPE OF HANDLING SYSTEM.
C
      CALL DQC(IA7,QFLAG,NQFLAG)
C
C     CHECK FIRST IF THERE ARE ANY BREAKDOWNS DELAYED

      FFLAG=0
      CALL BRKCK(IA7,FFLAG)
      IF (FFLAG.EQ.0) THEN
         RETURN
      ENDIF

C     IF NNQ(NIDQ)=0 IT MEANS THAT PARTS WERE LOADED FOR ANOTHER CYCLE OF
C     BURN-IN. THEREFORE, SCHEDULE THE COMPLETION OF BURN-IN.
C
      IF (NNQ(NIDQ).GT.0) THEN
         NSTATU(IA7)=1
```

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```
            ATRIB(1)=0
            ATRIB(2)=0
            ATRIB(3)=0
            ATRIB(4)=0
            ATRIB(5)=0
            ATRIB(6)=0
            ATRIB(7)=IA7
            ATRIB(8)=0
            ATRIB(9)=0
            ATRIB(10)=0
            ATRIB(11)=0
            ATRIB(12)=0
            ATRIB(13)=0
            ATRIB(14)=0

         CALL SCHDL(4,CYCLET(IA7),ATRIB)
         TLASTP(IA7)=TNOW+CYCLET(IA7)
         START(IA7)=TNOW
      ELSE
         NSTATU(IA7)=0
         CAPAV(IA7)=NCAP(IA7)
      ENDIF

      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE LOAD(IA7,EXPLOT)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MEQXV)
C
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NARRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NHOP(50,50),SPEED(50,50),
     2 CLENGN(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IBI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTNA(50),NBLKSC(50),NBLKNA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVNT,OPNDT,NDTNA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQARWK,PHCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      COMMON/UCOM73/LOADD(50),P1LD(50),P2LD(50),P3LD(50)
      common/ucomd/iffl
C
      GO TO (6000,6001,6001,6003,6004,6005,6006,6007,6008,6009
     1) LOADD(IA7)
C
6000  EXPLOT=P1LD(IA7)
      GO TO 6010
C
6001  EXPLOT=(P1LD(IA7)+P2LD(IA7))/2
      GO TO 6010
C
C6002  EXPLOT=??????
C      GO TO 6010
C
6003  EXPLOT=(P1LD(IA7)+P2LD(IA7)+P3LD(IA7))/3
      GO TO 6010
C
6004  EXPLOT=P1LD(IA7)
      GO TO 6010
```

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c
6005  EXPLOT=P1LD(IA7)
      GO TO 6010
c
6006  EXPLOT=P1LD(IA7)*P2LD(IA7)
      GO TO 6010
c
6007  EXPLOT=P1LD(IA7)*P2LD(IA7)
      GO TO 6010
c
6008  EXPLOT=(P1LD(IA7)*PROLOW(IA7)+P2LD(IA7)*PROUPP(IA7))/
     1(P1LD(IA7)+P2LD(IA7))
c
      GO TO 6010
c
6009  EXPLOT=P1LD(IA7)
c
6010  RETURN
      END
c
c ******************************************************************
c
      SUBROUTINE EXSELP(IA7,EXPSEL)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NASREC(50),
     1 NDEPSC(50),NSUPP(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLESC(50),NBLEMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,WAVRT,OPNDT,NDTWA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
c
      GO TO (6020,6021,6021,6023,6024,6025,6026,6027,6028,6029
     1) SELDIS(IA7)
c
6020  EXPSEL=SEP1(IA7)
      GO TO 6030
c
6021  EXPSEL=(SEP1(IA7)+SEP2(IA7))/2
      GO TO 6030
c
C6022  EXPSEL=??????
c      GO TO 6030
c
6023  EXPSEL=(SEP1(IA7)+SEP2(IA7)+SEP3(IA7))/3
      GO TO 6030
c
6024  EXPSEL=SEP1(IA7)
      GO TO 6030
c
6025  EXPSEL=SEP1(IA7)
      GO TO 6030
c
6026  EXPSEL=SEP1(IA7)*SEP2(IA7)
      GO TO 6030
c
6027  EXPSEL=SEP1(IA7)*SEP2(IA7)
```

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mdirisar@c50030-201ps.i          cell6.f          .0/17/96  14:02    206/220
      GO TO 6030
c
6028  EXPSEL=(SEP1(IA7)*PROLOW(IA7)+SEP2(IA7)*PROUPP(IA7))/
     1(SEP1(IA7)+SEP2(IA7))
c
      GO TO 6030
c
6029  EXPSEL=SEP1(IA7)
c
6030  RETURN
      END
c
c ******************************************************************
c
      SUBROUTINE NSQPUL(IA7,QFLAG,SFLAG)
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NASREC(50),
     1 NDEPSC(50),NSUPP(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLESC(50),NBLEMA(50),
     6 RELT(40,500)
c
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
c
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
c
      COMMON/UCOM7/WALKEN,WAVRT,OPNDT,NDTWA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
c
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQANWK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRWD,TRWKP1,TRWKP2,TRWKP3
      COMMON/UCOM17/TRDRJP(40),TRDRWP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNW,TSELNW
c
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
      common/ucomd/iffl
c
c     WHEN THERE ARE NO UNITS WAITING IN QUEUE, QFLAG REMAINS AS ZERO
c
      IF (NNQ(IA7).EQ.0) THEN
         RETURN
      ELSE
         QFLAG=1
         SFLAG=1
      ENDIF
c
      RETURN
      END
c
c ******************************************************************
c
      SUBROUTINE THRUPT
c
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
c
      COMMON QSET(600000)
c
      COMMON/UCOM1/NTYPE(50),NOPCD(50),NSUCD(50),NQCD(50),NASREC(50),
     1 NDEPSC(50),NSUPP(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),NN(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IEI(40),
     4 IDEPUL(40,50),NCAP(50),L(50),NSEQ(50,40),NOPSTA(50),NSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),NBLESC(50),NBLEMA(50),
     6 RELT(40,500)

      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
      COMMON/UCOM47/NEXAUT(50),DAYLTH
```

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mdirizar@c50030-201ps.1          cell6.f          .0/17/96  14:02   207/220
      COMMON/UCOM74/TRPUT
      COMMON/UCOM78/THPWK
C
C     SCHEDULE THE NEXT COLLECTION OF STATISTICS ON THROUGHPUT.
C
      ATRIB(1)=0
      ATRIB(2)=0
      ATRIB(3)=0
      ATRIB(4)=0
      ATRIB(5)=0
      ATRIB(6)=0
      ATRIB(7)=0
      ATRIB(8)=0
      ATRIB(9)=0
      ATRIB(10)=0
      ATRIB(11)=0
      ATRIB(12)=0
      ATRIB(13)=0

      CALL SCHDL(27,DAYLTH,ATRIB)
C
      WRITE(10,8990) TRPUT,(NP(I),I=1,NPN)
8990  FORMAT(' ',F7.0,1X,13I6)
      TRPUT=0
C
      RETURN
      END
C
C ********************************************************************
C
      SUBROUTINE MESSAGE(LLL)
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MSUCD(50),MQCD(50),MAXREC(50),
     1 MDSPSC(50),MBUFF(50),MSUTYP(50),MMOP(50,50),SPEED(50,50),
     2 CLSNUM(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 ICP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IRI(40),
     4 IDSPUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MMLESC(50),MBLKMA(50),
     6 RELT(40,500)
C
      WRITE(6,8995) LLL,TNOW
8995  FORMAT(1X,'PROBLEMS W/MACHINE:',I3,1X,'AT TNOW=',F10.2)

      STOP
      END
C
C ********************************************************************
C
      SUBROUTINE OTPUT
C
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON QSET(600000)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),MSUCD(50),MQCD(50),MAXREC(50),
     1 MDSPSC(50),MBUFF(50),MSUTYP(50),MMOP(50,50),SPEED(50,50),
     2 CLSNUM(50,50),DIST(50,50),SCRAPP(40,50),REWKP(40,50),MM(50),
     3 ICP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(40),IRI(40),
     4 IDSPUL(40,50),MCAP(50),L(50),MSEQ(50,40),NOPSTA(50),MSTATU(50),
     5 LASTPN(50),LASLOT(50),LASTMA(50),MMLESC(50),MBLKMA(50),
     6 RELT(40,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(40),TOTAL(40,500),NPN,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKEN,NAVWT,OPNDT,NDTWA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(40,50),COCOST(50),ICOCAP(40,50),CACOST,
     1NUSECO(50),NUSECA,ICOSUM(50),ICASUM,NCOST,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOW(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(40,50),TOTQA,TQASMK,PNCOST(40,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TNORMD,TNMLP1,TNMLP2,TNMLP3
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mdirizar@c50030-201ps.1          cell6.f          .0/17/96  14:02   208/220
      COMMON/UCOM17/TRDRJP(40),TRDEMP(40)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCRW,TSELRW
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
      COMMON/UCOM20/NSURWD(50),SURWP1(50),SURWP2(50),SURWP3(50)
      COMMON/UCOM21/NSERWD(50),SERWP1(50),SERWP2(50),SERWP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
C
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      COMMON/UCOM26/NP3,NP4
      COMMON/UCOM27/NOP

      common/ucomd/iffl

      COMMON/UCOM30/TLASTP(50)
      COMMON/UCOM32/XINBUF(50)
      COMMON/UCOM34/NOBOP(50,14),NOBMA(50,40),PERCOP(50,14)
     1,PERCMA(50,14)
      COMMON/UCOM36/TRAIN,WCIN
      COMMON/UCOM37/TRPDIS(50),TRPP1(50),TRPP2(50),TRPP3(50),NRECD(50)
      COMMON/UCOM38/TTRDIS(50),TTRP1(50),TTRP2(50),TTRP3(50),SCREW
      COMMON/UCOM39/TOTRT
      COMMON/UCOM40/REMPT(50)
      COMMON/UCOM41/NRNEW(50)
      COMMON/UCOM42/NTL(40,500),TL(40,500),NL(40,50),NFL(40,50)
      COMMON/UCOM43/BRKDSC,BKNEXT(50),UPTIME(50),TOTUP(50)
      COMMON/UCOM44/BLKTM(50)
      COMMON/UCOM45/WAITTM(50)
      COMMON/UCOM46/NAUTOD(50),AUTOP1(50),AUTOP2(50),AUTOP3(50),TOTAUT
      COMMON/UCOM49/PGICC(40),CR
      COMMON/UCOM50/RA,CUSLT,NLO,DPCLO,RLENGH
      COMMON/UCOM51/SUMWIP(40,50),NOMWIP(40,50)
      COMMON/UCOM54/NYRS,SUINV,PHINV,MEINV,QAINV,RELAY,PSPACE
      COMMON/UCOM55/WG,OMG,NSUCRW,SUMG,NSUSC,SUTRAI,SUTWRK,NWEEKS,AIR
      COMMON/UCOM56/PRTRAI,PNCOST,SMG,PC(50),NPEMP
      COMMON/UCOM57/TNMR(40,50),QAMG,NMKC(40,50),QATRAI
      COMMON/UCOM58/PGINV(40),MAXPG(40),PGCAP(40),PGCC(40)
      COMMON/UCOM59/NCOPG(40)
      COMMON/UCOM64/CAPAV(50)
      COMMON/UCOM66/TWORK
      COMMON/UCOM71/TCFLAG
      COMMON/UCOM79/NFACT,IEXP
      COMMON/UCOM80/NDMG
      COMMON/UCOM81/FACT(6)
      COMMON/UCOM82/MAXN
C
      WRITE(6,9000)
9000  FORMAT()
      WRITE(6,9001)
9001  FORMAT()
C
      WRITE(6,9002)
9002  FORMAT(1X,'PRODUCTION RESULTS:')
      WRITE(6,9003)
9003  FORMAT()
C
      DO 9005 J=1,NPN
      WRITE(6,9004) J,NP(J)
9004  FORMAT(1X,'TOTAL PRODUCTION (GOOD UNITS) OF PN=',I2,1X,'WAS'
     1,1X,I10)
9005  CONTINUE
C
      WRITE(6,9006)
9006  FORMAT()
C
      WRITE(6,9010) NPARTS
9010  FORMAT(10X,'*** TOTAL NUMBER OF GOOD UNITS=',I8)
C
      TPUT=NPARTS/NWEEKS
C
      WRITE(6,9022) TPUT
9022  FORMAT(10X,'*** CELL WEEKLY THROUGHPUT=',F10.0)
C
      WRITE(6,9011)
9011  FORMAT()
C
      WRITE(6,9015) TOTLOT
9015  FORMAT(1X,'TOTAL NUMBER OF LOTS=',F8.0)
C
      go to 9206

      WRITE(6,9102)
9102  FORMAT()
      WRITE(6,9103)
9103  FORMAT(1X,'SETUP RESULTS:')
      WRITE(6,9104)
9104  FORMAT()
C
      WRITE(6,9105) SUTEX
9105  FORMAT(1X,'TOTAL EXTERNAL SETUP TIME=',F10.2)
C
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mdirizar@c50030-201ps.1          cell6.f          0/17/96  14:02   209/220
      WRITE(6,9190) SUTIN
9190  FORMAT(1X,'TOTAL INTERNAL SETUP TIME=',F10.2)
      WRITE(6,9191) TRAIN
9191  FORMAT(4X,'TRADITIONAL:',F10.2)
      WRITE(6,9192) WCIN
9192  FORMAT(4X,'WORLD CLASS:',F10.2)
C
      WRITE(6,9195)
9195  FORMAT()
C
      WRITE(6,9200)
9200  FORMAT()
      WRITE(6,9201)
9201  FORMAT(1X,'MATERIAL HANDLING RESULTS:')
      WRITE(6,9202)
9202  FORMAT()
      WRITE(6,9203) OPMDT
9203  FORMAT(1X,'TIME SPENT BY OPERATORS ON MAT. HANDLING=',F12.2)
      WRITE(6,9204) HDTMA
9204  FORMAT(1X,'TIME SPENT BY HANDLERS ON MAT. HANDLING=',F12.2)
      NHAND=HDTMA/HPEMP
      WRITE(6,9205) NHAND
9205  FORMAT(1X,'MATERIAL HANDLERS NEEDED:',1X,I2)
      WRITE(6,9208)
9208  FORMAT()
      WRITE(6,9209)
9209  FORMAT()
C
      WRITE(6,9210)
9210  FORMAT(1X,'RESULTS ON CONTAINERS AND CARTS:')
      WRITE(6,9215)
9215  FORMAT()
C
      DO 9245 I=1,NCONT
      IF (NOBSCO(I).NE.0) THEN
         AVGUSE=ICOSUM(I)/NOBSCO(I)
         WRITE(6,9220) I,AVGUSE
9220     FORMAT(1X,'AVG.NO. OF CONT TYPE',1X,I2,1X,'IN USE=',F8.2)
         WRITE(6,9230) I,MAXCO(I)
9230     FORMAT(1X,'MAXIMUM NUMBER OF CONT.',1X,I2,1X,'IN USE=',I5)
         WRITE(6,9232) I,MINCO(I)
9232     FORMAT(1X,'MINIMUM NUMBER OF CONT.',1X,I2,1X,'IN USE=',I5)
         WRITE(6,9235) I,NOBSCO(I)
9235     FORMAT(1X,'NUMBER OF OBS. FOR CONT. TYPE',I3,1X,'=',I5)
         WRITE(6,9240)
9240     FORMAT()
      ENDIF
9245  CONTINUE
C
      IF (NOBSCA.NE.0) THEN
         AVGCART=ICASUM/NOBSCA
         WRITE(6,9250) AVGCART
9250     FORMAT(1X,'AVG. NO OF CARTS IN USE=',F8.2)
         WRITE(6,9260) MAXCA
9260     FORMAT(1X,'MAXIMUM NUMBER OF CARTS IN USE=',I5)
         WRITE(6,9265) NOBSCA
9265     FORMAT(1X,'NUMBER OF OBS. FOR CARTS =',I7)
      ENDIF
C
      WRITE(6,9270)
9270  FORMAT()
      WRITE(6,9275)
9275  FORMAT()
      WRITE(6,9280)
9280  FORMAT(1X,'QUALITY RESULTS:')
      WRITE(6,9285)
9285  FORMAT()
C
9286  PRODSCRP=0
      TOTSCRCO=0
      DO 9310 I=1,NPN
      SCRAPCO=0
C
      DO 9290 J=1,MAXM
      SCRAPCO=SCRAPCO+PNCOST(I,J)*TOTSCR(I,J)
9290  CONTINUE
C
c      WRITE(6,9295)
c9295  FORMAT()
C
c      WRITE(6,9300) I,SCRAP(I)
c9300  FORMAT(1X,'TOTAL SCRAP OF PN',1X,I3,'='F7.0,1X,'UNITS')
c      WRITE(6,9305) I,SCRAPCO
c9305  FORMAT(1X,'SCRAP COST PN',1X,I3,'= $',F12.2)
C
      PRODSCRP=PRODSCRP+SCRAP(I)
      TOTSCRCO=TOTSCRCO+SCRAPCO
9310  CONTINUE
c      WRITE(6,9380)
c9380  FORMAT()

c      WRITE(6,9390) PRODSCRP
```

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mdirizar@c50030-201ps.1          cell6.f          0/17/96  14:02   210/220
c9390  FORMAT(1X,'TOTAL NUMBER OF UNITS SCRAPPED=',F7.0)
c      WRITE(6,9392) TOTSCRCO
c9392  FORMAT(1X,'TOTAL SCRAP COST= $',F12.2)
C
c      WRITE(6,9395)
c9395  FORMAT()
C
c      WRITE(6,9400) TOTQA
c9400  FORMAT(1X,'TOTAL Q.A. INSPECTION TIME:',F9.2)

       NQACP=INT(TOTQA/HPEMP+.99)

c      WRITE(6,9402) NQACP
c9402  FORMAT(1X,'NUMBER OF QA INSPECTORS NEEDED:',1X,I2)
c      WRITE(6,9405)
c9405  FORMAT()
C
       TOTINSP=TSUCIN+TSELIN
c      WRITE(6,9415) TOTINSP
c9415  FORMAT(1X,'TOTAL INSPECTION TIME BY OPERATORS:',F9.2)
c      WRITE(6,9416)
c9416  FORMAT()
C
       TOTRWK=TSUCRW+TSELRW+TQARWK
c      WRITE(6,9420) TOTRWK
c9420  FORMAT(1X,'TOTAL REWORK TIME BY OPERATORS:',F9.2)

       NREKOP=INT(TQARWK/HPEMP+.99)

       go to 9806

      WRITE(6,9410) NREKOP
9410  FORMAT(1X,'NUMBER OF OFFLINE REWORK OPERATORS NEEDED:',1X,I2)
      WRITE(6,9421)
9421  FORMAT()
C
      WRITE(6,9422)
9422  FORMAT()
C
C      WRITE(6,9423)
C9423  FORMAT(1X,'OPERATOR STATUS AT END OF SIMULATION:')
C      WRITE(6,9424)
C9424  FORMAT()
C      DO 9426 J=1,NOP
C      WRITE(6,9425) J,NOPSTA(J)
C9425  FORMAT(1X,'STATUS OF OPERATOR(',I2,')=',I2)
C9426  CONTINUE
C      WRITE(6,9427)
C9427  FORMAT()
C
C      WRITE(6,9428)
C9428  FORMAT()
C
C      WRITE(6,9430)
C9430  FORMAT(1X,'MACHINE STATUS AT END OF SIMULATION:')
c
C      WRITE(6,9431)
C9431  FORMAT()
C
C      DO 9433 J=1,MAXM
C      WRITE(6,9432) J,MSTATU(J)
C9432  FORMAT(1X,'MACH.NO:',I3,1X,'STATUS:',I3)
C9433  CONTINUE
c
C      WRITE(6,9435)
C9435  FORMAT()

       DO 9500 J=1,MAXM
C
       IF (MSTATU(J).EQ.0) THEN
        IF (TLASTP(J).NE.0) THEN

C          MACHINE STATUS IS ZERO: IDLE
C
9440       WRITE(6,9441) J,MTYPE(J),MSTATU(J)
9441       FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3,1X
     1,'IDLE')
           WRITE(6,9442) LASTPN(J)
9442       FORMAT(1X,'LAST PART NUMBER PROCESSED:',I3)
           IF (MTYPE(J).EQ.5) THEN
              WRITE(6,9443) CAPAV(J)
9443          FORMAT(1X,'CAPACITY AVAILABLE:',F5.0)
           ENDIF
           GO TO 9570
        ELSE
           GO TO 9580
        ENDIF
       ENDIF
C
       GO TO (9450,9460,9470,9480,9490,9500,9510,9520,9530,9540,9551
     1,9562,9563) MSTATU(J)
C
```

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mdirizar@c50030-201ps.1                cell6.f                .0/17/96  14:02   211/220
C     MACHINE STATUS IS ONE: PROCESSING PARTS
C
9450  N=1

      IF (NTYPE(J).EQ.3) THEN
         WRITE(6,9445) J,NTYPE(J),NSTATU(J)
9445     FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
         WRITE(6,9446) CAPAV(J)
9446     FORMAT(1X,'CAPACITY AVAILABLE=',1X,F7.0)
         GO TO 9570
      ENDIF

      IF (NTYPE(J).EQ.7) THEN
         WRITE(6,9453) J,NTYPE(J),NSTATU(J)
9453     FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
         WRITE(6,9454) TCFLAG
9454     FORMAT(1X,'TCFLAG=',F4.0)
         GO TO 9570
      ENDIF

9451  NRANK=NFIND(N,NCLNR,21,0,4.0,0.)
      CALL COPY(NRANK,NCLNR,ATRIB)
      IA7=ATRIB(7)
      IF (IA7.EQ.J) THEN
         IA2=ATRIB(2)
         WRITE(6,9455) J,NTYPE(J),NSTATU(J)
9455     FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
         WRITE(6,9456) IA2
9456     FORMAT(1X,'PROCESSING PN:',I3)
          IF (NTYPE(J).EQ.5) THEN
             WRITE(6,9452) CAPAV(J)
9452         FORMAT(1X,'CAPACITY AVAILABLE:',F5.0)
          ENDIF
         GO TO 9570
      ELSE
         N=NRANK+1
         IF (N.GT.NNQ(NCLNR)) THEN
            WRITE(6,9457) J,NTYPE(J),NSTATU(J)
9457        FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
            WRITE(6,9458)
9458        FORMAT(1X,'CANNOT FIND THE ENTITY IN THE EVENT CALENDAR')
            IF (NTYPE(J).EQ.5) THEN
               WRITE(6,9459) CAPAV(J)
9459           FORMAT(1X,'CAPACITY AVAILABLE:',F5.0)
            ENDIF
            GO TO 9570
         ELSE
            GO TO 9451
         ENDIF
      ENDIF
C
C     MACHINE STATUS IS TWO: BLOCKED
C
9460  IF (NTYPE(J).EQ.7) THEN
         WRITE(6,9461) J,NTYPE(J),NSTATU(J)
9461     FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
         WRITE(6,9462) NBLKSC(J)
9462     FORMAT(1X,'BLOCKING SOURCE:',I3)
         IF (NBLKSC(J).EQ.1) THEN
            WRITE(6,9463) NBLKMA(J)
9463        FORMAT(1X,'BLOCKING MACHINE:',I3)
         ENDIF
         GO TO 9570
      ENDIF

      NODQ=J+MAXM*2
      CALL COPY(1,NODQ,ATRIB)
      IA2=ATRIB(2)
      WRITE(6,9465) J,NTYPE(J),NSTATU(J)
9465  FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
      WRITE(6,9466) IA2
9466  FORMAT(1X,'PN AT OUTPUT BUFFER:',I3)
      WRITE(6,9467) NBLKSC(J)
9467  FORMAT(1X,'BLOCKING SOURCE:',I3)
      IF (NBLKSC(J).EQ.1) THEN
         WRITE(6,9468) NBLKMA(J)
9468     FORMAT(1X,'BLOCKING MACHINE:',I3)
      ENDIF
      IF (NTYPE(J).EQ.5) THEN
         WRITE(6,9469) CAPAV(J)
9469     FORMAT(1X,'CAPACITY AVAILABLE:',F5.0)
      ENDIF
      GO TO 9570
C
C     MACHINE STATUS IS THREE: CANNOT BE!!!
C
9470  GO TO 9570
C
C     MACHINE STATUS IS FOUR: UNDER PM BY OPERATOR
C
9480  WRITE(6,9481) J,NTYPE(J),NSTATU(J)
9481  FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
```

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mdirizar@c50030-201ps.1                cell6.f                .0/17/96  14:02   212/220
      WRITE(6,9482)
9482  FORMAT(1X'UNDER AUTONOMOUS MAINT.')
      IF (NTYPE(J).EQ.5) THEN
         WRITE(6,9483) CAPAV(J)
9483     FORMAT(1X,'CAPACITY AVAILABLE:',F5.0)
      ENDIF
      GO TO 9570
C
C     MACHINE STATUS IS FIVE: UNDER SETUP
C
9490  WRITE(6,9491) J,NTYPE(J),NSTATU(J)
9491  FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
      WRITE(6,9492) NSUTYP(J)
9492  FORMAT(1X,'MACH. SETUP TYPE:',I2)
      GO TO 9570
C
C     MACHINE STATUS IS SIX: UNDER SUCCESSIVE INSPECTION
C
9500  N=1
9501  NRANK=NFIND(N,NCLNR,21,0,2.,0.)
      CALL COPY(NRANK,NCLNR,ATRIB)
      IA7=ATRIB(7)
      IF (IA7.EQ.J) THEN
         IA2=ATRIB(2)
         IA6=ATRIB(6)
         WRITE(6,9505) J,NTYPE(J),NSTATU(J)
9505     FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
         WRITE(6,9506) IA2,IA6
9506     FORMAT(1X,'SUCCESSIVE INSP. OF PN:',I3,1X,'ULS:',I3)
         GO TO 9570
      ELSE
         N=NRANK+1
         IF (N.GT.NNQ(NCLNR)) THEN
            WRITE(6,9507) J,NTYPE(J),NSTATU(J)
9507        FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
            WRITE(6,9508)
9508        FORMAT(1X,'CANNOT FIND THE ENTITY IN THE EVENT CALENDAR')
            GO TO 9570
         ELSE
            GO TO 9501
         ENDIF
      ENDIF
C
C     MACHINE STATUS IS SEVEN: UNDER SELF INSPECTION
C
9510  N=1
9511  NRANK=NFIND(N,NCLNR,21,0,5.,0.)
      CALL COPY(NRANK,NCLNR,ATRIB)
      IA7=ATRIB(7)
      IF (IA7.EQ.J) THEN
         IA2=ATRIB(2)
         IA6=ATRIB(6)
         WRITE(6,9515) J,NTYPE(J),NSTATU(J)
9515     FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
         WRITE(6,9516) IA2,IA6
9516     FORMAT(1X,'SELF INSP. OF PN:',I3,1X,'ULS:',I3)
         GO TO 9570
      ELSE
         N=NRANK+1
         IF (N.GT.NNQ(NCLNR)) THEN
            WRITE(6,9517) J,NTYPE(J),NSTATU(J)
9517        FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
            WRITE(6,9518)
9518        FORMAT(1X,'CANNOT FIND THE ENTITY IN THE EVENT CALENDAR')
            GO TO 9570
         ELSE
            GO TO 9511
         ENDIF
      ENDIF
C
C     MACHINE STATUS IS EIGHT: UNDER SUCCESSIVE REWORK
C
9520  N=1
9521  NRANK=NFIND(N,NCLNR,21,0,3.,0.)
      CALL COPY(NRANK,NCLNR,ATRIB)
      IA7=ATRIB(7)
      IF (IA7.EQ.J) THEN
         IA2=ATRIB(2)
         IA6=ATRIB(6)
         WRITE(6,9525) J,NTYPE(J),NSTATU(J)
9525     FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
         WRITE(6,9526) IA2,IA6
9526     FORMAT(1X,'SUCC. REWORK FOR PN:',I3,1X,'ULS:',I3)
         GO TO 9570
      ELSE
         N=NRANK+1
         IF (N.GT.NNQ(NCLNR)) THEN
            WRITE(6,9527) J,NTYPE(J),NSTATU(J)
9527        FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
            WRITE(6,9528)
9528        FORMAT(1X,'CANNOT FIND THE ENTITY IN THE EVENT CALENDAR')
            GO TO 9570
```


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         ELSE
            GO TO 9521
         ENDIF
      ENDIF
C
C     MACHINE STATUS IS NINE: UNDER SELF REWORK
C
9530  N=1
9531  NRANK=NFIND(N,NCLNR,21,0,6.,0.)
      CALL COPY(NRANK,NCLNR,ATRIB)
      IA7=ATRIB(7)
      IF (IA7.EQ.J) THEN
         IA2=ATRIB(2)
         IA6=ATRIB(6)
         WRITE(6,9535) J,MTYPE(J),MSTATU(J)
9535     FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
         WRITE(6,9536) IA2,IA6
9536     FORMAT(1X,'SELF REWORK FOR PN:',I3,1X,'ULS:',I3)
         GO TO 9570
      ELSE
         N=NRANK+1
         IF (N.GT.NNQ(NCLNR)) THEN
            WRITE(6,9537) J,MTYPE(J),MSTATU(J)
9537        FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
            WRITE(6,9538)
9538        FORMAT(1X,'CANNOT FIND THE ENTITY IN THE EVENT CALENDAR')
            GO TO 9570
         ELSE
            GO TO 9531
         ENDIF
      ENDIF
C
C     MACHINE STATUS IS TEN: WAITING FOR PART TO COMPLETE UNIT LOAD
C
9540  NODQ=J+MAXN*2
      CALL COPY(1,NODQ,ATRIB)
      IA2=ATRIB(2)
      WRITE(6,9543) J,MTYPE(J),MSTATU(J)
9543  FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
      WRITE(6,9544) IA2
9544  FORMAT(1X,'WAITING FOR PN:',I3)
      IF (MTYPE(J).EQ.5) THEN
         WRITE(6,9545) CAPAV(J)
9545     FORMAT(1X,'CAPACITY AVAILABLE:',F5.0)
      ENDIF
      GO TO 9570
C
C     MACHINE STATUS IS ELEVEN: UNDER REPAIR
C
9551  WRITE(6,9552) J,MTYPE(J),MSTATU(J)
9552  FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
      WRITE(6,9553)
9553  FORMAT(1X,'UNDER REPAIR')
      IF (MTYPE(J).EQ.5) THEN
         WRITE(6,9554) CAPAV(J)
9554     FORMAT(1X,'CAPACITY AVAILABLE:',F5.0)
      ENDIF
      GO TO 9570
C
C     MACHINE IS UNDER REPLENISHMENT
C
9562  WRITE(6,9563) J,MTYPE(J),MSTATU(J)
9563  FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
      WRITE(6,9564)
9564  FORMAT(1X,'UNDER REPLENISHMENT')
      IF (MTYPE(J).EQ.5) THEN
         WRITE(6,9568) CAPAV(J)
9568     FORMAT(1X,'CAPACITY AVAILABLE:',F5.0)
      ENDIF
C
      GO TO 9570
C
C     MACHINE IS BEING IMPROVED AFTER A POKA-YOKE SIGNAL
C
9565  WRITE(6,9566) J,MTYPE(J),MSTATU(J)
9566  FORMAT(1X,'MACH. NO.:',I3,1X,'TYPE:',I2,1X,'STATUS:',I3)
      WRITE(6,9567)
9567  FORMAT(1X,'UNDER MACHINE IMPROVEMENTS')
C
9570  WRITE(6,9571) TLASTP(J)
9571  FORMAT(1X,'TIME OF LAST DEPARTURE:',F10.2)
      WRITE(6,9572)
9572  FORMAT()
C
9580  CONTINUE
C
      WRITE(6,9581)
9581  FORMAT()
C
      WRITE(6,9600)
9600  FORMAT()
C
```



```
      DO 9620 I=1,NOP
      DO 9610 J=1,14
      PERCOP(I,J)=NCBOP(I,J)*5.0/RLENGH
9610  CONTINUE
9620  CONTINUE
C
      DO 9640 I=1,MAXN
      DO 9630 J=1,14
      PERCMA(I,J)=NCBMA(I,J)*5.0/RLENGH
9630  CONTINUE
9640  CONTINUE
C
      WRITE(6,9650)
9650  FORMAT(1X,'STATISTICS ON OPERATOR AND MACHINE STATUS:')
      WRITE(6,9655)
9655  FORMAT()
C
      WRITE(6,9660) (I,I=1,12)
9660  FORMAT(1X,'STATUS','  0 ',1X,12(I3,3X))
C
      WRITE(6,9662)
9662  FORMAT()
C
C      DO 9670 I=1,NOP
C      WRITE(6,9665) I,PERCOP(I,14),(PERCOP(I,J),J=1,12)
C9665  FORMAT(1X,'OP. ',I2,1X,F5.3,1X,12(F5.3,1X))
C9670  CONTINUE
C
      WRITE(6,9667)
9667  FORMAT()
C
      DO 9680 I=1,MAXN
      IF (PERCMA(I,14).NE.1) THEN
         WRITE(6,9675) I,PERCMA(I,14),(PERCMA(I,J),J=1,12)
9675     FORMAT(1X,'MA. ',I2,1X,F5.3,1X,12(F5.3,1X))
      ENDIF
9680  CONTINUE
C
      WRITE(6,9683)
9683  FORMAT()
      WRITE(6,9684)
9684  FORMAT()
      WRITE(6,9687)
9687  FORMAT(1X,'WORK IN PROCESS AT THE END OF THE SIMULATION')
      WRITE(6,9690)
9690  FORMAT()
C
      WRITE(6,9695)
9695  FORMAT(3X,'MACH.NO.',1X,'MAIN B',2X,' DIB ')
C
      DO 9720 I=1,MAXN
      NIDQ=I+MAXN
      NODQ=I+MAXN*2
      NINBUF=XINBUF(I)
      NODBUF=0
9699  WRITE(6,9700) I,NINBUF,NNQ(NIDQ)
9700  FORMAT(3X,I3,3X,I6,1X,I6)
9720  CONTINUE
C
      WRITE(6,9725)
9725  FORMAT()
      WRITE(6,9730)
9730  FORMAT()
C
      WRITE(6,9731)
9731  FORMAT(1x,'BREAKDOWNS AND REPAIRS:')
      WRITE(6,9732)
9732  FORMAT()

      WRITE(6,9735)
9735  FORMAT(1X,'DELAYED BREAKDOWNS STILL WAITING AT THE END OF')
      WRITE(6,9740)
9740  FORMAT(1X,'THE SIMULATION')
      WRITE(6,9745)
9745  FORMAT()
C
      NBRKDQ=MAXN*3+1
      IF (NNQ(NBRKDQ).GT.0) THEN
         DO 9755 I=1,NNQ(NBRKDQ)
         CALL COPY(I,NBRKDQ,ATRIB)
         IA7=ATRIB(7)
         NBRKW(IA7)=NBRKW(IA7)+1
9755     CONTINUE
      ENDIF
C
      DO 9765 I=1,MAXN
      WRITE(6,9760) I,NBRKD(I),NBRKW(I)
9760  FORMAT(1X,'MACH.'1X,I3,2X,'TOTAL NO. OF BRKDN',1X,I3,2X,
     1'BRKDOWNS WAITING:',1x,I3)
9765  CONTINUE
C
```

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mdirizar@c50030-201ps.i          cell6.f          0/17/96  14:02   215/220
      WRITE(6,9770)
9770  FORMAT()
      WRITE(6,9771) TOTRT
9771  FORMAT(1X,'TOTAL TIME UNDER REPAIR (ALL MACHINES):',F10.2)
      WRITE(6,9772)
9772  FORMAT()
      REPPER=TOTRT/(NMACH*RLENGH)
      WRITE(6,9776) REPPER
9776  FORMAT(1X,'AVG.REPAIR DOWNTIME (% OF TOT.SIM.TIME PER MACH):',
     11X,F8.4)
      WRITE(6,9780)
9780  FORMAT()
C
      REPLAB=TOTRT*SCREW
C
      WRITE(6,9785) REPLAB
9785  FORMAT(1X,'TOTAL REPAIR LABOR TIME:',F10.2)
C
      WRITE(6,9786)
9786  FORMAT()
      WRITE(6,9787)
9787  FORMAT()
C
C      WRITE(6,9790)
C9790  FORMAT(1X,'MACHINE DOWNTIME AND UPTIME:')          .
C      WRITE(6,9791)
C9791  FORMAT()
C
C      DO 9795 I=1,MAXM
C      PERUP=TOTUP(I)/RLENGH
C      PERDN=1-PERUP
C      WRITE(6,9794) I,PERDN,PERUP
C9794  FORMAT(1X,'MACH:',I3,5X,'%DOWN:',F7.3,5X,'%UP:',F7.3)
C9795  CONTINUE
C      WRITE(6,9836)
C9836  FORMAT()
C      WRITE(6,9837)
C9837  FORMAT(1X,'UPTIME INCLUDES:PROCESSING,INSPECTING,BLOCKED,WAITING')
C      WRITE(6,9838)
C9838  FORMAT(1X,'DOWNTIME INCLUDES:IDLE,MAINT,SETUP,REPAIR,MINOR STOPS')
C
C      WRITE(6,9800)
C9800  FORMAT()
C      WRITE(6,9801)
C9801  FORMAT()
C
      WRITE(6,9802)
9802  FORMAT(1x,'AUTONOMOUS MAINTENANCE:')
      WRITE(6,9803)
9803  FORMAT()
      WRITE(6,9805) TOTAUT
9805  FORMAT(1X,'TOTAL TIME SPENT BY OPERATORS ON AUTONOMOUS
     1 MAINTENANCE:',F10.2)

c      WRITE(6,9806)
c9806  FORMAT()

9806  WRITE(6,9796)
9796  FORMAT()
      WRITE(6,9797)
9797  FORMAT(1x,'*****************************************************')
      WRITE(6,9807)
9807  FORMAT()
C
      WRITE(6,9808)
9808  FORMAT(1X,'TOTAL RELATIVE ANNUAL COST:')
      WRITE(6,9809)
9809  FORMAT()
      WRITE(6,9810)
C
      TFGICC=0
      DO 9813 I=1,NPN
      FGICC(I)=FGICC(I)/RLENGH
9813  TFGICC=TFGICC+FGICC(I)

      TWIPCC=0
      DO 9830 I=1,MAXM
      DO 9820 J=1,NPN
      IF (NUMWIP(J,I).GT.0) THEN
         AVGWIP=SUMWIP(J,I)/NUMWIP(J,I)
      ELSE
         AVGWIP=0
      ENDIF
      WIPCC=AVGWIP*PNCOST(J,I)*CR
9820  TWIPCC=TWIPCC+WIPCC
9830  CONTINUE
C
      TICC=TFGICC+TWIPCC
C
9810  FORMAT()
      WRITE(6,9811) TICC
9811  FORMAT(1X,'1.0 INVENTORY CARRYING COSTS:',1X,'$',F12.2)
```

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mdirizar@c50030-201ps.i          cell6.f          0/17/96  14:02   216/220
      WRITE(6,9812)
9812  FORMAT()

      WRITE(6,9814) TFGICC
9814  FORMAT(5X,'1.A FINISHED GOODS INVENTORY CARRYING COST:',1X,'$'
     1,F11.2)
C
      WRITE(6,9816)
9816  FORMAT()
C
      NPG=MAXM+1
      DO 9820 I=1,NPN
      AVGINV=FGICC(I)/(CR*PNCOST(I,NPG))
      WRITE(6,9817) I,AVGINV
9817  FORMAT(10X,'AVERAGE INV. OF PN',1X,I3,1X,':',1X,F8.0)
      WRITE(6,9818)I,FGICC(I)
9818  FORMAT(10X,'INV. CARRYING COST OF PN',1X,I3,1X,':',1X,'$',F10.2)
      WRITE(6,9819)
9819  FORMAT()
9820  CONTINUE

      WRITE(6,9835) TWIPCC
9835  FORMAT(5X,'1.B WIP INVENTORY CARRYING COST:',1X,'$',F10.2)

      WRITE(6,9845)
9845  FORMAT()
C
C     DETERMINE LATE DELIVERY COST FOR OUTSTANDING ORDERS
C
      DCOUTO=0
      IPG=MAXM+1
      LOTQ=MAXM*3+3
      DO 9860 I=1,NNQ(LOTQ)
      CALL COPY(I,LOTQ,ATRIB)
      IA2=ATRIB(2)
      IA8=ATRIB(8)
9860  DCOUTO=DCOUTO+PNCOST(IA2,IPG)*IA8
C
      TDPC=DPCLO+DCOUTO
C
      WRITE(6,9850) TDPC
9850  FORMAT(1X,'2.0 LATE DELIVERY PENALTY COST:',1X,'$',F12.2)
C
      WRITE(6,9851)
9851  FORMAT()
      WRITE(6,9852) DPCLO
9852  FORMAT(5X,'2.A LATE ORDERS:',1X,'$',1X,F11.2)
      WRITE(6,9853) NLO
9853  FORMAT(10X,'NUMBER OF LATE ORDERS:',1X,I5)
      WRITE(6,9855)
9855  FORMAT()


      WRITE(6,9861) DCOUTO
9861  FORMAT(5X,'2.B OUTSTANDING DEMAND:',1X,'$',1X,F11.2)
      WRITE(6,9862) NNQ(LOTQ)
9862  FORMAT(10X,'OUTSTANDING ORDERS:',1X,I3)
      WRITE(6,9863)
9863  FORMAT()
C
      COSTA=TRAIN*NSUCHN*SUMQ/60+MCIN*NSUCHN*SUMQ/60+SUTEX*NSUCHN
     1*SUMQ/60+MCIN*1*NQ/60

      NCREWS=INT((TRAIN+MCIN+SUTEX)/NPEMP+.99)
C
      COSTB=NSUBC*(SUTRAI*NOP*CWG/60+TWORK+SUINV)*
     1(1/(1+AIR))*((AIR*(1+AIR)**NYRS)/((1+AIR)**NYRS-1))
C
      TSUC=COSTA+COSTB
C
      WRITE(6,9865)  TSUC
9865  FORMAT(1X,'3.0 SETUP COST:',1X,'$',1X,F12.2)
      WRITE(6,9866)
9866  FORMAT()
C
      WRITE(6,9868) COSTA
9868  FORMAT(5X,'3.A CHANGE OVERS:',1X,'$',1X,F11.2)
      WRITE(6,9871) NCREWS
9871  FORMAT(9X,'NUMBER OF SETUP CREWS NEEDED:',1X,I3)
      WRITE(6,9869)
9869  FORMAT()
      WRITE(6,9872) COSTB
9872  FORMAT(5X,'3.B TRAINING AND INVESTMENTS:',1X,'$',1X,F11.2)
      WRITE(6,9874)
9874  FORMAT()
C
      AUTC=TOTAUT*WG
      REPC=TOTRT*SCREW*WG/60
      TI=PMINV*((AIR*(1+AIR)**NYRS)/((1+AIR)**NYRS-1))+PMTRAI*NOP
     1*CWG/60
C
      TMC=AUTC+REPC+TI+PMCOST
```


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```
C
      WRITE(6,9876) TMC
9876  FORMAT(1X,'4.0 MAINTENANCE COST:',1X,'$',1X,F12.2)
      WRITE(6,9878)
9878  FORMAT()
C
      WRITE(6,9880) AUTC
9880  FORMAT(5X,'4.A AUTONOMOUS MAINTENANCE:',1X,'$',1X,F11.2)
      WRITE(6,9881)
9881  FORMAT()
C
      WRITE(6,9884) REPC
9884  FORMAT(5X,'4.B REPAIR COST:',1X,'$',1X,F11.2)
      WRITE(6,9885)
9885  FORMAT()
C
      WRITE(6,9887) TI
9887  FORMAT(5X,'4.C TRAINING AND INVESTMENTS:',1X,'$',1X,F11.2)
      WRITE(6,9888)
9888  FORMAT()
C
      WRITE(6,9890) PMCOST
9890  FORMAT(5X,'4.D SCHEDULED MAINTENANCE:',1X,'$',1X,F11.2)
      WRITE(6,9891)
9891  FORMAT()
C
      TRC=0
      DO 9894 I=1,NPW
      DO 9894 J=1,MAXN
      TRC=TRC+TRWK(I,J)*RWKC(I,J)
9894  CONTINUE
C
      TITC=QAINV*((AIR*(1+AIR)**NYRS)/((1+AIR)**NYRS-1))+
     1QATRAI*NOP*OWG/60
C
      TIC=TOTINSP*WG/60+TOTQA*QAWG/60
C
      TQC=TRC+TITC+TOTSCRCO+TIC
C
      WRITE(6,9892) TQC
9892  FORMAT(1X,'5.0 QUALITY COST:',1X,'$',1X,F12.2)
      WRITE(6,9893)
9893  FORMAT()
C
      WRITE(6,9895) TRC
9895  FORMAT(5X,'5.A REWORK COST:',1X,'$',1X,F11.2)
      WRITE(6,9896)
9896  FORMAT()
C
      WRITE(6,9897) TITC
9897  FORMAT(5X,'5.B INVESTMENT AND TRAINING COST:',1X,'$',1X,F11.2)
      WRITE(6,9898)
9898  FORMAT()
C
      WRITE(6,9900) TOTSCRCO
9900  FORMAT(5X,'5.C SCRAP COST:',1X,'$',1X,F11.2)
      WRITE(6,9901)
9901  FORMAT()
C
      WRITE(6,9903) TIC
9903  FORMAT(5X,'5.D INSPECTION COST:',1X,'$',1X,F11.2)
      WRITE(6,9904)
9904  FORMAT()
C
      TLC=OPNDT*WG/60+NDTMA*MHWG/60
C
      TMHIC=MHINV*((AIR*(1+AIR)**NYRS)/((1+AIR)**NYRS-1))
C
      TCONTC=0
      DO 9906 I=1,NCONT
      IF (NOBSCO(I).NE.0) THEN
         TCONTC=TCONTC+MAXCO(I)*COCOST(I)
      ENDIF
9906  CONTINUE

      TSEIC=TCONTC*((AIR*(1+AIR)**NYRS)/((1+AIR)**NYRS-1))
C
      TMHC=TLC+TMHIC+TSEIC
C
      WRITE(6,9908) TMHC
9908  FORMAT(1X,'6.0 MATERIAL HANDLING COST:',1X,'$',1X,F12.2)
      WRITE(6,9909)
9909  FORMAT()
C
      WRITE(6,9910) TLC
9910  FORMAT(5X,'6.A LABOR COST:',1X,'$',1X,F11.2)
      WRITE(6,9912)
9912  FORMAT()
C
      WRITE(6,9914) TMHIC
9914  FORMAT(5X,'6.B HANDLING EQUIPMENT INVESTMENT COST:',1X,'$',1X
     1,F11.2)
```



```
      WRITE(6,9916)
9916  FORMAT()
C
      WRITE(6,9918) TSEIC
9918  FORMAT(5X,'6.C STORAGE EQUIPMENT INVESTMENT COST:',1X,'$',1X
     1,F11.2)
      WRITE(6,9919)
9919  FORMAT()
C      DO 9922 I=1,NPW
C      WRITE(6,9920) I,NCOPO(I)
C9920  FORMAT(10X,'MAXIMUM NUMBER OF CONTAINERS FOR PW',I3,1X,'P
C     1 G:',I6)
C      WRITE(6,9921)
C9921  FORMAT()
C9922  CONTINUE
C
      TPLC=(NPERP*NOP-NCIN-TOTAUT-OPNDT-TOTINSP-TOTRWK)*WG/60
C
      WRITE(6,9924) TPLC
9924  FORMAT(1X,'7.0 PRODUCTION LABOR COST:',1X,'$',1X,F12.2)
      WRITE(6,9925)
9925  FORMAT()
C
      RLC=RELAY*((AIR*(1+AIR)**NYRS)/((1+AIR)**NYRS-1))
C
      WRITE(6,9927) RLC
9927  FORMAT(1X,'8.0 COST TO LAYOUT THE CELL:',1X,'$',1X,F12.2)
      WRITE(6,9928)
9928  FORMAT()
C
      WRITE(6,9930) PSPACE
9930  FORMAT(1X,'9.0 FLOOR SPACE COST:',1X,'$',1X,F12.2)
      WRITE(6,9932)
9932  FORMAT()
C
      TRAC=TICC+TOPC+TSUC+TMC+TQC+TMHC+TPLC+RELAY+PSPACE
C
      WRITE(6,9934) TRAC
9934  FORMAT(15X,' TOTAL RELATIVE ANNUAL COST:',1X,'$',1X,F15.2)
      WRITE(6,9935)
9935  FORMAT()
C
      WRITE(12,9940) IEXP,TICC,TOPC,TSUC,TMC,TQC,TMHC,TPLC,RELAY,PSPACE
     1,TRAC
9940  FORMAT(' ',I2,1X,10F10.0)

      WRITE(13,9945) IEXP,(FACT(K),K=1,NFACT),TRAC
9945  FORMAT(' ',I2,1X,6E10.5,1X,F10.0)
C
      CLOSE(9)
      RETURN
      END
C
C ********************************************************************
      subroutine shewf1
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB),DD(MEQT),DDL(MEQT),DTNOW,II,MFA,
     1MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(MEQT),
     2SSL(MEQT),TNEXT,TNOW,XX(MMXXV)
C
      COMMON/UCOM1/MTYPE(50),NOPCD(50),NFUCD(50),NQCD(50),NABRSC(50),
     1 NDEPSC(50),NBUFF(50),NSUTYP(50),NNOP(50,50),SPEED(50,50),
     2 CLENGH(50,50),DIST(50,50),SCRAPP(60,50),REWKP(60,50),NM(50),
     3 IOP(50),MACH(10,50),IOPCD(50),MACHS(50),IUL(60),IRI(60),
     4 IDEPUL(60,50),MCAP(50),L(50),NSEQ(50,60),NOPSTA(50),NSTATU(50),
     5 LASTPW(50),LASLOT(50),LASTMA(50),NBLKSC(50),NBLKMA(50),
     6 RELT(60,500)
C
      COMMON/UCOM2/NMACH
      COMMON/UCOM3/NUL,NRELUL
      COMMON/UCOM4/A(100)
      COMMON/UCOM5/NP(60),TOTAL(60,500),NPW,NLOTS,NPARTS,TOTLOT
C
      COMMON/UCOM6/NSUDIS(50),SUP1(50),SUP2(50),SUP3(50)
C
      COMMON/UCOM7/WALKRM,NAVNT,OPNDT,NDTMA,WALKLD
      COMMON/UCOM8/SUTEX,SUTIN
      COMMON/UCOM9/ICOTYP(60,50),COCOST(50),ICOCAP(60,50),CACOST,
     1NOBSCO(50),NOBSCA,ICOSUM(50),ICASUM,NCONT,NOBSCO(50),NOBSCA,
     2MAXCO(50),MINCO(50),MAXCA,MINCA
C
      COMMON/UCOM10/NPART1,NPART2,NPART3,NPART4
      COMMON/UCOM11/ISCHDP(50)
      COMMON/UCOM12/PROLOM(50),PROUPP(50),PROEXP(50)
      COMMON/UCOM13/TOTSCR(60,50),TOTQA,TQARWK,PUCOST(60,51)
      COMMON/UCOM14/SAMPLP
      COMMON/UCOM15/QAINSD,QAP1,QAP2,QAP3
      COMMON/UCOM16/TRDRMD,TRMKP1,TRMKP2,TRMKP3
      COMMON/UCOM17/TRDRJP(60),TRDRMP(60)
      COMMON/UCOM18/TSUCIN,TSELIN,TSUCNM,TSELNM
C
      COMMON/UCOM19/SELDIS(50),SEP1(50),SEP2(50),SEP3(50)
```


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      COMMON/UCOM20/NSUMMD(50),SUMMP1(50),SUMMP2(50),SUMMP3(50)
      COMMON/UCOM21/NSERMD(50),SERMP1(50),SERMP2(50),SERMP3(50)
      COMMON/UCOM24/NPROCD(40,50),PROP1(40,50),PROP2(40,50)
     1,PROP3(40,50)
c
      COMMON/UCOM25/SCRAP(40),LSCRAP(40,500)
      COMMON/UCOM26/NP3,NP6
      COMMON/UCOM27/NOP
      common/ucomd/iffl
      call prntf(iffl)
      return
      end


      SUBROUTINE RMOVE (NTRY,IFILE,ATRX)
      DIMENSION ATRX(100)
      DIMENSION NSET(600000)
      COMMON QSET(600000)
      PARAMETER (KVACP1=1,KVACP2=2,KVALEN=3,KVACAP=4,KVADIR=5,KVANTK=6,
     $ KVANCO=7,KVASTO=8,KVANMO=9,KVATLU=10,KVAPPE=11,KVAPLE=12,
     $ KVCSPR=1,KVCNML=2,KVCPPE=3,KVCPLE=4,KVCNXL=5,KVCPPL=6,
     $ KVCCRC=7,KVCNTE=8,KVCCST=9,KVCSTB=10,KVCTLU=11,KVCVCO=12,
     $ KVCNRC=13,KVCCP1=14,KVSESP=1,KVSLSP=2,KVSACC=3,KVSDEC=4,KVSLEN=5,
     $ KVSNUP=6,KVSCRE=7,KVSIFL=8,KVSJRQ=9,KVSINI=10,KVSNEP=11,
     $ KVSNTL=12,KVSNTU=13,KVSNUL=14,KVSNUU=16,KVSNUE=18,KVSNUF=20,
     $ KVSNUC=22,KVSNUS=24,KVSSTE=26,KVSSTP=27,KVSTLU=28,KVSPPE=29,
     $ KVSPLE=30,KVSPAL=31,KVSNOV=32,KVUPVS=1,KVUCSO=2,KVUCCP=3,
     $ KVUICP=4,KVUDCP=5,KVUPCL=6,KVUVNO=7,KVUCSI=8,KVUSPO=9,KVUCRP=10,
     $ KVUCST=11,KVUTLU=12,KVUSCP=13,KVUNNT=14,KVUNTL=15,KVUNPT=16,
     $ KVPVSI=4,KVWIFL=4,KVWVSI=5,KVWVRQ=6,KVWVRE=7,
     $ KVACP1=8,KVNCP1=4,KVANMP=13,KVCNMP=15,KVPNMP=5,KVWNMP=4,
     $ KVSNMP=33,KVUNMP=15,KVWNMP=8)
      PARAMETER (MXMSG=250)
      PARAMETER (MXPOUT=6)
      INCLUDE '/ncsu/jwilson_res/PARAM.INC'
      COMMON/SCOM1/ATRIB(MATRB), DD(MEQT), DDL(MEQT), DTNOW, II, MFA,
     1MSTOP,NCLNR, NCRDR, NPRNT, NNRUN, NNSET, NTAPE, SS(MEQT),
     2SSL(MEQT),TNEXT, TNOW, XX(MXXV)
      COMMON/SCOM2/NNISE, NNCXR, NNNLO, NNNTP, NNNXC, NNBIT, JPLCT, NNTAG, NNTYT
     1,NNTAL,IIIPR
      COMMON/XCOM1/ MFE(MFILS),MLE(MFILS),NQ(MFILS)
      COMMON/GCOM1/ JJCDR,KRNN,LLFIL,LLRNR,LLTRY,NFEX,NNAM1,NNAM2,NNAM3,
     1NNAPO,NNAPT,NNATR,NNFIL,NNTRY,TTBEG,TTCLR,TTFIN,
     2TTSET,XXI(MXXV),TTTS,TTTF
      COMMON /GCOM3/ AAERR,DTMAX,DTMIN,DTSAV,IITER,LLERR,LLSAV,LLSEV,NNR
     1NR,TTLAS,TTSAV,DTSUG
      COMMON /GCOM6/ EENQ(MFILS), IINN(MFILS),KKRNK(MFILS),MMAXQ(MFILS),
     1QQTIN(MFILS),SSOBV(NCLCT,5),SSTPV(NSTAT,6),VVNQ(MFILS)
      EQUIVALENCE (NSET(1),QSET(1))
      DIMENSION NTRY(500000)
      NTRYG=NTRY(1)
      IFILG=IABS(IFILE)
c        if ( ifilg .eq. 22 .or. ifilg.eq. 23) then
c          print *, ' tnow = ', tnow
c          continue
c      endif
      NTMP=NSET(NNNTP+1)
      MLO=NSET(NNNLO+1)
      MXC=NSET(NNNXC+1)
      ISEAR=NSET(NNISE+1)
      IF (IFILG.NE.NCLNR) NTMP=0
      IF (NTRYG) 40,10,30
   10 CALL XXERR (7,NTRYG)
   20 CALL XXERR (6,IFILG)
   30 NTRYG=LOCAT(NTRY,IFILG)
      GO TO 50
   40 NTRYG=-NTRYG
   50 IF (IFILE) 80,20,60
   60 DO 70 I=1,NNATR
      NSISA=NTRYG+I
   70 ATRX(I)=QSET(NSISA)
   80 IF (IFILG.EQ.LLFIL) LLFIL=0
      NSISA=NNAPO+NTRYG
      JL=NSET(NSISA)
      JK=NSET(NTRYG)
      NSET(NSISA)=MFA
      MFA=NTRYG
      NSISA=NNAPO+JK
      IF (JL) 100,100,90
   90 IF (JK) 120,120,110
  100 IF (JK) 140,140,130
  110 NSET(NSISA)=JL
      NSET(JL)=JK
      GO TO 131
  120 NSET(JL)=0
      MFE(IFILG)=JL
      IF (NTMP.LE.0) GO TO 150
      IF (QSET(MFA+NNATR).LE.TNOW) GO TO 160
      JK = JL
      GO TO 131
  130 NSET(NSISA)=0
```



```
      MLE(IFILG)=JK
  131 IF (NTMP.LE.0) GO TO 150
      DO 135 I=1,ISEAR
      IF (NSET(MXC+I).NE.MFA) GO TO 135
      NSET(MXC+I) = JK
      QSET(NTMP+I) = QSET(JK+NNATR)
  135 CONTINUE
      GO TO 150
  140 MFE(IFILG)=0
      MLE(IFILG)=0
      IF(NTMP.LE.0)GO TO 150
      DO 141 I=1,ISEAR
      QSET(NTMP+I)=0.
      NSET(MXC+I)=0
      NSET(MLO+I)=0
  141 CONTINUE
      NSET(NNISE+1)=1
      NSET(NNBIT+1)=0
      NSET(MLO+1)=-1
  150 IF (IFILG-NCLNR) 200,160,170
  160 NEXTE=MFE(NCLNR)
      IF (NEXTE) 170,190,180
  170 CALL ERROR (312)
  180 NJ=NEXTE+NNATR
      TNEXT=QSET(NJ)
      IF (TNEXT-TTFIN) 200,200,190
  190 TNEXT=TTFIN
  200 IF (QQTIN(IFILG).GE.TNOW) GO TO 210
      XNQ=NQ(IFILG)
      TPPS=TNOW-TTSET+TTTF
      CALL XXBAR(XNQ,EENQ(IFILG),QQTIN(IFILG),TPPS,VVNQ(IFILG),AVG,STD)
      EENQ(IFILG)=AVG
      VVNQ(IFILG)=STD
      QQTIN(IFILG)=TNOW
  210 NQ(IFILG)=NQ(IFILG)-1
      RETURN
      END
```

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APPENDIX B EXAMPLE OF SIMULATION OUTPUT

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CELL THROUGHPUT:

TOTAL PRODUCTION (GOOD UNITS) OF PN= 1 WAS 14420
TOTAL PRODUCTION (GOOD UNITS) OF PN= 2 WAS 9360
TOTAL PRODUCTION (GOOD UNITS) OF PN= 3 WAS 9460
TOTAL PRODUCTION (GOOD UNITS) OF PN= 4 WAS 7336
TOTAL PRODUCTION (GOOD UNITS) OF PN= 5 WAS 6600
TOTAL PRODUCTION (GOOD UNITS) OF PN= 6 WAS 8336
TOTAL PRODUCTION (GOOD UNITS) OF PN= 7 WAS 6200
TOTAL PRODUCTION (GOOD UNITS) OF PN= 8 WAS 9322
TOTAL PRODUCTION (GOOD UNITS) OF PN= 9 WAS 13950
TOTAL PRODUCTION (GOOD UNITS) OF PN=10 WAS 11802
TOTAL PRODUCTION (GOOD UNITS) OF PN=11 WAS 7226
TOTAL PRODUCTION (GOOD UNITS) OF PN=12 WAS 9330
TOTAL PRODUCTION (GOOD UNITS) OF PN=13 WAS 7362

*** TOTAL NUMBER OF GOOD UNITS= 118796
*** CELL WEEKLY THROUGHPUT= 2284.

TOTAL NUMBER OF LOTS= 3374.

****

STORAGE EQUIPMENT (CONTAINERS AND CARTS):

AVG.NO. OF CONT TYPE 8 IN USE= 4.00
MAXIMUM NUMBER OF CONT. 8 IN USE= 10
MINIMUM NUMBER OF CONT. 8 IN USE= 0

AVG.NO. OF CONT TYPE 12 IN USE= 339.00
MAXIMUM NUMBER OF CONT. 12 IN USE= 651
MINIMUM NUMBER OF CONT. 12 IN USE= 0

AVG.NO. OF CONT TYPE 13 IN USE= 7.00
MAXIMUM NUMBER OF CONT. 13 IN USE= 13
MINIMUM NUMBER OF CONT. 13 IN USE= 0

AVG.NO. OF CONT TYPE 14 IN USE= 8.00
MAXIMUM NUMBER OF CONT. 14 IN USE= 15
MINIMUM NUMBER OF CONT. 14 IN USE= 0

AVG. NO OF CARTS IN USE= 17.00
MAXIMUM NUMBER OF CARTS IN USE= 33
NUMBER OF OBS. FOR CARTS = 35212

****

SCRAP COST:

TOTAL SCRAP OF PN 1= 120. UNITS
SCRAP COST PN 1= $ 23232.00

TOTAL SCRAP OF PN 2= 62. UNITS
SCRAP COST PN 2= $ 14656.00

TOTAL SCRAP OF PN 3= 71. UNITS
SCRAP COST PN 3= $ 12930.00

TOTAL SCRAP OF PN 4= 47. UNITS
SCRAP COST PN 4= $ 10016.00

TOTAL SCRAP OF PN 5= 36. UNITS
SCRAP COST PN 5= $ 10120.00

TOTAL SCRAP OF PN 6= 53. UNITS
SCRAP COST PN 6= $ 12264.00

TOTAL SCRAP OF PN 7= 57. UNITS
SCRAP COST PN 7= $ 16074.00

TOTAL SCRAP OF PN 8= 86. UNITS
SCRAP COST PN 8= $ 34466.00

TOTAL SCRAP OF PN 9= 125. UNITS
SCRAP COST PN 9= $ 59154.00

TOTAL SCRAP OF PN 10= 135. UNITS
SCRAP COST PN 10= $ 71136.00

TOTAL SCRAP OF PN 11= 79. UNITS
SCRAP COST PN 11= $ 17467.00

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TOTAL SCRAP OF PN 12= 78. UNITS
SCRAP COST PN 12= $ 20437.50

TOTAL SCRAP OF PN 13= 52. UNITS
SCRAP COST PN 13= $ 15532.50

TOTAL NUMBER OF UNITS SCRAPPED= 1009.
TOTAL SCRAP COST= $ 310101.00

****

REQUIREMENTS ON Q.A. INSPECTORS AND OFFLINE REWORK OPERATORS:

TOTAL Q.A. INSPECTION TIME: 0.00
NUMBER OF QA INSPECTORS NEEDED: 0

TOTAL REWORK TIME BY OPERATORS:118672.37
NUMBER OF OFFLINE REWORK OPERATORS NEEDED: 2

****

STATISTICS ON MACHINE UTILIZATION:

STATUS	0	1	2	3	4	5	6	7	8	9	10	11	12
MA. 1	0.106	0.621	0.246	0.000	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.009	0.000
MA. 2	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MA. 3	0.104	0.645	0.239	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.008	0.000
MA. 4	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MA. 5	0.097	0.716	0.091	0.000	0.000	0.067	0.000	0.000	0.000	0.000	0.000	0.004	0.025
MA. 6	0.136	0.747	0.021	0.000	0.000	0.060	0.000	0.000	0.000	0.000	0.000	0.004	0.025
MA. 7	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MA. 8	0.157	0.799	0.006	0.000	0.000	0.033	0.000	0.000	0.000	0.000	0.000	0.004	0.000
MA. 9	0.320	0.189	0.084	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.479	0.000	0.000
MA. 10	0.070	0.684	0.217	0.000	0.000	0.021	0.000	0.000	0.000	0.000	0.000	0.008	0.000
MA. 11	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MA. 12	0.057	0.829	0.085	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.004	0.024
MA. 13	0.610	0.369	0.001	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.004	0.006
MA. 14	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MA. 15	0.429	0.522	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MA. 16	0.899	0.072	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.000	0.000	0.003	0.000
MA. 17	0.295	0.110	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.595	0.000	0.000
MA. 18	0.583	0.415	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MA. 19	0.362	0.616	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.003	0.000
MA. 20	0.850	0.146	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MA. 21	0.526	0.465	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
MA. 22	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MA. 23	0.512	0.485	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
MA. 24	0.798	0.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
MA. 25	0.512	0.486	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
MA. 26	0.718	0.280	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
MA. 27	0.023	0.975	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
MA. 28	0.657	0.000	0.183	0.000	0.000	0.000	0.000	0.153	0.000	0.007	0.000	0.000	0.000
MA. 29	0.622	0.378	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

DESCRIPTION OF MACHINE STATUS:

0 = IDLE
1 = PROCESSING PARTS
2 = BLOCKED
3 = DOES NOT APPLY (MATERIAL HANDLING)
4 = AUTONOMOUS MAINTENANCE
5 = SETUP
6 = STOPPED DURING PART SUCCESSIVE INSPECTION
7 = STOPPED DURING PART SELF INSPECTION
8 = PART REWORK AFTER SUCCESSIVE INSPECTION
9 = PART REWORK AFTER SELF INSPECTION
10 = WAITING FOR A PART TO COMPLETE A UNIT LOAD
11 = DOWN FOR REPAIR
12 = MINOR STOP (EX. MATERIAL REPLENISHMENTS)

****

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CELL ANNUAL COST:

1.0 INVENTORY CARRYING COSTS: $ 35687.42

1.A FINISHED GOODS INVENTORY CARRYING COST: $ 30167.39

AVERAGE INV. OF FW 1 : 112.
INV. CARRYING COST OF FW 1 : $ 3365.22

AVERAGE INV. OF FW 2 : 66.
INV. CARRYING COST OF FW 2 : $ 3616.06

AVERAGE INV. OF FW 3 : 59.
INV. CARRYING COST OF FW 3 : $ 1760.57

AVERAGE INV. OF FW 4 : 68.
INV. CARRYING COST OF FW 4 : $ 1510.39

AVERAGE INV. OF FW 5 : 22.
INV. CARRYING COST OF FW 5 : $ 986.78

AVERAGE INV. OF FW 6 : 52.
INV. CARRYING COST OF FW 6 : $ 1935.80

AVERAGE INV. OF FW 7 : 33.
INV. CARRYING COST OF FW 7 : $ 1503.61

AVERAGE INV. OF FW 8 : 37.
INV. CARRYING COST OF FW 8 : $ 2514.93

AVERAGE INV. OF FW 9 : 32.
INV. CARRYING COST OF FW 9 : $ 2520.43

AVERAGE INV. OF FW 10 : 14.
INV. CARRYING COST OF FW 10 : $ 1229.35

AVERAGE INV. OF FW 11 : 8.
INV. CARRYING COST OF FW 11 : $ 288.99

AVERAGE INV. OF FW 12 : 3.
INV. CARRYING COST OF FW 12 : $ 123.10

AVERAGE INV. OF FW 13 : 0.
INV. CARRYING COST OF FW 13 : $ 5.20

1.B WIP INVENTORY CARRYING COST: $ 5520.03

2.0 LATE DELIVERY PENALTY COST: $ 523293.01

2.A LATE ORDERS: $ 406118.01
NUMBER OF LATE ORDERS: 640

2.B OUTSTANDING DEMAND: $ 117175.00
OUTSTANDING ORDERS: 0

3.0 SETUP COST: $ 39919.96

3.A CHANGE OVERS: $ 39919.96
NUMBER OF SETUP CREWS NEEDED: 1

3.B TRAINING AND INVESTMENTS: $ 0.00

4.0 MAINTENANCE COST: $ 3550.00

4.A AUTONOMOUS MAINTENANCE: $ 0.00

4.B REPAIR COST: $ 3550.00

4.C TRAINING AND INVESTMENTS: $ 0.00

4.D SCHEDULED MAINTENANCE: $ 0.00

5.0 QUALITY COST: $ 1057394.13

5.A REWORK COST: $ 734573.00

5.B INVESTMENT AND TRAINING COST: $ 0.00

5.C SCRAP COST: $ 318101.00

5.D INSPECTION COST: $ 4720.06

6.0 MATERIAL HANDLING COST: $ 29790.03

6.A LABOR COST: $ 5388.14

6.B HANDLING EQUIPMENT INVESTMENT COST: $ 0.00

6.C STORAGE EQUIPMENT INVESTMENT COST: $ 24401.89

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7.0 PRODUCTION LABOR COST: $ 289242.16

8.0 COST TO LAYOUT THE CELL: $ 0.00

9.0 FLOOR SPACE COST: $ 192000.00

TOTAL RELATIVE ANNUAL COST: $ 2160085.50

****

S L A M I I S U M M A R Y R E P O R T

SIMULATION PROJECT GENCELL   BY MARIA

DATE 7/27/1996   RUN NUMBER 1 OF 8

CURRENT TIME 0.2430E+06
STATISTICAL ARRAYS CLEARED AT TIME 0.9000E+04

STATISTICS FOR VARIABLES BASED ON OBSERVATION

	MEAN VALUE	STANDARD DEVIATION	COEFF. OF VARIATION	MINIMUM VALUE	MAXIMUM VALUE	NO.OF OBS
PROD LEAD TIME	0.1463E+04	0.709E+03	0.497E+00	0.291E+03	0.361E+04	3376

FILE STATISTICS

FILE NUMBER	LABEL/TYPE	AVERAGE LENGTH	STANDARD DEVIATION	MAXIMUM LENGTH	CURRENT LENGTH	AVERAGE WAIT TIME
1		14.249	7.725	33	10	51.500
2		0.000	0.000	0	0	0.000
3		4.093	1.931	6	5	17.693
4		0.000	0.000	0	0	0.000
5		4.960	1.072	6	5	17.964
6		2.175	1.079	3	2	7.065
7		0.000	0.000	0	0	0.000
8		0.421	1.090	5	0	1.524
9		0.637	2.793	27	0	2.304
10		1.354	1.047	5	2	50.001
11		0.000	0.000	0	0	0.000
12		5.179	1.549	6	6	18.732
13		0.041	0.309	3	0	0.204
14		0.000	0.000	0	0	0.000
15		0.105	0.664	6	0	0.668
16		0.190	0.559	2	0	0.717
17		0.009	0.095	2	0	0.032
18		0.037	0.189	1	0	1.616
19		0.142	0.355	1	0	4.161
20		0.007	0.083	2	0	3.176
21		0.149	0.378	3	0	5.102
22		0.000	0.000	0	0	0.000
23		1.749	2.542	11	1	214.496
24		0.171	0.409	4	0	65.403
25		0.070	1.137	5	1	80.296
26		0.024	1.626	8	0	109.094
27		3.566	1.959	14	0	130.755
28		0.169	0.500	5	0	5.750
29		1.061	1.401	3	0	2.050
101	CALENDAR	44.662	5.968	63	52	4.190

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                          **HISTOGRAM NUMBER 1**
                              PROD LEAD TIME

OBS  RELA    UPPER
FREQ FREQ  CELL LIM 0         20        40        60        80        100
                    +    +    +    +    +    +    +    +    +    +    +
   1 0.000 0.300E+03 +                                                 +
 225 0.067 0.540E+03 +***                                              +
 372 0.110 0.780E+03 +******   C                                       +
 737 0.218 0.102E+04 +************         C                           +
 495 0.147 0.126E+04 +********                    C                    +
 232 0.069 0.150E+04 +***                             C                +
 143 0.042 0.174E+04 +**                                C              +
 218 0.065 0.198E+04 +***                                  C           +
 330 0.098 0.222E+04 +*****                                     C      +
 219 0.065 0.246E+04 +***                                          C   +
 241 0.071 0.270E+04 +****                                            C+
 150 0.044 0.294E+04 +**                                               C
   9 0.003 0.318E+04 +                                                 C
   2 0.001 0.342E+04 +                                                 C
   0 0.000 0.366E+04 +                                                 C
   0 0.000 0.390E+04 +                                                 C
   0 0.000 0.414E+04 +                                                 C
   0 0.000 0.438E+04 +                                                 C
   0 0.000 0.462E+04 +                                                 C
   0 0.000 0.486E+04 +                                                 C
   0 0.000 0.510E+04 +                                                 C
   0 0.000    INF    +                                                 C
---                 +    +    +    +    +    +    +    +    +    +    +
3334                0         20        40        60        80        100

              **STATISTICS FOR VARIABLES BASED ON OBSERVATION**

                 MEAN      STANDARD  COEFF. OF  MINIMUM    MAXIMUM  NO.OF
                 VALUE     DEVIATION VARIATION   VALUE      VALUE     OBS

PROD LEAD TIME  0.143E+04 0.709E+03 0.497E+00 0.291E+03 0.341E+04  3374
```

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APPENDIX C SAS OUTPUT FOR THE SCREENING EXPERIMENT

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OBS	TR	LT	UL	SU	QL	MA	ST	BLK	TRAC
1	1	-1	-1	-1	-1	-1	-1	1	2170200
2	1	-1	-1	-1	-1	-1	-1	1	2166304
3	1	-1	-1	-1	-1	-1	-1	1	2176116
4	1	-1	-1	-1	-1	-1	-1	1	2197316
5	1	-1	-1	-1	-1	-1	-1	1	2142670
6	1	-1	-1	-1	-1	-1	-1	1	2181240
7	1	-1	-1	-1	-1	-1	-1	1	2184299
8	1	-1	-1	-1	-1	-1	-1	1	2173600
9	1	-1	-1	-1	-1	-1	-1	1	2186503
10	1	-1	-1	-1	-1	-1	-1	1	2180051
11	2	1	1	1	1	-1	-1	1	1391530
12	3	-1	1	1	-1	1	1	1	2274293
13	4	1	-1	-1	1	1	1	1	16267301
14	5	1	1	1	-1	1	-1	1	2029203
15	6	-1	-1	-1	1	1	-1	1	2160647
16	7	1	-1	-1	-1	-1	1	1	15320751
17	8	-1	1	1	1	-1	1	1	1617552

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OBS	TR	LT	UL	SU	QL	MA	ST	BLK	TRAC
18	9	1	1	-1	-1	-1	-1	1	26517870
19	10	-1	-1	1	1	-1	-1	1	1676204
20	11	1	-1	1	-1	1	1	1	2020651
21	12	-1	1	-1	1	1	1	1	2007279
22	13	-1	-1	1	-1	1	-1	1	2311724
23	1	1	1	-1	1	1	-1	1	20037656
24	15	-1	1	-1	-1	-1	1	1	2077920
25	16	1	-1	1	1	-1	1	1	1370279
26	17	1	-1	1	-1	-1	-1	-1	1736150
27	18	-1	1	-1	1	-1	-1	-1	1773094
28	19	1	1	-1	-1	1	1	-1	21696176
29	20	-1	-1	1	1	1	1	-1	2007732
30	21	-1	1	-1	-1	1	-1	-1	2402737
31	22	1	-1	1	1	1	-1	-1	1710942
32	23	-1	-1	1	-1	-1	1	-1	2034490
33	24	1	1	-1	1	-1	1	-1	12262492
34	25	-1	1	1	-1	-1	-1	-1	1905030

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OBS	TR	LT	UL	SU	QL	MA	ST	BLK	TRAC
35	26	1	-1	-1	1	-1	-1	-1	24392574
36	27	-1	-1	-1	-1	1	1	-1	2492354
37	28	1	1	1	1	1	1	-1	1735201
38	28	1	1	1	1	1	1	-1	1736043
39	28	1	1	1	1	1	1	-1	1735491
40	28	1	1	1	1	1	1	-1	1733070
41	28	1	1	1	1	1	1	-1	1740264
42	28	1	1	1	1	1	1	-1	1738034
43	28	1	1	1	1	1	1	-1	1737445
44	28	1	1	1	1	1	1	-1	1742127
45	28	1	1	1	1	1	1	-1	1739344
46	28	1	1	1	1	1	1	-1	1738027
47	29	1	-1	-1	-1	1	-1	-1	29063736
48	30	-1	1	1	1	1	-1	-1	1962582
49	31	1	1	1	-1	-1	1	-1	1736615
50	32	-1	-1	-1	1	-1	1	-1	1807099

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General Linear Models Procedure

Number of observations in data set = 50

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General Linear Models Procedure

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Dependent Variable: TRAC Total Annual Cost

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	22	2.8331E+15	1.2878E+14	47.18	0.0001
Error	27	7.3025E+13	2.7342E+12		
Corrected Total	49	2.9069E+15			

R-Square	C.V.	Root MSE	TRAC Mean
0.974604	32.36995	1653555	5108303

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General Linear Models Procedure

Dependent Variable: TRAC Total Annual Cost

Source	DF	Type I SS	Mean Square	F Value	Pr > F
LT	1	4.5273E+14	4.5273E+14	165.58	0.0001
UL	1	6.9706E+13	6.9706E+13	25.49	0.0001
SU	1	1.0332E+15	1.0332E+15	377.86	0.0001
QL	1	6.9519E+12	6.9519E+12	2.54	0.1225
MA	1	1.3570E+13	1.3570E+13	4.96	0.0344
ST	1	5.2240E+13	5.2240E+13	19.11	0.0002
BLK	1	9.5779E+11	9.5779E+11	0.35	0.5589
LT*UL	1	6.4030E+13	6.4030E+13	23.42	0.0001
LT*SU	1	1.0022E+15	1.0022E+15	366.54	0.0001
LT*QL	1	3.0622E+12	3.0622E+12	1.12	0.2993
LT*MA	1	7.2957E+12	7.2957E+12	2.67	0.1140
LT*ST	1	5.1624E+13	5.1624E+13	18.88	0.0002

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General Linear Models Procedure

Dependent Variable: TRAC Total Annual Cost

Source	DF	Type I SS	Mean Square	F Value	Pr > F
UL*SU	1	3.4240E+10	3.4240E+10	0.01	0.9117
UL*QL	1	7.6616E+08	7.6616E+08	0.00	0.9860
UL*MA	1	2.6583E+12	2.6583E+12	0.97	0.3329
UL*ST	1	6.1377E+11	6.1377E+11	0.22	0.6395
SU*QL	1	5.1471E+12	5.1471E+12	1.88	0.1813
SU*MA	1	5.2493E+12	5.2493E+12	1.92	0.1772
SU*ST	1	6.0325E+13	6.0325E+13	22.06	0.0001
QL*MA	1	4.0336E+10	4.0336E+10	0.01	0.9042
QL*ST	1	8.7593E+11	8.7593E+11	0.32	0.5761
MA*ST	1	6.0949E+11	6.0949E+11	0.22	0.6406

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General Linear Models Procedure

Dependent Variable: TRAC Total Annual Cost

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LT	1	8.8198E+14	8.8198E+14	322.57	0.0001
UL	1	1.6165E+12	1.6165E+12	0.59	0.4486
SU	1	8.7168E+14	8.7168E+14	318.80	0.0001
QL	1	5.0211E+12	5.0211E+12	1.84	0.1866
MA	1	2.0656E+13	2.0656E+13	7.55	0.0105
ST	1	5.3196E+13	5.3196E+13	19.46	0.0001
BLK	1	9.5779E+11	9.5779E+11	0.35	0.5589
LT*UL	1	5.1209E+11	5.1209E+11	0.19	0.6684
LT*SU	1	8.3335E+14	8.3335E+14	304.78	0.0001
LT*QL	1	3.5020E+12	3.5020E+12	1.28	0.2677
LT*MA	1	7.7164E+12	7.7164E+12	2.82	0.1045
LT*ST	1	5.9477E+13	5.9477E+13	21.75	0.0001

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General Linear Models Procedure

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Dependent Variable: TRAC Total Annual Cost

Source	DF	Type III SS	Mean Square	F Value	Pr > F
UL*SU	1	3.6667E+11	3.6667E+11	0.13	0.7171
UL*QL	1	5.6969E+11	5.6969E+11	0.21	0.6517
UL*MA	1	9.6093E+11	9.6093E+11	0.35	0.5582
UL*ST	1	5.0509E+10	5.0509E+10	0.02	0.8929
SU*QL	1	3.5561E+12	3.5561E+12	1.30	0.2641
SU*MA	1	7.0690E+12	7.0690E+12	2.88	0.1013
SU*ST	1	6.0001E+13	6.0001E+13	21.94	0.0001
QL*MA	1	3.5110E+10	3.5110E+10	0.01	0.9106
QL*ST	1	9.6192E+11	9.6192E+11	0.35	0.5580
MA*ST	1	6.0949E+11	6.0949E+11	0.22	0.6486

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General Linear Models Procedure

Dependent Variable: TRAC Total Annual Cost

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT	6881023.722	24.23	0.0001	283969.7975
LT	4941840.350	17.96	0.0001	275156.0991
UL	211566.208	0.77	0.4486	275156.0991
SU	-4912923.462	-17.86	0.0001	275156.0991
QL	-372070.337	-1.36	0.1866	275156.0991
MA	756282.788	2.75	0.0105	275156.0991
ST	-1213668.525	-4.41	0.0001	275156.0991
BLK	-162053.163	-0.59	0.5589	275156.0991
LT*UL	122988.784	0.43	0.6684	283969.7975
LT*SU	-4957341.966	-17.46	0.0001	283969.7975
LT*QL	-321410.591	-1.13	0.2677	283969.7975

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General Linear Models Procedure

Dependent Variable: TRAC Total Annual Cost

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
LT*MA	477847.659	1.68	0.1045	283969.7975
LT*ST	-1324626.020	-4.66	0.0001	283969.7975
UL*SU	-103989.520	-0.37	0.7171	283969.7975
UL*QL	-129620.151	-0.46	0.6517	283969.7975
UL*MA	168344.347	0.59	0.5582	283969.7975
UL*ST	38595.786	0.14	0.8929	283969.7975
SU*QL	323869.097	1.14	0.2641	283969.7975
SU*MA	-481765.779	-1.70	0.1013	283969.7975
SU*ST	1330267.159	4.68	0.0001	283969.7975
QL*MA	-32102.403	-0.11	0.9106	283969.7975
QL*ST	-168431.716	-0.59	0.5580	283969.7975

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General Linear Models Procedure

Dependent Variable: TRAC Total Annual Cost

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
MA*ST	134071.659	0.47	0.6486	283969.7975

Observation	Observed Value	Predicted Value	Residual
1	2178300.0000000	2303719.7861772	-213439.7861772
2	2166304.0000000	2303719.7861772	-217415.7861772
3	2176116.0000000	2303719.7861772	-207603.7861772
4	2197316.0000000	2303719.7861772	-186403.7861772
5	2142670.0000000	2303719.7861772	-241049.7861772
6	2101240.0000000	2303719.7861772	-202479.7861772

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
7	2104299.0000000	2303719.7861772	-199420.7861772
8	2173680.0000000	2303719.7861772	-210031.7861772
9	2106503.0000000	2303719.7861772	-197216.7861772
10	2100851.0000000	2303719.7861772	-202868.7861772
11	1391530.0000000	2104087.4129747	-712557.4129747
12	2274293.0000000	3442867.4129747	-1168574.4129747
13	16267381.0000000	17776693.7879747	-1509312.7879747
14	2029203.0000000	4339002.6629747	-2309799.6629747
15	2169647.0000000	3146375.6368759	-977728.6368759
16	15320751.0000000	16520929.8060760	-1200178.8060760
17	1617552.0000000	3191771.6629747	-1574219.6629747
18	26517870.0000000	24996534.0110759	1521335.9889241
19	1676204.0000000	1541522.1360760	134681.8639240
20	2028651.0000000	1471254.5379747	557396.4620253

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
21	2087279.0000000	1101250.6629747	986028.3370253
22	2311724.0000000	-609253.6139240	2920977.6139240
23	28037656.0000000	26536634.9129747	1501021.0870253
24	2077920.0000000	321146.2610759	1756773.7389241
25	1370279.0000000	-781816.2120253	2152095.2120253
26	1736150.0000000	2722178.3370253	-986028.3370253
27	1773894.0000000	2331290.4620253	-557396.4620253
28	21696176.0000000	21830857.8639240	-134681.8639240
29	2007732.0000000	3529067.9889241	-1521335.9889241
30	2482737.0000000	4594832.2120253	-2152095.2120253
31	1718942.0000000	3475715.7389241	-1756773.7389241
32	2034498.0000000	3535519.0870253	-1501021.0870253
33	12242492.0000000	15163469.6139241	-2920977.6139240
34	1985830.0000000	476517.2120253	1509312.7879747

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
35	24392574.0000000	23223999.5870253	1168574.4129747
36	2492354.0000000	1779796.5870253	712557.4129747
37	1735281.0000000	1529880.3158228	205400.6841772
38	1736043.0000000	1529880.3158228	206162.6841772
39	1735491.0000000	1529880.3158228	205610.6841772
40	1733878.0000000	1529880.3158228	203997.6841772
41	1740264.0000000	1529880.3158228	210383.6841772
42	1738834.0000000	1529880.3158228	208953.6841772
43	1737445.0000000	1529880.3158228	207564.6841772
44	1742127.0000000	1529880.3158228	212246.6841772
45	1739344.0000000	1529880.3158228	209463.6841772
46	1738027.0000000	1529880.3158228	208146.6841772
47	29063736.0000000	27489516.3370253	1574219.6629747
48	1962582.0000000	762403.1139241	1200178.8860759

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
49	1736615.0000000	758886.3639241	977728.6360759
50	1887899.0000000	-581900.6629747	2389799.6629747

Sum of Residuals	-0.0000000
Sum of Squared Residuals	73824596489771.6000000
Sum of Squared Residuals - Error SS	-0.1406250
First Order Autocorrelation	0.5501974
Durbin-Watson D	0.8187198

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                                               11:40 Wednesday, August 21, 1996
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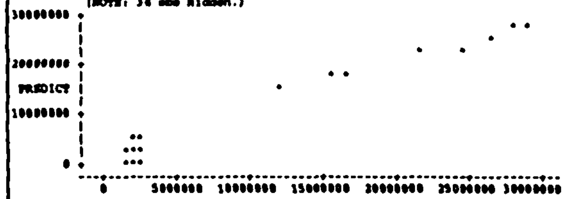


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                                                                          18
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                              Univariate Procedure

Variable=RESIDUAL

                                     Moments

                  N                50  Sum Wgts         50
                  Mean              0  Sum               0
                  Std Dev     1227446  Variance   1.507E12
                  Skewness   -0.00001  Kurtosis   0.062653
                  USS        7.382E13  CSS        7.382E13
                  CV                .  Std Mean   173587.1
                  T:Mean=0          0  Pr>|T|       1.0000
                  Num ^= 0         50  Num > 0          25
                  M(Sign)           0  Pr>=|M|      1.0000
                  Sgn Rank          7  Pr>=|S|      0.9469
                  W:Normal   0.976127  Pr<W         0.5043
```

```
                                                                          19
                                               11:40 Wednesday, August 21, 1996

                              Univariate Procedure

Variable=RESIDUAL

                                 Quantiles(Def=5)

                  100% Max    2920970          99%    2920970
                   75% Q3    712557.4          95%    2152095
                   50% Med   1.63E-9           90%    1547770
                   25% Q1     -712557          10%   -1547770
                    0% Min   -2920970           5%   -2152095
                                                1%   -2920970

                  Range       5841955
                  Q3-Q1       1425115
                  Mode       -2920970
```

```
                                                                          20
                                               11:40 Wednesday, August 21, 1996

                              Univariate Procedure

Variable=RESIDUAL

                                    Extremes

                     Lowest    Obs     Highest    Obs
                   -2920970(    33)   1574220(    47)
                   -2309000(    14)   1756774(    20)
                   -2152095(    30)   2152095(    25)
```

```
mdirizar@c50030-201ps.i              glm.out              10/17/96 14:09   6/8
                   -1756774(    31)   2309000(    50)
                   -1574220(    17)   2920970(    22)
```

```
                                                                          21
                                               11:40 Wednesday, August 21, 1996

                              Univariate Procedure

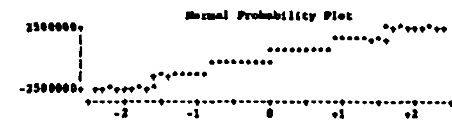
Variable=RESIDUAL

              Stem Leaf                     #              Boxplot
                 2 239                      3                 0
                 1 002255560                9                 |
                 0 1222222222267           13              +--+--+
                -0 7622222222221           13              +-----+
                -1 865552200                9                 |
                -2 932                      3                 0
                   ----+----+----+----+
              Multiply Stem.Leaf by 10**+6
```

```
                                                                          22
                                               11:40 Wednesday, August 21, 1996

                              Univariate Procedure

Variable=RESIDUAL
```




```
          Total Cell Annual Cost by Quality Scenario                      23
                                               11:40 Wednesday, August 21, 1996

     Analysis Variable : TRAC Total Annual Cost
```

QL	N Obs	N	Mean	Std Dev	Minimum
-1	25	25	5500631.32	8149326.67	1736150.00
1	25	25	4715975.00	7374933.14	1370279.00

QL	N Obs	Maximum
-1	25	29063736.00
1	25	20037656.00

```
          Total Cell Annual Cost by Lot Size Scenario                     24
                                               11:40 Wednesday, August 21, 1996

     Analysis Variable : TRAC Total Annual Cost
```

LT	N Obs	N	Mean	Std Dev	Minimum
-1	25	25	2099216.40	210107.10	1617552.00
1	25	25	8117109.92	10110000.96	1370279.00

LT	N Obs	Maximum
-1	25	2492354.00
1	25	29063736.00

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Total Cell Annual Cost by Unit Load Scenario 25
11:40 Wednesday, August 21, 1996

Analysis Variable : TRAC Total Annual Cost

UL	N Obs	N	Mean	Std Dev	Minimum
-1	25	25	5126591.00	7561045.86	1370279.00
1	25	25	5090016.52	7996982.07	1391530.00

UL	N Obs	Maximum
-1	25	29063736.00
1	25	30037656.00

Total Cell Annual Cost by Maintenance Scenario 26
11:40 Wednesday, August 21, 1996

Analysis Variable : TRAC Total Annual Cost

MA	N Obs	N	Mean	Std Dev	Minimum
-1	25	25	4777973.32	7032630.30	1370279.00
1	25	25	5430633.00	8435330.32	1710942.00

MA	N Obs	Maximum
-1	25	26517070.00
1	25	29063736.00

Total Cell Annual Cost by Setup Scenario 27
11:40 Wednesday, August 21, 1996

Analysis Variable : TRAC Total Annual Cost

SU	N Obs	N	Mean	Std Dev	Minimum
-1	25	25	8406265.32	9930296.00	1773094.00
1	25	25	1810361.00	223770.13	1370279.00

SU	N Obs	Maximum
-1	25	29063736.00
1	25	2311724.00

Total Cell Annual Cost by Stoppages Scenario 28
11:40 Wednesday, August 21, 1996

Analysis Variable : TRAC Total Annual Cost

ST	N Obs	N	Mean	Std Dev	Minimum
-1	25	25	6030742.16	9360571.10	1391530.00
1	25	25	4177864.24	5616772.31	1370279.00

ST	N Obs	Maximum
-1	25	29063736.00
1	25	21696176.00

Total Cell Annual Cost by Setup and Lot 29
11:40 Wednesday, August 21, 1996

Analysis Variable : TRAC Total Annual Cost

SU	LT	N Obs	N	Mean	Std Dev
-1	-1	17	17	2153529.24	173079.62
	1	8	8	21693329.50	6374003.65
1	-1	8	8	1903081.00	246191.15
	1	17	17	1720712.47	162692.00

SU	LT	N Obs	Minimum	Maximum
-1	-1	17	1773094.00	2692356.00

Total Cell Annual Cost by Setup and Lot 30
11:40 Wednesday, August 21, 1996

Analysis Variable : TRAC Total Annual Cost

SU	LT	N Obs	Minimum	Maximum
-1	1	8	12262692.00	29063736.00
1	-1	8	1617352.00	2311724.00
	1	17	1370279.00	2029203.00

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APPENDIX D SAS OUTPUTS FOR EXPERIMENTS 1 THROUGH 4

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This results correspond to experiment (branch) 01:

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OBS	TR	QL	MR	ST	L/T	UL	SU	TRAC
1	1	-1	-1	-1	-1	-1	-1	2170280
2	1	-1	-1	-1	-1	-1	-1	2166304
3	1	-1	-1	-1	-1	-1	-1	2176116
4	2	-1	-1	-1	-1	-1	0	2030071
5	2	-1	-1	-1	-1	-1	0	2052721
6	2	-1	-1	-1	-1	-1	0	2041161
7	3	-1	-1	-1	-1	-1	1	2001529
8	3	-1	-1	-1	-1	-1	1	2022109
9	3	-1	-1	-1	-1	-1	1	2039522
10	4	-1	-1	-1	-1	0	-1	2082001
11	4	-1	-1	-1	-1	0	-1	2098293
12	4	-1	-1	-1	-1	0	-1	2123718
13	5	-1	-1	-1	-1	0	0	1979396
14	5	-1	-1	-1	-1	0	0	2005225
15	5	-1	-1	-1	-1	0	0	1982811
16	6	-1	-1	-1	-1	0	1	1946864
17	6	-1	-1	-1	-1	0	1	1976300

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19:50 Wednesday, October 2, 1996

OBS	TR	QL	MR	ST	L/T	UL	SU	TRAC
18	6	-1	-1	-1	-1	0	1	1983034
19	7	-1	-1	-1	-1	1	-1	2065354
20	7	-1	-1	-1	-1	1	-1	2081730
21	7	-1	-1	-1	-1	1	-1	2102777
22	8	-1	-1	-1	-1	1	0	1965612
23	8	-1	-1	-1	-1	1	0	1989030
24	8	-1	-1	-1	-1	1	0	1976037
25	9	-1	-1	-1	-1	1	1	1950013
26	9	-1	-1	-1	-1	1	1	1961977
27	9	-1	-1	-1	-1	1	1	1982919

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19:50 Wednesday, October 2, 1996

General Linear Models Procedure

Number of observations in data set = 27

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General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	1.2052E+11	2.4105E+10	108.31	0.0001
Error	21	4.6737E+09	2.2255E+08		
Corrected Total	26	1.2520E+11			

R-Square	C.V.	Root MSE	TRAC Mean
0.962670	0.732970	14918.3	2035297

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19:50 Wednesday, October 2, 1996

General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Source	DF	Type I SS	Mean Square	F Value	Pr > F
UL	1	2.1657E+10	2.1657E+10	97.31	0.0001
SU	1	8.0293E+10	8.0293E+10	360.78	0.0001
UL*SU	1	7.4557E+08	7.4557E+08	3.35	0.0814
UL*UL	1	3.2630E+09	3.2630E+09	14.66	0.0010

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Source	DF	Type I SS	Mean Square	F Value	Pr > F
SU*SU	1	1.4564E+10	1.4564E+10	65.44	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
UL	1	2.1657E+10	2.1657E+10	97.31	0.0001
SU	1	8.0293E+10	8.0293E+10	360.78	0.0001
UL*SU	1	7.4557E+08	7.4557E+08	3.35	0.0814
UL*UL	1	3.2630E+09	3.2630E+09	14.66	0.0010

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General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SU*SU	1	1.4564E+10	1.4564E+10	65.44	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
pred. at op	1954904.78	380.60	0.0001	5136.43914

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT	1986904.815	309.50	0.0001	6419.001914

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General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
UL	-34686.889	-9.86	0.0001	3516.270323
SU	-66780.778	-18.99	0.0001	3516.270323
UL*SU	7802.333	1.81	0.0814	4306.514065
UL*UL	23320.111	3.83	0.0010	6090.350053
SU*SU	49267.778	8.09	0.0001	6090.350053

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
1	2170280.00000000	2168850.70370370	1429.29629630
2	2166304.00000000	2168850.70370370	-2546.70370370
3	2176116.00000000	2168850.70370370	7265.29629630
4	2030071.00000000	2044911.01481481	-14840.01481481
5	2052721.00000000	2044911.01481481	7809.98518519
6	2041161.00000000	2044911.01481481	-3750.01481481
7	2001529.00000000	2019508.48148148	-17979.48148148
8	2022109.00000000	2019508.48148148	2600.51851852
9	2039522.00000000	2019508.48148148	20013.51851852
10	2082001.00000000	2102961.37037037	-20960.37037037
11	2098293.00000000	2102961.37037037	-4668.37037037
12	2123718.00000000	2102961.37037037	20756.62962963
13	1979396.00000000	1986904.01481481	-7508.01481481
14	2005225.00000000	1986904.01481481	18320.98518519

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
15	1982811.00000000	1986904.01481481	-4093.01481481
16	1946864.00000000	1969383.01481481	-22519.01481481

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17	1976308.00000000	1969303.01481481	7004.98518519
18	1983054.00000000	1969303.01481481	13750.98518519
19	2065354.00000000	2083712.25925926	-18358.25925926
20	2081730.00000000	2083712.25925926	-1982.25925926
21	2102777.00000000	2083712.25925926	19064.74074074
22	1965612.00000000	1975538.03703704	-9926.03703704
23	1989030.00000000	1975538.03703704	13491.96296296
24	1976037.00000000	1975538.03703704	498.96296296
25	1950013.00000000	1965099.37037037	-15086.37037037
26	1961177.00000000	1965099.37037037	-3922.37037037
27	1982919.00000000	1965099.37037037	17819.62962963

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General Linear Models Procedure

Sum of Residuals	0.00000000
Sum of Squared Residuals	4673651340.37037000
Sum of Squared Residuals - Error SS	-0.00150082
First Order Autocorrelation	-0.32957969
Durbin-Watson D	2.59674137

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Coding Coefficients for the Independent Variables

Factor	Subtracted off	Divided by
UL	0	1.000000
SU	0	1.000000

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Response Surface for Variable TRAC: Annualized cost

Response Mean	2035297
Root MSE	14918
R-Square	0.9627
Coef. of Variation	0.7330
Sum of Squared Residuals	4673651340
Predicted Resid SS (PRESS)	7784408452

Regression	Degrees of Freedom	Type I Sum of Squares	R-Square	F-Ratio	Prob > F
Linear	2	101950579761	0.8143	229.0	0.0000
Quadratic	2	17826049056	0.1424	40.050	0.0000
Crossproduct	1	745574145	0.0060	3.350	0.0814

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Regression	Degrees of Freedom	Type I Sum of Squares	R-Square	F-Ratio	Prob > F
Total Regress	5	120523802963	0.9627	108.3	0.0000

Residual	Degrees of Freedom	Sum of Squares	Mean Square	F-Ratio	Prob > F
Lack of Fit	3	91245169	30415056	0.119	0.9475
Pure Error	18	4582406171	254578121		
Total Error	21	4673651340	222554826		

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Parameter	Degrees of Freedom	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEPT	1	1986905	6419.001914	309.5	0.0000
UL	1	-34687	3516.270323	-9.865	0.0000
SU	1	-66789	3516.270323	-18.994	0.0000
UL*UL	1	23320	6090.350053	3.829	0.0010
SU*UL	1	7882.333333	4306.536045	1.830	0.0814
SU*SU	1	49260	6090.350053	8.089	0.0000

Parameter	Parameter Estimate from Coded Data
INTERCEPT	1986905
UL	-34687
SU	-66789

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Parameter	Parameter Estimate from Coded Data
UL*UL	23320
SU*UL	7882.333333
SU*SU	49260

Factor	Degrees of Freedom	Sum of Squares	Mean Square	F-Ratio	Prob > F	
UL	3	25665784333	8555261444	38.441	0.0000	Unit load
SU	3	95602792775	31867597592	143.2	0.0000	Setups

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Canonical Analysis of Response Surface
(based on coded data)

Factor	Critical Value Coded	Uncoded	
UL	0.637702	0.637702	Unit load
SU	0.626795	0.626795	Setups

Predicted value at stationary point 1954912

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Canonical Analysis of Response Surface
(based on coded data)

Eigenvalues	Eigenvectors UL	SU
49853	0.146926	0.989148
22735	0.989148	-0.146926

Stationary point is a minimum.

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Estimated Ridge of Minimum Response for Variable TRAC: Annualized cost

Coded Radius	Estimated Response	Standard Error	Uncoded Factor Values UL	SU

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0.0	1986905	6419.001914	0	0
0.1	1979847	6391.060150	0.040162	0.087630
0.2	1973716	6306.553265	0.100903	0.172601
0.3	1968496	6171.305500	0.150910	0.254656
0.4	1964167	5993.640127	0.222069	0.332159
0.5	1960707	5785.669540	0.293303	0.404079
0.6	1958006	5564.657794	0.370049	0.471660
0.7	1956271	5355.715790	0.455334	0.531660
0.8	1955226	5195.741177	0.546482	0.584250
0.9	1954913	5136.510747	0.641530	0.629102
1.0	1955294	5241.004300	0.745432	0.666593

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OBS	UL	SU	_TYPE_	TRAC
1	-1	-1	RESIDUAL	1429.30
2	-1	-1	RESIDUAL	-2546.70
3	-1	-1	RESIDUAL	7265.30
4	-1	0	RESIDUAL	-14840.01
5	-1	0	RESIDUAL	7089.19
6	-1	0	RESIDUAL	-3750.01
7	-1	1	RESIDUAL	-17979.40
8	-1	1	RESIDUAL	2600.52
9	-1	1	RESIDUAL	20013.52
10	0	-1	RESIDUAL	-20960.37
11	0	-1	RESIDUAL	-4669.37
12	0	-1	RESIDUAL	20756.63
13	0	0	RESIDUAL	-7500.01
14	0	0	RESIDUAL	10320.19
15	0	0	RESIDUAL	-4893.01
16	0	1	RESIDUAL	-22519.01
17	0	1	RESIDUAL	7084.19

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OBS	UL	SU	_TYPE_	TRAC
18	0	1	RESIDUAL	13670.19
19	1	-1	RESIDUAL	-10350.26
20	1	-1	RESIDUAL	-1902.26
21	1	-1	RESIDUAL	19064.74
22	1	0	RESIDUAL	-9926.04
23	1	0	RESIDUAL	13491.96
24	1	0	RESIDUAL	498.96
25	1	1	RESIDUAL	-15086.37
26	1	1	RESIDUAL	-3922.37
27	1	1	RESIDUAL	17019.63

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19:50 Wednesday, October 2, 1996

Univariate Procedure

Variable=TRAC Annualized cost

Moments

N	27	Sum Wgts	27
Mean	0	Sum	0
Std Dev	13407.3	Variance	1.797680
Skewness	-0.00714	Kurtosis	-1.06077
USS	4.673789	CSS	4.673789
CV	.	Std Mean	2580.237
T:Mean=0	0	Pr>|T|	1.0000
Num ^= 0	27	Num > 0	13
M(Sign)	-0.5	Pr>=|M|	1.0000
Sgn Rank	-4	Pr>=|S|	0.9256
W:Normal	0.965761	Pr<W	0.1055

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Univariate Procedure

Variable=TRAC Annualized cost

Quantiles(Def=5)

100% Max	20756.63	99%	20756.63
75% Q3	13491.96	95%	20013.52
50% Med	-1902.26	90%	19064.74
25% Q1	-9926.04	10%	-18350.3
0% Min	-22519.0	5%	-20960.4
		1%	-22519.0
Range	43276.64		
Q3-Q1	23418		
Mode	-22519.0		

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Univariate Procedure

Variable=TRAC Annualized cost

Extremes

Lowest	Obs	Highest	Obs
-22519.0(	16)	17019.63(	27)
-20960.4(	10)	10320.19(	14)
-18350.3(	19)	19064.74(	21)
-17979.5(	7)	20013.52(	9)
-15086.4(	25)	20756.63(	12)

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Univariate Procedure

Variable=TRAC Annualized cost

```
Stem Leaf                  #         Boxplot
   2 01                    2            |
   1 789                   3            |
   1 34                    2         +-----+
   0 778                   3         |     |
   0 013                   3         |  +  |
  -0 44432                 5         *-----*
  -0 85                    2         |     |
  -1 0                     1         +-----+
  -1 8865                  4            |
  -2 31                    2            |
     ----+----+----+----+
Multiply Stem.Leaf by 10**+4
```

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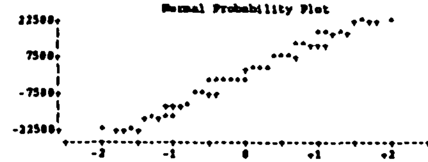
Univariate Procedure

Variable=TRAC Annualized cost

Normal Probability Plot



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OBS	_DEPVAR_	_TYPE_	_RADIUS_	UL	SU	_PRED_	_STDERR_
1	TRAC	MINIMUM	0.0	0.00000	0.00000	1986904.81	6419.00
2	TRAC	MINIMUM	0.1	0.04016	0.08764	1979846.75	6391.06
3	TRAC	MINIMUM	0.2	0.10090	0.17260	1973715.55	6306.55

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4	TRAC	MINIMUM	0.3	0.15891	0.25446	1960695.53	6171.31
5	TRAC	MINIMUM	0.4	0.22207	0.33216	1964167.23	5993.64
6	TRAC	MINIMUM	0.5	0.29338	0.40400	1960706.70	5705.67
7	TRAC	MINIMUM	0.6	0.37005	0.47167	1958005.67	5564.66
8	TRAC	MINIMUM	0.7	0.45533	0.53167	1956270.95	5355.72
9	TRAC	MINIMUM	0.8	0.54640	0.58426	1955226.30	5195.74
10	TRAC	MINIMUM	0.9	0.64353	0.62910	1954913.21	5136.52
11	TRAC	MINIMUM	1.0	0.74542	0.66659	1955294.05	5241.00

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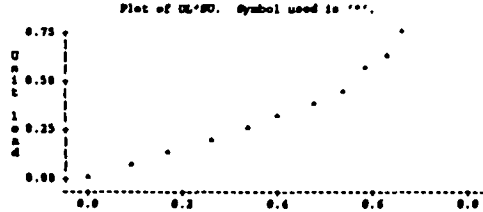
Plot of UL*SU. Symbol used is '*'.



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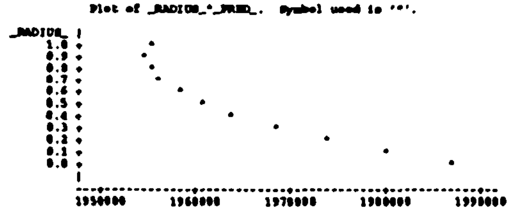
19:50 Wednesday, October 2, 1996

Plot of _RADIUS_*_PRED_. Symbol used is '*'.



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This results correspond to experiment (branch) 02:

OBS	TR	QL	MA	ST	L/T	UL	SU	TRAC
1	10	-1	-1	-1	1	-1	-1	26109006
2	10	-1	-1	-1	1	-1	-1	26429440
3	10	-1	-1	-1	1	-1	-1	26741324
4	11	-1	-1	-1	1	-1	0	1688792
5	11	-1	-1	-1	1	-1	0	1709556
6	11	-1	-1	-1	1	-1	0	1747433
7	12	-1	-1	-1	1	-1	1	1734920
8	12	-1	-1	-1	1	-1	1	1721049
9	12	-1	-1	-1	1	-1	1	1735343
10	13	-1	-1	-1	1	0	-1	26275176
11	13	-1	-1	-1	1	0	-1	26386184
12	13	-1	-1	-1	1	0	-1	27168350
13	14	-1	-1	-1	1	0	0	1706055
14	14	-1	-1	-1	1	0	0	1707182
15	14	-1	-1	-1	1	0	0	1741485
16	15	-1	-1	-1	1	0	1	1720884
17	15	-1	-1	-1	1	0	1	1718412

OBS	TR	QL	MA	ST	L/T	UL	SU	TRAC
18	15	-1	-1	-1	1	0	1	1742342
19	16	-1	-1	-1	1	1	-1	26976848
20	16	-1	-1	-1	1	1	-1	26561782
21	16	-1	-1	-1	1	1	-1	27376812
22	17	-1	-1	-1	1	1	0	1715432
23	17	-1	-1	-1	1	1	0	1716481
24	17	-1	-1	-1	1	1	0	1765605
25	18	-1	-1	-1	1	1	1	1728924
26	18	-1	-1	-1	1	1	1	1760166
27	18	-1	-1	-1	1	1	1	1773966

General Linear Models Procedure

Number of observations in data set = 27

General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	3.7356E+15	7.4713E+14	15046.64	0.0001
Error	21	1.0427E+12	4.9654E+10		
Corrected Total	26	3.7367E+15			

R-Square	C.V.	Root MSE	TRAC Mean
0.999721	2.210465	222832	1.0E+07

General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Source	DF	Type I SS	Mean Square	F Value	Pr > F
UL	1	1.4927E+11	1.4927E+11	3.01	0.0976
SU	1	2.7997E+15	2.7997E+15	56384.99	0.0001
UL*SU	1	1.8840E+11	1.8840E+11	3.80	0.0649
UL*UL	1	9.0932E+09	9.0932E+09	0.18	0.6731

Source	DF	Type I SS	Mean Square	F Value	Pr > F
SU*SU	1	9.3554E+14	9.3554E+14	18841.24	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
UL	1	1.4927E+11	1.4927E+11	3.01	0.0976
SU	1	2.7997E+15	2.7997E+15	56384.99	0.0001
UL*SU	1	1.8840E+11	1.8840E+11	3.80	0.0649
UL*UL	1	9.0932E+09	9.0932E+09	0.18	0.6731

General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SU*SU	1	9.3554E+14	9.3554E+14	18841.24	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
prod. at sp	-1425522.20	-17.26	0.0001	82588.2238

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT	1693826.81	17.66	0.0001	95891.67695

General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
UL	91064.86	1.73	0.0976	52521.92500
SU	-12471606.44	-237.46	0.0001	52521.92500
UL*SU	-125327.33	-1.95	0.0649	64325.95820
UL*UL	38929.96	0.43	0.6731	90970.64261
SU*SU	12486938.11	137.26	0.0001	90970.64261

General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
1	26109006.0000000	26474989.9259259	-365983.9259259
2	26429440.0000000	26474989.9259259	-45549.9259259
3	26741324.0000000	26474989.9259259	266334.0740741
4	1688792.0000000	1641692.7037037	47099.2962963
5	1709556.0000000	1641692.7037037	67863.2962963
6	1747433.0000000	1641692.7037037	105740.2962963
7	1734920.0000000	1782351.7037037	-47431.7037037
8	1721049.0000000	1782351.7037037	-61302.7037037
9	1735343.0000000	1782351.7037037	-47008.7037037
10	26275176.0000000	26652371.3703704	-377195.3703704
11	26386184.0000000	26652371.3703704	-266187.3703704
12	27168350.0000000	26652371.3703704	515978.6296296
13	1706055.0000000	1693826.8948948	12228.1051052
14	1707182.0000000	1693826.8948948	13355.1051052

General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
15	1741485.0000000	1693826.8948948	47658.1051052
16	1720884.0000000	1709158.4814815	11725.5185185
17	1718412.0000000	1709158.4814815	9253.5185185
18	1742342.0000000	1709158.4814815	33183.5185185
19	26976848.0000000	26907692.7037037	69155.2962963
20	26561782.0000000	26907692.7037037	-345910.7037037

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```
mdirisar@c50030-201ps.i            opexp2.out            10/17/96 14:12  3/7

   21      27176812.0000000    26907692.7037037     469119.2962963
   22       1715432.0000000     1023020.0140140    -100300.0140140
   23       1716401.0000000     1023020.0140140    -107339.0140140
   24       1745605.0000000     1023020.0140140     -70215.0140140
   25       1720924.0000000     1713025.1401401      15090.0510519
   26       1740166.0000000     1713025.1401401      26360.0510519
   27       1773966.0000000     1713025.1401401      60140.0510519

                                                                     113
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              General Linear Models Procedure

        Sum of Residuals                                     -0.00000003
        Sum of Squared Residuals               1042732006938.37000000
        Sum of Squared Residuals - Error SS                  -0.25366211
        First Order Autocorrelation                          -0.19224799
        Durbin-Watson D                                       2.30263610

                                                                     114
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          Coding Coefficients for the Independent Variables

              Factor      Subtracted off    Divided by

              UL                       0      1.000000
              SU                       0      1.000000

                                                                     115
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         Response Surface for Variable TRAC: Annualized cost

                 Response Mean             10066606
                 Root MSE                    222832
                 R-Square                    0.9997
                 Coef. of Variation          2.2105

              Sum of Squared Residuals    1.0427329E12
              Predicted Resid SS (PRESS)  1.7563003E12

               Degrees
                  of        Type I Sum
Regression     Freedom     of Squares      R-Square    F-Ratio    Prob > F

Linear               2    2.7990067E15      0.7493      20194     0.0000
Quadratic            2    9.3555003E14      0.2504     9420.7     0.0000
Crossproduct         1    100603205765      0.0001      3.796     0.0649

                                                                     116
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               Degrees
                  of        Type I Sum
Regression     Freedom     of Squares      R-Square    F-Ratio    Prob > F

Total Regress        5    3.7356265E15      0.9997      15067     0.0000

               Degrees
                  of         Sum of
Residual       Freedom      Squares       Mean Square   F-Ratio   Prob > F

Lack of Fit          3    78480327133   26160109044     0.488     0.6947
Pure Error          18   964252557006   53569586545
Total Error         21   1.0427329E12   49653946903

                                                                     117
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                Degrees
                   of      Parameter    Standard    T for H0:
```

```
mdirisar@c50030-201ps.i            opexp2.out            10/17/96 14:12  4/7
Parameter        Freedom   Estimate        Error   Parameter=0 Prob > |T|

INTERCEPT           1        1693027        95891     17.664    0.0000
UL                  1          91064        52522      1.734    0.0976
SU                  1      -12471606        52522     -237.5    0.0000
UL*UL               1          38938        90971      0.420    0.6731
SU*UL               1        -125327        64326     -1.948    0.0649
SU*SU               1       12486938        90971      137.3    0.0000

                  Parameter
                  Estimate
                  from Coded
Parameter           Data

INTERCEPT          1693027
UL                   91064
SU               -12471606

                                                                     118
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                  Parameter
                  Estimate
                  from Coded
Parameter           Data

UL*UL                38938
SU*UL              -125327
SU*SU             12486938

            Degrees
               of       Sum of
  Factor    Freedom    Squares     Mean Square F-Ratio Prob > F

  UL           3  346844449068 115614816356   2.328  0.1037  Unit load
  SU           3  3.7354676E15 1.2451559E15   25077  0.0000  Setups

                                                                     119
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          Canonical Analysis of Response Surface
                   (based on coded data)

                         Critical Value
         Factor           Coded          Uncoded

         UL             -0.360729      -0.360729    Unit load
         SU              0.497536       0.497536    Setups

         Predicted value at stationary point      -1425497

                                                                     120
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          Canonical Analysis of Response Surface
                   (based on coded data)

                                   Eigenvectors
          Eigenvalues          UL                SU

            12407254       -0.005034         0.999987
               30615        0.999987         0.005034

               Stationary point is a minimum.

                                                                     121
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  Estimated Ridge of Minimum Response for Variable TRAC: Annualized cost

  Coded      Estimated       Standard        Uncoded Factor Values
  Radius     Response        Error           UL                SU

   0.0        1693027         95891               0                 0
   0.1         571505         95463       -0.000787          0.099997
   0.2        -301075         94228       -0.001762          0.199992
```

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```
mdirisar@c50030-201ps.1          opexp2.out          10/17/96  14:12   4/7
                     0% Min    -377195         5%    -345911
                                               1%    -377195
                   Range        893174
                   Q3-Q1      138356.7
                   Mode        -377195

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

                                                                        126
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                          Univariate Procedure

Variable=TRAC            Annualised cost

                               Extremes

                    Lowest     Obs      Highest    Obs
                   -377195(      10)   69155.3(      19)
                   -345911(      20)  105740.3(       6)
                   -285904(       1)  266414.1(       3)
                   -266107(      11)  469119.3(      21)
                   -188389(      22)  515978.6(      12)

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

                                                                        127
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                          Univariate Procedure

Variable=TRAC            Annualised cost

                Stem Leaf                      #              Boxplot
                   5 2                         1                 *
                   4 7                         1                 0
                   3
                   2 7                         1                 |
                   1 1                         1                 |
                   0 11112335677              12              +--+--+
                  -0 86555                     5              +-----+
                  -1 11                        2                 |
                  -2 97                        2                 0
                  -3 85                        2                 0
                     ----+----+----+----+
                 Multiply Stem.Leaf by 10**+5

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

                                                                        128
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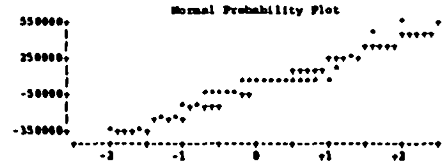
                          Univariate Procedure

Variable=TRAC            Annualised cost

                       Normal Probability Plot
```




```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

                                                                        129
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OBS  _DEPVAR_  _TYPE_   _RADIUS_     UL        SU         _PRED_      _STDERR_

  1    TRAC    MINIMUM     0.0    0.00000   0.00000   1693826.81   95891.40
  2    TRAC    MINIMUM     0.1   -0.00079   0.10000    571504.69   95463.32
  3    TRAC    MINIMUM     0.2   -0.00176   0.19999   -301075.87   94219.89
  4    TRAC    MINIMUM     0.3   -0.00321   0.29998   -923916.38   92289.69
  5    TRAC    MINIMUM     0.4   -0.00651   0.39995  -1297038.99   89904.63
  6    TRAC    MINIMUM     0.5   -0.08103   0.49339  -1621910.51   87313.52
  7    TRAC    MINIMUM     0.6   -0.33533   0.49755  -1625453.42   83324.17
```

```
mdirisar@c50030-201ps.1          opexp2.out          10/17/96  14:12   5/7
     0.3          -923916          92298       -0.003306        0.299903
     0.4         -1297039          89905       -0.006514        0.399947
     0.5         -1621911          87314       -0.081027        0.493391
     0.6         -1625453          83324       -0.335328        0.497549
     0.7         -1624902          79888       -0.492636        0.497303
     0.8         -1622916          77998       -0.626989        0.496875
     0.9         -1619854          78725       -0.750723        0.496402
     1.0         -1615847          83025       -0.868372        0.495913

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

                                                                        122
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                  OBS     UL     SU     _TYPE_         TRAC

                    1     -1     -1    RESIDUAL    -285903.93
                    2     -1     -1    RESIDUAL     -85469.93
                    3     -1     -1    RESIDUAL     266414.07
                    4     -1      0    RESIDUAL      67099.30
                    5     -1      0    RESIDUAL      67063.30
                    6     -1      0    RESIDUAL     105740.30
                    7     -1      1    RESIDUAL     -67431.70
                    8     -1      1    RESIDUAL     -61382.70
                    9     -1      1    RESIDUAL     -67888.70
                   10      0     -1    RESIDUAL    -377195.37
                   11      0     -1    RESIDUAL    -266107.37
                   12      0     -1    RESIDUAL     515978.63
                   13      0      0    RESIDUAL      12220.19
                   14      0      0    RESIDUAL      13355.19
                   15      0      0    RESIDUAL      47650.19
                   16      0      1    RESIDUAL      11725.52
                   17      0      1    RESIDUAL       9253.52

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

                                                                        123
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                  OBS     UL     SU     _TYPE_         TRAC

                   18      0      1    RESIDUAL      33183.52
                   19      1     -1    RESIDUAL      69155.30
                   20      1     -1    RESIDUAL    -345910.70
                   21      1     -1    RESIDUAL     469119.30
                   22      1      0    RESIDUAL    -188388.81
                   23      1      0    RESIDUAL    -187339.81
                   24      1      0    RESIDUAL     -78215.81
                   25      1      1    RESIDUAL      15898.85
                   26      1      1    RESIDUAL      36348.85
                   27      1      1    RESIDUAL      60148.85

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

                                                                        124
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                          Univariate Procedure

Variable=TRAC            Annualised cost

                                Moments

                 N                 27  Sum Wgts          27
                 Mean               0  Sum                0
                 Std Dev     208262.6  Variance    4.0118E10
                 Skewness    0.625962  Kurtosis    1.776513
                 USS         1.043E12  CSS         1.043E12
                 CV                 .  Std Mean    38540.56
                 T:Mean=0           0  Pr>|T|        1.0000
                 Num ^= 0          27  Num > 0           16
                 M(Sign)          2.5  Pr>=|M|       0.4421
                 Sgn Rank          -2  Pr>=|S|       0.9620
                 W:Normal    0.893024  Pr<W          0.0095

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

                                                                        125
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                          Univariate Procedure

Variable=TRAC            Annualised cost

                            Quantiles(Def=5)

                   100% Max   515978.6         99%   515978.6
                    75% Q3    60148.85         95%   469119.3
                    50% Med   12220.19         90%   266414.1
                    25% Q1    -78215.8         10%    -285904
```

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8	TRAC	MINIMUM	0.7	-0.49264	0.49730	-1424982.86	79887.64
9	TRAC	MINIMUM	0.8	-0.62699	0.49680	-1422916.19	77997.97
10	TRAC	MINIMUM	0.9	-0.75072	0.49640	-1419854.40	79726.95
11	TRAC	MINIMUM	1.0	-0.86837	0.49591	-1415846.95	83826.78

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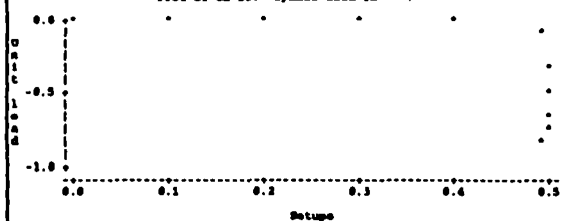
Plot of UL*SU. Symbol used is '*'.



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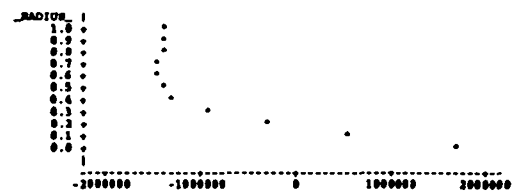
Plot of _RADIUS_*_PRED_. Symbol used is '*'.



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This results correspond to experiment (branch) 0):

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19:50 Wednesday, October 2, 1996

OBS	TR	QL	MA	ST	LP	UL	SU	TRAC
1	19	-1	-1	1	-1	-1	-1	2145942
2	19	-1	-1	1	-1	-1	-1	2139838
3	19	-1	-1	1	-1	-1	-1	2153638
4	20	-1	-1	1	-1	-1	0	2008236
5	20	-1	-1	1	-1	-1	0	2038270
6	20	-1	-1	1	-1	-1	0	2021602
7	21	-1	-1	1	-1	-1	1	1983695
8	21	-1	-1	1	-1	-1	1	2001533
9	21	-1	-1	1	-1	-1	1	2015599
10	22	-1	-1	1	-1	0	-1	2084729
11	22	-1	-1	1	-1	0	-1	2077431
12	22	-1	-1	1	-1	0	-1	2088321
13	23	-1	-1	1	-1	0	0	1950674
14	23	-1	-1	1	-1	0	0	1982493
15	23	-1	-1	1	-1	0	0	1967753
16	24	-1	-1	1	-1	0	1	1938030
17	24	-1	-1	1	-1	0	1	1953781

431
19:50 Wednesday, October 2, 1996

OBS	TR	QL	MA	ST	LP	UL	SU	TRAC
18	24	-1	-1	1	-1	0	1	1974462
19	25	-1	-1	1	-1	1	-1	2075687
20	25	-1	-1	1	-1	1	-1	2066965
21	25	-1	-1	1	-1	1	-1	2073427
22	26	-1	-1	1	-1	1	0	1952883
23	26	-1	-1	1	-1	1	0	1969623
24	26	-1	-1	1	-1	1	0	1953996
25	27	-1	-1	1	-1	1	1	1929480
26	27	-1	-1	1	-1	1	1	1948198
27	27	-1	-1	1	-1	1	1	1967969

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19:50 Wednesday, October 2, 1996

General Linear Models Procedure

Number of observations in data set = 27

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19:50 Wednesday, October 2, 1996

General Linear Models Procedure

Dependent Variable: TRAC Annualised cost

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	1.1661E+11	2.3322E+10	148.30	0.0001
Error	21	3.3026E+09	1.5726E+08		
Corrected Total	26	1.1991E+11			

R-Square	C.V.	Root MSE	TRAC Mean
0.972459	0.621682	12540.5	2017194

434
19:50 Wednesday, October 2, 1996

General Linear Models Procedure

Dependent Variable: TRAC Annualised cost

Source	DF	Type I SS	Mean Square	F Value	Pr > F
UL	1	1.8059E+10	1.8059E+10	114.83	0.0001
SU	1	7.9097E+10	7.9097E+10	502.96	0.0001
UL*SU	1	3.8736E+08	3.8736E+08	2.46	0.1315
UL*UL	1	3.1314E+09	3.1314E+09	19.91	0.0002

mdirizar@c50030-201ps.1 opexp3.out 10/17/96 14:12 2/7

Source	DF	Type I SS	Mean Square	F Value	Pr > F
SU*SU	1	1.5936E+10	1.5936E+10	101.33	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
UL	1	1.8059E+10	1.8059E+10	114.83	0.0001
SU	1	7.9097E+10	7.9097E+10	502.96	0.0001
UL*SU	1	3.8736E+08	3.8736E+08	2.46	0.1315
UL*UL	1	3.1314E+09	3.1314E+09	19.91	0.0002

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19:50 Wednesday, October 2, 1996

General Linear Models Procedure

Dependent Variable: TRAC Annualised cost

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SU*SU	1	1.5936E+10	1.5936E+10	101.33	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
pred. at op	1937637.72	448.35	0.0001	4321.70568

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT	1967606.556	364.60	0.0001	5396.386690

436
19:50 Wednesday, October 2, 1996

General Linear Models Procedure

Dependent Variable: TRAC Annualised cost

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
UL	-31676.722	-10.72	0.0001	2955.032215
SU	-66289.500	-22.43	0.0001	2955.032215
UL*SU	5681.503	1.57	0.1315	3620.140345
UL*UL	22845.167	4.46	0.0002	5119.651574
SU*SU	51535.833	10.07	0.0001	5119.651574

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19:50 Wednesday, October 2, 1996

General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
1	2145942.00000000	2145633.36111111	308.63888889
2	2139838.00000000	2145633.36111111	-5795.36111111
3	2153638.00000000	2145633.36111111	8004.63888889
4	2008236.00000000	2022126.44444444	-13890.44444444
5	2038270.00000000	2022126.44444444	16143.55555556
6	2021602.00000000	2022126.44444444	-524.44444444
7	1983695.00000000	2001691.19444444	-17996.19444444
8	2001533.00000000	2001691.19444444	-158.19444444
9	2015599.00000000	2001691.19444444	13907.80555556
10	2084729.00000000	2085431.88888889	-702.88888889
11	2077431.00000000	2085431.88888889	-8000.88888889
12	2088321.00000000	2085431.88888889	2889.11111111
13	1950674.00000000	1967606.55555556	-16932.55555556
14	1982493.00000000	1967606.55555556	14886.44444444

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
15	1967753.00000000	1967606.55555556	146.44444444
16	1938030.00000000	1952852.88888889	-14822.88888889

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17	1953781.00000000	1952852.88888889	928.11111111
18	1974462.00000000	1952852.88888889	21609.11111111
19	2075687.00000000	2070920.75000000	4766.25000000
20	2066945.00000000	2070920.75000000	-3975.75000000
21	2073427.00000000	2070920.75000000	2506.25000000
22	1952003.00000000	1950777.00000000	-5894.00000000
23	1969623.00000000	1950777.00000000	18846.00000000
24	1953996.00000000	1950777.00000000	-4781.00000000
25	1929480.00000000	1949704.91666667	-20224.91666667
26	1948198.00000000	1949704.91666667	-1506.91666667
27	1967969.00000000	1949704.91666667	18264.08333333

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General Linear Models Procedure

Sum of Residuals	0.00000000
Sum of Squared Residuals	3302564862.36111000
Sum of Squared Residuals - Error SS	-0.00521278
First Order Autocorrelation	-0.20087373
Durbin-Watson D	2.39911326

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Coding Coefficients for the Independent Variables

Factor	Subtracted off	Divided by
UL	0	1.000000
SU	0	1.000000

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Response Surface for Variable TRAC: Annualized cost

Response Mean	2017194
Root MSE	12541
R-Square	0.9725
Coef. of Variation	0.6217

Sum of Squared Residuals	3302564862
Predicted Resid SS (PRESS)	5603074276

Regression	Degrees of Freedom	Type I Sum of Squares	R-Square	F-Ratio	Prob > F
Linear	2	97156545806	0.8102	308.9	0.0000
Quadratic	2	19067062546	0.1590	60.621	0.0000
Crossproduct	1	387364670	0.0032	2.463	0.1315

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Regression	Degrees of Freedom	Type I Sum of Squares	R-Square	F-Ratio	Prob > F
Total Regress	5	116610972300	0.9725	148.3	0.0000

Residual	Degrees of Freedom	Sum of Squares	Mean Square	F-Ratio	Prob > F
Lack of Fit	3	49071592	16357197	0.0905	0.9643
Pure Error	18	3253493271	180749626		
Total Error	21	3302564862	157264993		

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Parameter	Degrees of Freedom	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEPT	1	1967607	5396.586600	364.6	0.0000
UL	1	-31675	2955.032215	-10.716	0.0000
SU	1	-66290	2955.032215	-22.427	0.0000
UL*UL	1	22845	5119.651576	4.462	0.0002
SU*UL	1	5681.583333	3620.140345	1.569	0.1315
SU*SU	1	51536	5119.651576	10.066	0.0000

Parameter	Parameter Estimate from Coded Data
INTERCEPT	1967607
UL	-31675
SU	-66290

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Parameter	Parameter Estimate from Coded Data
UL*UL	22845
SU*UL	5681.583333
SU*SU	51536

Factor	Degrees of Freedom	Sum of Squares	Mean Square	F-Ratio	Prob > F	
UL	3	21577959012	7192653004	45.736	0.0000	Unit load
SU	3	95420377959	31806792653	202.2	0.0000	Setups

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Canonical Analysis of Response Surface
(based on coded data)

Factor	Critical Value Coded	Critical Value Uncoded	
UL	0.617506	0.617506	Unit load
SU	0.609101	0.609101	Setups

Predicted value at stationary point 1937630

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Canonical Analysis of Response Surface
(based on coded data)

Eigenvalues	Eigenvectors UL	Eigenvectors SU
51814	0.097594	0.995226
22567	0.995226	-0.097594

Stationary point is a minimum.

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Estimated Ridge of Minimum Response for Variable TRAC: Annualized cost

Coded Radius	Estimated Response	Standard Error	Uncoded Factor Values UL	Uncoded Factor Values SU

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0.0	1967607	5396.586600	0	0
0.1	1960741	5372.430034	0.045547	0.089025
0.2	1954020	5301.454016	0.096505	0.175176
0.3	1949865	5187.949635	0.153716	0.257626
0.4	1945767	5030.877372	0.217972	0.335393
0.5	1942563	4864.187350	0.289866	0.407404
0.6	1940194	4678.060127	0.369617	0.472636
0.7	1938619	4501.629971	0.456920	0.530299
0.8	1937794	4366.784553	0.550967	0.580030
0.9	1937674	4318.963140	0.650521	0.621951
1.0	1938219	4413.676500	0.754232	0.656600

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OBS	UL	SU	_TYPE_	TRAC
1	-1	-1	RESIDUAL	308.64
2	-1	-1	RESIDUAL	-5795.36
3	-1	-1	RESIDUAL	8004.64
4	-1	0	RESIDUAL	-13090.44
5	-1	0	RESIDUAL	16143.56
6	-1	0	RESIDUAL	-524.44
7	-1	1	RESIDUAL	-17996.19
8	-1	1	RESIDUAL	-150.19
9	-1	1	RESIDUAL	13987.01
10	0	-1	RESIDUAL	-702.89
11	0	-1	RESIDUAL	-8088.89
12	0	-1	RESIDUAL	2809.11
13	0	0	RESIDUAL	-16932.56
14	0	0	RESIDUAL	14086.44
15	0	0	RESIDUAL	146.44
16	0	1	RESIDUAL	-14022.89
17	0	1	RESIDUAL	920.11

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OBS	UL	SU	_TYPE_	TRAC
18	0	1	RESIDUAL	21609.11
19	1	-1	RESIDUAL	4766.25
20	1	-1	RESIDUAL	-3975.75
21	1	-1	RESIDUAL	2506.25
22	1	0	RESIDUAL	-5094.00
23	1	0	RESIDUAL	10046.00
24	1	0	RESIDUAL	-4781.00
25	1	1	RESIDUAL	-20224.92
26	1	1	RESIDUAL	-1506.92
27	1	1	RESIDUAL	10264.08

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Univariate Procedure

Variable=TRAC Annualized cost

Moments

N	27	Sum Wgts	27
Mean	0	Sum	0
Std Dev	11270.39	Variance	1.270289
Skewness	0.067793	Kurtosis	-0.52822
USS	3.302629	CSS	3.302629
CV	.	Std Mean	2169.988
T:Mean=0	0	Pr>|T|	1.0000
Num ^= 0	27	Num > 0	13
M(Sign)	-0.5	Pr>=|M|	1.0000
Sgn Rank	-6	Pr>=|S|	0.9256
W:Normal	0.966076	Pr<W	0.5273

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Univariate Procedure

Variable=TRAC Annualized cost

Quantiles(Def=5)

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100% Max	21609.11	99%	21609.11
75% Q3	8004.639	95%	18264.08
50% Med	-150.194	90%	16143.56
25% Q1	-5094	10%	-16932.6
0% Min	-20224.9	5%	-17996.2
		1%	-20224.9

Range	41834.03
Q3-Q1	13098.64
Mode	-20224.9

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Univariate Procedure

Variable=TRAC Annualized cost

Extremes

Lowest	Obs	Highest	Obs
-20224.9(	25)	13987.01(	9)
-17996.2(	7)	14086.44(	14)
-16932.6(	13)	16143.56(	5)
-14022.9(	16)	18264.08(	27)
-13090.4(	4)	21609.11(	18)

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Univariate Procedure

Variable=TRAC Annualized cost

```
Stem Leaf                 #          Boxplot
   2 2                    1             |
   1 560                  3             |
   1 14                   2             |
   0 58                   2          +-----+
   0 00133                5          |  +  |
  -0 42110                5          *-----*
  -0 8665                 4          +-----+
  -1 4                    1             |
  -1 875                  3             |
  -2 0                    1             |
     ----+----+----+----+
Multiply Stem.Leaf by 10**+4
```

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Univariate Procedure

Variable=TRAC Annualized cost

Normal Probability Plot

```
 22500+                                          ++*++
      |                                   *++*+
      |                              *+**++
  7500+                          ++*+
      |                    +*****
      |              ******
 -7500+          ***+
      |      ++**+
      |   +*++*
-22500+ ++*++
       +----+----+----+----+----+----+----+----+----+----+
           -2        -1         0        +1        +2
```

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OBS	_DEPVAR_	_TYPE_	_RADIUS_	UL	SU	_PRED_	_STDERR_
1	TRAC	MINIMUM	0.0	0.00000	0.00000	1967606.56	5396.59
2	TRAC	MINIMUM	0.1	0.04555	0.08903	1960741.31	5372.43
3	TRAC	MINIMUM	0.2	0.09651	0.17510	1954027.71	5301.45

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4	TRAC	MINIMUM	0.3	0.15372	0.25763	1949065.83	5187.95
5	TRAC	MINIMUM	0.4	0.21797	0.33539	1945767.29	5030.88
6	TRAC	MINIMUM	0.5	0.28987	0.40740	1942562.88	4864.19
7	TRAC	MINIMUM	0.6	0.36962	0.47263	1940194.15	4670.07
8	TRAC	MINIMUM	0.7	0.45693	0.53030	1938619.37	4501.63
9	TRAC	MINIMUM	0.8	0.55097	0.58083	1937794.07	4366.78
10	TRAC	MINIMUM	0.9	0.65052	0.62195	1937674.20	4318.96
11	TRAC	MINIMUM	1.0	0.75423	0.65661	1938210.66	4413.60

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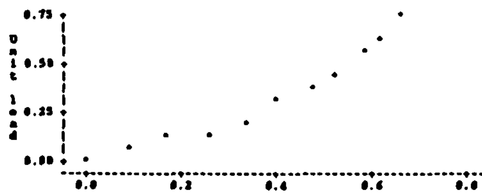
Plot of UL*SU. Symbol used is '*'.



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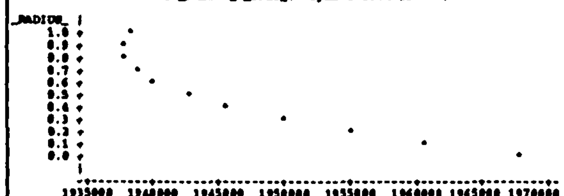
Plot of _RADIUS_*_PRED_. Symbol used is '*'.



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This results correspond to experiment (branch) 04:

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OBS	TR	QL	MA	ST	LT	UL	SU	TRAC
1	28	-1	-1	1	1	-1	-1	16516176
2	28	-1	-1	1	1	-1	-1	15898266
3	28	-1	-1	1	1	-1	-1	18299858
4	29	-1	-1	1	1	-1	0	1710487
5	29	-1	-1	1	1	-1	0	1717999
6	29	-1	-1	1	1	-1	0	1731748
7	30	-1	-1	1	1	-1	1	1728892
8	30	-1	-1	1	1	-1	1	1737824
9	30	-1	-1	1	1	-1	1	1742356
10	31	-1	-1	1	1	0	-1	15418559
11	31	-1	-1	1	1	0	-1	14978772
12	31	-1	-1	1	1	0	-1	16965880
13	32	-1	-1	1	1	0	0	1705920
14	32	-1	-1	1	1	0	0	1713093
15	32	-1	-1	1	1	0	0	1766288
16	33	-1	-1	1	1	0	1	1717426
17	33	-1	-1	1	1	0	1	1723928

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OBS	TR	QL	MA	ST	LT	UL	SU	TRAC
18	33	-1	-1	1	1	0	1	1770094
19	34	-1	-1	1	1	1	-1	15309713
20	34	-1	-1	1	1	1	-1	12120211
21	34	-1	-1	1	1	1	-1	17040900
22	35	-1	-1	1	1	1	0	1710769
23	35	-1	-1	1	1	1	0	1714351
24	35	-1	-1	1	1	1	0	1743740
25	36	-1	-1	1	1	1	1	1735392
26	36	-1	-1	1	1	1	1	1728257
27	36	-1	-1	1	1	1	1	1762618

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General Linear Models Procedure

Number of observations in data set = 27

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General Linear Models Procedure

Dependent Variable: TRAC   Annualized cost

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	1.1999E+15	2.3998E+14	266.95	0.0001
Error	21	1.8878E+13	8.9894E+11		
Corrected Total	26	1.2188E+15			

R-Square	C.V.	Root MSE	TRAC Mean
0.984511	14.73792	948126	6433242

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General Linear Models Procedure

Dependent Variable: TRAC   Annualized cost

Source	DF	Type I SS	Mean Square	F Value	Pr > F
UL	1	2.1422E+12	2.1422E+12	2.38	0.1376
SU	1	8.9478E+14	8.9478E+14	995.37	0.0001
UL*SU	1	3.2500E+12	3.2500E+12	3.62	0.0707
UL*UL	1	4.2249E+09	4.2249E+09	0.00	0.9460

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Source	DF	Type I SS	Mean Square	F Value	Pr > F
SU*SU	1	2.9969E+14	2.9969E+14	333.39	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
UL	1	2.1422E+12	2.1422E+12	2.38	0.1376
SU	1	8.9478E+14	8.9478E+14	995.37	0.0001
UL*SU	1	3.2500E+12	3.2500E+12	3.62	0.0707
UL*UL	1	4.2249E+09	4.2249E+09	0.00	0.9460

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General Linear Models Procedure

Dependent Variable: TRAC   Annualized cost

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SU*SU	1	2.9969E+14	2.9969E+14	333.39	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
pred. at sp	-161377.528	-0.07	0.9445	2298592.69

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT	1703908.889	4.18	0.0004	408088.5128

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General Linear Models Procedure

Dependent Variable: TRAC   Annualized cost

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
UL	-344988.389	-1.54	0.1376	223675.4661
SU	-7050538.889	-31.55	0.0001	223675.4661
UL*SU	521055.250	1.90	0.0707	273788.6318
UL*UL	26535.833	0.07	0.9460	387078.0616
SU*SU	7067463.333	18.26	0.0001	387078.0616

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
1	16516176.0000000	16714474.5833333	-198298.5833333
2	15898266.0000000	16714474.5833333	-816208.5833333
3	18299858.0000000	16714474.5833333	1585383.4166667
4	1710487.0000000	2075425.1111111	-364938.1111111
5	1717999.0000000	2075425.1111111	-357426.1111111
6	1731748.0000000	2075425.1111111	-343677.1111111
7	1728892.0000000	1571302.3055556	157589.6944444
8	1737824.0000000	1571302.3055556	166521.6944444
9	1742356.0000000	1571302.3055556	171053.6944444
10	15418559.0000000	15821903.1111111	-403344.1111111
11	14978772.0000000	15821903.1111111	-843131.1111111
12	16965880.0000000	15821903.1111111	1143976.8888889
13	1705920.0000000	1703908.8888889	2011.1111111
14	1713093.0000000	1703908.8888889	9184.1111111

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
15	1766288.0000000	1703908.8888889	62379.1111111
16	1717426.0000000	1720841.3333333	-3415.3333333
17	1723928.0000000	1720841.3333333	3086.6666667
18	1770094.0000000	1720841.3333333	49252.6666667
19	15309713.0000000	14982403.3055556	327309.6944444
20	12120211.0000000	14982403.3055556	-2862192.3055556

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   21      17040900.0000000    14902403.3055556     2066504.6944444
   22       1710769.0000000     1385464.3333333      325304.6666667
   23       1714351.0000000     1385464.3333333      328886.6666667
   24       1743740.0000000     1385464.3333333      358275.6666667
   25       1735392.0000000     1923452.0277778     -188060.0277778
   26       1728257.0000000     1923452.0277778     -195195.0277778
   27       1762618.0000000     1923452.0277778     -160834.0277778

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               General Linear Models Procedure

     Sum of Residuals                                       0.0000000
     Sum of Squared Residuals                10077805339979.6000000
     Sum of Squared Residuals - Error SS                    0.1640625
     First Order Autocorrelation                           -0.4202965
     Durbin-Watson D                                        2.0531357

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     Coding Coefficients for the Independent Variables

         Factor        Subtracted off      Divided by

         UL                         0        1.000000
         SU                         0        1.000000

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     Response Surface for Variable TRAC: Annualized cost

            Response Mean                 6433282
            Root MSE                       948126
            R-Square                       0.9845
            Coef. of Variation            14.7379

         Sum of Squared Residuals    1.0077805E13
         Predicted Resid SS (PRESS)  3.4226504E13

               Degrees
                  of        Type I Sum
Regression     Freedom    of Squares      R-Square    F-Ratio    Prob > F

Linear               2    9.9692195E14     0.7359      498.9     0.0000
Quadratic            2    2.9969845E14     0.2459      166.7     0.0000
Crossproduct         1    3.2579829E12     0.0027      3.624     0.0707

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               Degrees
                  of        Type I Sum
Regression     Freedom    of Squares      R-Square    F-Ratio    Prob > F

Total Regress        5    1.1990704E15     0.9845      267.0     0.0000

               Degrees
                  of        Sum of
Residual       Freedom     Squares       Mean Square    F-Ratio   Prob > F

Lack of Fit          3  1.0079341E12   362644606062     0.367    0.7777
Pure Error          18  1.7709871E13   908326102139
Total Error         21  1.0077805E13   0989431111305

                                                                   145
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                Degrees
                  of       Parameter    Standard    T for H0:
```

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Parameter          Freedom   Estimate        Error    Parameter=0 Prob > |T|

INTERCEPT              1       1703909      408009      4.176     0.0004
UL                     1       -344980      223475     -1.544     0.1376
SU                     1      -7050531      223475    -31.549     0.0000
UL*UL                  1         26536      387071      0.0686    0.9460
SU*UL                  1        521055      273700      1.904     0.0707
SU*SU                  1       7067463      387071     18.259     0.0000

                     Parameter
                     Estimate
                     from Coded
Parameter              Data

INTERCEPT             1703909
UL                    -344980
SU                   -7050531

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                     Parameter
                     Estimate
                     from Coded
Parameter              Data

UL*UL                   26536
SU*UL                  521055
SU*SU                 7067463

           Degrees
              of        Sum of
  Factor   Freedom     Squares      Mean Square F-Ratio Prob > F

  UL           3   5.4044162E12 1.8014714E12    2.004  0.1443  Unit load
  SU           3    1.197732E15 3.9924399E14    444.1  0.0000  Setups

                                                                   147
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               Canonical Analysis of Response Surface
                         (based on coded data)

                              Critical Value
        Factor             Coded           Uncoded

        UL              2.512310         2.512310     Unit load
        SU              0.406191         0.406191     Setups

          Predicted value at stationary point        -161371

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               Canonical Analysis of Response Surface
                         (based on coded data)

                                      Eigenvectors
             Eigenvalues          UL                 SU

               7077090         0.036926           0.999318
                 16909         0.999318          -0.036926

                    Stationary point is a minimum.

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  Estimated Ridge of Minimum Response for Variable TRAC: Annualized cost

   Coded      Estimated       Standard          Uncoded Factor Values
  Radius      Response          Error            UL              SU

    0.0        1703909         408009              0               0
    0.1        1060771         406107       0.005106        0.099865
    0.2         575132         400095       0.011366        0.199677
```

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0.3	222930	392673	0.020028	0.299331
0.4	11053	382460	0.030456	0.390147
0.5	-65077	370276	0.150976	0.474053
0.6	-82737	353043	0.362257	0.470299
0.7	-93603	340033	0.513921	0.475274
0.8	-102327	333206	0.646194	0.471620
0.9	-109055	330134	0.760035	0.467060
1.0	-116546	350462	0.805000	0.464067

%%

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OBS	OL	SU	_TYPE_	TRAC
1	-1	-1	RESIDUAL	-198290.50
2	-1	-1	RESIDUAL	-816208.50
3	-1	-1	RESIDUAL	1505303.42
4	-1	0	RESIDUAL	-364930.11
5	-1	0	RESIDUAL	-357626.11
6	-1	0	RESIDUAL	-343677.11
7	-1	1	RESIDUAL	157509.69
8	-1	1	RESIDUAL	166521.69
9	-1	1	RESIDUAL	171053.69
10	0	-1	RESIDUAL	-603344.11
11	0	-1	RESIDUAL	-843131.11
12	0	-1	RESIDUAL	1143976.89
13	0	0	RESIDUAL	2011.11
14	0	0	RESIDUAL	9184.11
15	0	0	RESIDUAL	42379.11
16	0	1	RESIDUAL	-3615.33
17	0	1	RESIDUAL	3086.67

%%

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OBS	OL	SU	_TYPE_	TRAC
18	0	1	RESIDUAL	49252.67
19	1	-1	RESIDUAL	327309.69
20	1	-1	RESIDUAL	-2062192.31
21	1	-1	RESIDUAL	2066504.69
22	1	0	RESIDUAL	325306.67
23	1	0	RESIDUAL	328006.67
24	1	0	RESIDUAL	350275.67
25	1	1	RESIDUAL	-188060.03
26	1	1	RESIDUAL	-195195.03
27	1	1	RESIDUAL	-169034.03

%%

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Univariate Procedure

Variable=TRAC Annualized cost

Moments

N	27	Sum Wgts	27
Mean	0	Sum	0
Std Dev	852097.1	Variance	7.261E11
Skewness	-0.69461	Kurtosis	5.303343
USS	1.888E13	CSS	1.888E13
CV	.	Std Mean	163986.2
T:Mean=0	0	Pr>|T|	1.0000
Num ^= 0	27	Num > 0	15
M(Sign)	1.5	Pr>=|M|	0.7011
Sgn Rank	-6	Pr>=|S|	0.8886
W:Normal	0.840449	Pr<W	0.0005

%%

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Univariate Procedure

Variable=TRAC Annualized cost

Quantiles(Def=5)

100% Max	2066505	99%	2066505
75% Q3	325306.7	95%	1505303
50% Med	3086.667	90%	1143977
25% Q1	-343677	10%	-816209

0% Min	-2062192	5%	-843131
		1%	-2062192
Range	4928697		
Q3-Q1	668983.8		
Mode	-2062192		

%%

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Univariate Procedure

Variable=TRAC Annualized cost

Extremes

Lowest	Obs	Highest	Obs
-2062192(	20)	328006.7(	23)
-843131(	11)	350275.7(	24)
-816209(	2)	1143977(	12)
-603344(	10)	1505303(	3)
-364930(	4)	2066505(	21)

%%

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Univariate Procedure

Variable=TRAC Annualized cost

```
Stem Leaf                  #        Boxplot
   2 1                     1           0
   1 6                     1           0
   1 1                     1           |
   0                                   |
   0 000002223334         12        +--+--+
  -0 866322220             9        +-----+
  -0 88                    2           |
  -1
  -1
  -2
  -2 9                     1           *
     ----+----+----+----+
Multiply Stem.Leaf by 10**+6
```

%%

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Univariate Procedure

Variable=TRAC Annualized cost

Normal Probability Plot

```
 2250000+                                                  *   ++
        |                                              * ++++++
        |                                          +*++++
        |                                     ++++++
        |                           ********** **
 -250000+               ** *******+
        |          *  * ++++++
        |        ++++++
        |   ++++++
        |++
-2750000+    *
         +----+----+----+----+----+----+----+----+----+----+
             -2        -1         0        +1        +2
```

%%

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OBS	_DEPVAR_	_TYPE_	_RADIUS_	OL	SU	_PRED_	_STDERR_
1	TRAC	MINIMUM	0.0	0.00000	0.00000	1703900.09	608008.51
2	TRAC	MINIMUM	0.1	0.00519	0.09987	1060770.62	606186.69
3	TRAC	MINIMUM	0.2	0.01137	0.19960	575132.08	608896.69
4	TRAC	MINIMUM	0.3	0.02003	0.29933	222930.31	392673.27
5	TRAC	MINIMUM	0.4	0.03046	0.39015	11053.21	382460.22
6	TRAC	MINIMUM	0.5	0.15098	0.47405	-65076.67	370273.63
7	TRAC	MINIMUM	0.6	0.36226	0.47030	-82737.36	353062.67

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8	TRAC	MINIMUM	0.7	0.51392	0.47527	-93603.21	360032.02
9	TRAC	MINIMUM	0.8	0.66619	0.47163	-102327.37	333203.53
10	TRAC	MINIMUM	0.9	0.76003	0.46786	-109854.55	330134.06
11	TRAC	MINIMUM	1.0	0.88500	0.46407	-116545.03	350462.40

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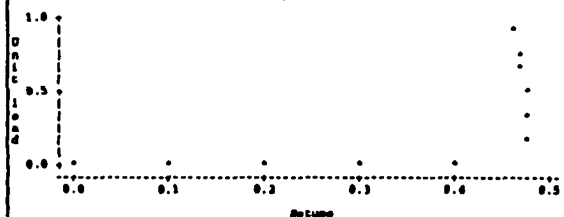
Plot of UL*SU. Symbol used is '*'.



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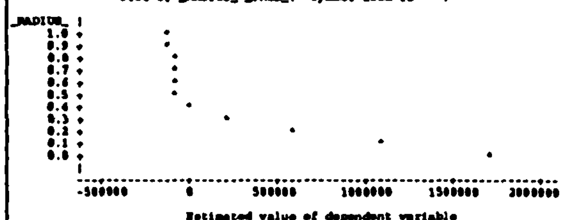
09:25 Saturday, October 5, 1996

Plot of _RADIUS_*_PRED_. Symbol used is '*'.



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APPENDIX E SAS OUTPUT FOR TRANSFORMATIONS AT EXPERIMENTS 2 AND 4.

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This results correspond to the natural logarithm at experiment (branch) 02:

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OBS	TR	QL	MA	ST	LT	UL	SU	TRAC
1	10	-1	-1	-1	1	-1	-1	17.0809
2	10	-1	-1	-1	1	-1	-1	17.0900
3	10	-1	-1	-1	1	-1	-1	17.1017
4	11	-1	-1	-1	1	-1	0	14.3395
5	11	-1	-1	-1	1	-1	0	14.3517
6	11	-1	-1	-1	1	-1	0	14.3737
7	12	-1	-1	-1	1	-1	1	14.3665
8	12	-1	-1	-1	1	-1	1	14.3506
9	12	-1	-1	-1	1	-1	1	14.3667
10	13	-1	-1	-1	1	0	-1	17.0841
11	13	-1	-1	-1	1	0	-1	17.0886
12	13	-1	-1	-1	1	0	-1	17.1176
13	14	-1	-1	-1	1	0	0	14.3497
14	14	-1	-1	-1	1	0	0	14.3506
15	14	-1	-1	-1	1	0	0	14.3703
16	15	-1	-1	-1	1	0	1	14.3506
17	15	-1	-1	-1	1	0	1	14.3569

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OBS	TR	QL	MA	ST	LT	UL	SU	TRAC
18	15	-1	-1	-1	1	0.0000	1.00	14.3787
19	16	-1	-1	-1	1	1.0000	-1.00	17.1105
20	16	-1	-1	-1	1	1.0000	-1.00	17.0950
21	16	-1	-1	-1	1	1.0000	-1.00	17.1252
22	17	-1	-1	-1	1	1.0000	0.00	14.3552
23	17	-1	-1	-1	1	1.0000	0.00	14.3550
24	17	-1	-1	-1	1	1.0000	0.00	14.3726
25	18	-1	-1	-1	1	1.0000	1.00	14.3630
26	18	-1	-1	-1	1	1.0000	1.00	14.3695
27	18	-1	-1	-1	1	1.0000	1.00	14.3807
28	37	-1	-1	-1	1	-0.5710	0.50	14.3689
29	37	-1	-1	-1	1	-0.5710	0.50	14.3672
30	37	-1	-1	-1	1	-0.5710	0.50	14.3800
31	37	-1	-1	-1	1	-0.5710	0.50	14.3772
32	37	-1	-1	-1	1	-0.5710	0.50	14.3609
33	38	-1	-1	-1	1	0.0000	0.25	14.3522
34	38	-1	-1	-1	1	0.0000	0.25	14.3642

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OBS	TR	QL	MA	ST	LT	UL	SU	TRAC
35	38	-1	-1	-1	1	0	0.25	14.3821
36	38	-1	-1	-1	1	0	0.75	14.3649
37	38	-1	-1	-1	1	0	0.75	14.3629
38	38	-1	-1	-1	1	0	0.75	14.3570
39	39	-1	-1	-1	1	0	0.50	14.3650
40	39	-1	-1	-1	1	0	0.50	14.3650
41	39	-1	-1	-1	1	0	0.50	14.3841

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General Linear Models Procedure

Number of observations in data set = 41

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General Linear Models Procedure

Dependent Variable: TRAC   Annualized cost

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	52.5053840	5.8339316	11263.18	0.0001
Error	31	0.0160855	0.0005189		
Corrected Total	40	52.5214695			

R-Square	C.V.	Root MSE	TRAC Mean
0.999694	0.152214	0.02278	14.9652

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General Linear Models Procedure

Dependent Variable: TRAC   Annualized cost

Source	DF	Type I SS	Mean Square	F Value	Pr > F
UL	1	0.1660274	0.1660274	321.51	0.0001
SU	1	39.0796216	39.0796216	76056.16	0.0001
UL*SU	1	0.0017320	0.0017320	3.34	0.0773
UL*UL	1	0.1337033	0.1337033	257.67	0.0001
SU*SU	1	11.7964084	11.7964084	22734.00	0.0001
UL*UL*UL	1	0.1900606	0.1900606	367.04	0.0001
SU*SU*SU	1	0.3358056	0.3358056	647.17	0.0001
UL*UL*SU	1	0.0003467	0.0003467	0.67	0.4199
UL*SU*SU	1	0.0000706	0.0000706	0.14	0.7140

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General Linear Models Procedure

Dependent Variable: TRAC   Annualized cost

Source	DF	Type III SS	Mean Square	F Value	Pr > F
UL	1	0.0001650	0.0001650	0.32	0.5759
SU	1	0.0900200	0.0900200	173.50	0.0001
UL*SU	1	0.0000678	0.0000678	0.13	0.7202
UL*UL	1	0.0000005	0.0000005	0.00	0.9751
SU*SU	1	12.1292011	12.1292011	23375.60	0.0001
UL*UL*UL	1	0.0002025	0.0002025	0.39	0.5367
SU*SU*SU	1	0.3054635	0.3054635	588.65	0.0001
UL*UL*SU	1	0.0003467	0.0003467	0.67	0.4199
UL*SU*SU	1	0.0000706	0.0000706	0.14	0.7140

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General Linear Models Procedure

Dependent Variable: TRAC   Annualized cost

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
pred. at op	14.3150110	795.62	0.0001	0.01799221
pred. at op	14.3160856	774.65	0.0001	0.01840527
pred. at op	14.3161780	959.04	0.0001	0.01492759

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT	14.36710311	1533.09	0.0001	0.00937137
UL	-0.02140514	-0.57	0.5759	0.03786409
SU	-0.46047751	-13.17	0.0001	0.03495874

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General Linear Models Procedure

Dependent Variable: TRAC   Annualized cost

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
UL*SU	-0.00237667	-0.36	0.7202	0.00657375
UL*UL	0.00020916	0.03	0.9751	0.00920206
SU*SU	1.36250826	152.89	0.0001	0.00891166
UL*UL*UL	0.02451514	0.62	0.5367	0.03924215
SU*SU*SU	-0.91459817	-24.26	0.0001	0.03769617
UL*UL*SU	0.00920260	0.82	0.4199	0.01125012
UL*SU*SU	0.00420000	0.37	0.7140	0.01130954

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual

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1	17.08085000	17.08615886	-0.00530886
2	17.08999000	17.08615886	0.00383114
3	17.10172000	17.08615886	0.01556114
4	14.33952000	14.36436227	-0.02484227
5	14.35174000	14.36436227	-0.01262227
6	14.37366000	14.36436227	0.00929773
7	14.36647000	14.35918220	0.00728780
8	14.35844000	14.35918220	-0.00074220
9	14.36672000	14.35918220	0.00753780
10	17.08414000	17.10475905	-0.02061905
11	17.08835000	17.10475905	-0.01640905
12	17.11756000	17.10475905	0.01280095
13	14.34969000	14.36718311	-0.01749311
14	14.35035000	14.36718311	-0.01683311

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
15	14.37025000	14.36718311	0.00306689
16	14.35835000	14.35462369	0.00372631
17	14.35691000	14.35462369	0.00228631
18	14.37074000	14.35462369	0.01611631
19	17.11049000	17.10553220	0.00495780
20	17.09498000	17.10553220	-0.01055220
21	17.12521000	17.10553220	0.01967780
22	14.35510000	14.37050227	-0.01540227
23	14.35579000	14.37050227	-0.01471227
24	14.37261000	14.37050227	0.00210773
25	14.36301000	14.36904886	-0.00603886
26	14.36949000	14.36904886	0.00044114
27	14.38873000	14.36904886	0.01968114
28	14.36886000	14.37258200	-0.00372200

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
29	14.36724000	14.37258200	-0.00534200
30	14.38076000	14.37258200	0.00817800
31	14.37715000	14.37258200	0.00456800
32	14.36898000	14.37258200	-0.00360200
33	14.35222000	14.32293003	0.02928997
34	14.36419000	14.32293003	0.04125997
35	14.38213000	14.32293003	0.05919997
36	14.36489000	14.40239315	-0.03750315
37	14.36291000	14.40239315	-0.03948315
38	14.35699000	14.40239315	-0.04540315
39	14.36584000	14.36324765	0.00259235
40	14.36579000	14.36324765	0.00254235
41	14.38411000	14.36324765	0.02086235

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General Linear Models Procedure

Sum of Residuals	0.00000000
Sum of Squared Residuals	0.01608540
Sum of Squared Residuals - Error SS	-0.00000000
First Order Autocorrelation	0.25641645
Durbin-Watson D	1.45035716

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```
        Plot of PREDICT*RESIDUAL.  Symbol used is '*'.
      (NOTE: 13 obs hidden.)
 17 +                     * *  * *    *   * * *
    |
    |
    |
 16 +
    |
```

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```
PREDICT |
        |
     15 +
        |
        |         *  **
        |                    *  ****  ** *** **  * *    *     *      *
        |
     14 +
        ---+---------+---------+---------+---------+---------+---------+--
         -0.06     -0.04     -0.02      0.00      0.02      0.04      0.06

                                  RESIDUAL
```

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Univariate Procedure

Variable=RESIDUAL

Moments

N	41	Sum Wgts	41
Mean	0	Sum	0
Std Dev	0.020053	Variance	0.000402
Skewness	0.269065	Kurtosis	1.465602
USS	0.016085	CSS	0.016085
CV	.	Std Mean	0.003132
T:Mean=0	0	Pr>|T|	1.0000
Num ^= 0	41	Num > 0	23
M(Sign)	2.5	Pr>=|M|	0.5327
Sgn Rank	6.5	Pr>=|S|	0.9544
W:Normal	0.960417	Pr<W	0.4163

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Univariate Procedure

Variable=RESIDUAL

Quantiles(Def=5)

100% Max	0.0592	99%	0.0592
75% Q3	0.008170	95%	0.02929
50% Med	0.002206	90%	0.019681
25% Q1	-0.01262	10%	-0.02062
0% Min	-0.0454	5%	-0.0375
		1%	-0.0454
Range	0.104683		
Q3-Q1	0.0208		
Mode	-0.0454		

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Univariate Procedure

Variable=RESIDUAL

Extremes

Lowest	Obs	Highest	Obs
-0.0454(	38)	0.019681(	27)
-0.03948(	37)	0.020862(	41)
-0.0375(	36)	0.02929(	33)
-0.02484(	4)	0.04126(	34)
-0.02062(	10)	0.0592(	35)

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Univariate Procedure

Variable=RESIDUAL

```
   Stem Leaf                    #             Boxplot
      5 9                       1                0
      4 1                       1                0
      3
      2 0019                    4                |
      1 366                     3                |
      0 02233344557889         14             +-----+
```


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```
   -0 655441                6          |     |
   -1 7765531               7          +-----+
   -2 51                    2             |
   -3 98                    2             |
   -4 5                     1             0
      ----+----+----+----+
  Multiply Stem.Leaf by 10**-2
```

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Univariate Procedure

Variable=RESIDUAL

```
                    Normal Probability Plot
  0.055+                                                      *  +
       |                                              *  +++++
       |                                         +++++
       |                                   ++++**
       |                              +++*****
  0.005+                        *********
       |                   ****+
       |             ******+
       |         *+*++
       |    +*++*
 -0.045+ ++*++
        +----+----+----+----+----+----+----+----+----+----+
            -2        -1         0        +1        +2
```

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OBS	B0	B1	B2	B3	B4	B5
1	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
2	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
3	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
4	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
5	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
6	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
7	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
1	0.024515	-0.91459	.0092027	.0042	-1	-1.00000	17.0062
2	0.024515	-0.91459	.0092027	.0042	-1	-0.90000	16.5353
3	0.024515	-0.91459	.0092027	.0042	-1	-0.80000	16.0611
4	0.024515	-0.91459	.0092027	.0042	-1	-0.70000	15.6579
5	0.024515	-0.91459	.0092027	.0042	-1	-0.60000	15.3202
6	0.024515	-0.91459	.0092027	.0042	-1	-0.50000	15.0427
7	0.024515	-0.91459	.0092027	.0042	-1	-0.40000	14.8190

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OBS	B0	B1	B2	B3	B4	B5
8	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
9	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
10	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
11	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
12	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
13	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
14	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
8	0.024515	-0.91459	.0092027	.0042	-1.0	-0.30000	14.6460
9	0.024515	-0.91459	.0092027	.0042	-1.0	-0.20000	14.5150
10	0.024515	-0.91459	.0092027	.0042	-1.0	-0.10000	14.4237
11	0.024515	-0.91459	.0092027	.0042	-1.0	-0.00000	14.3644
12	0.024515	-0.91459	.0092027	.0042	-1.0	0.10000	14.3321
13	0.024515	-0.91459	.0092027	.0042	-1.0	0.20000	14.3216
14	0.024515	-0.91459	.0092027	.0042	-1.0	0.30000	14.3272

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OBS	B0	B1	B2	B3	B4	B5
15	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
16	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
17	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
18	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
19	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

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OBS	B0	B1	B2	B3	B4	B5
20	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
21	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
15	0.024515	-0.91459	.0092027	.0042	-1.0	0.4	14.3436
16	0.024515	-0.91459	.0092027	.0042	-1.0	0.5	14.3652
17	0.024515	-0.91459	.0092027	.0042	-1.0	0.6	14.3865
18	0.024515	-0.91459	.0092027	.0042	-1.0	0.7	14.4020
19	0.024515	-0.91459	.0092027	.0042	-1.0	0.8	14.4063
20	0.024515	-0.91459	.0092027	.0042	-1.0	0.9	14.3930
21	0.024515	-0.91459	.0092027	.0042	-1.0	1.0	14.3592

21:02 Monday, October 7, 1996 23

OBS	B0	B1	B2	B3	B4	B5
22	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
23	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
24	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
25	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
26	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
27	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
28	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
22	0.024515	-0.91459	.0092027	.0042	-0.9	-1.00000	17.0930
23	0.024515	-0.91459	.0092027	.0042	-0.9	-0.90000	16.5619
24	0.024515	-0.91459	.0092027	.0042	-0.9	-0.80000	16.0674
25	0.024515	-0.91459	.0092027	.0042	-0.9	-0.70000	15.6639
26	0.024515	-0.91459	.0092027	.0042	-0.9	-0.60000	15.3268
27	0.024515	-0.91459	.0092027	.0042	-0.9	-0.50000	15.0483
28	0.024515	-0.91459	.0092027	.0042	-0.9	-0.40000	14.8251

21:02 Monday, October 7, 1996 24

OBS	B0	B1	B2	B3	B4	B5
29	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
30	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
31	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
32	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
33	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
34	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
35	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
29	0.024515	-0.91459	.0092027	.0042	-0.9	-0.30000	14.6511
30	0.024515	-0.91459	.0092027	.0042	-0.9	-0.20000	14.5207
31	0.024515	-0.91459	.0092027	.0042	-0.9	-0.10000	14.4284
32	0.024515	-0.91459	.0092027	.0042	-0.9	-0.00000	14.3688
33	0.024515	-0.91459	.0092027	.0042	-0.9	0.10000	14.3364
34	0.024515	-0.91459	.0092027	.0042	-0.9	0.20000	14.3257
35	0.024515	-0.91459	.0092027	.0042	-0.9	0.30000	14.3311

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OBS	B0	B1	B2	B3	B4	B5
36	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
37	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
38	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
39	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
40	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
41	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
42	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
36	0.024515	-0.91459	.0092027	.0042	-0.9	0.4	14.3473
37	0.024515	-0.91459	.0092027	.0042	-0.9	0.5	14.3687
38	0.024515	-0.91459	.0092027	.0042	-0.9	0.6	14.3899
39	0.024515	-0.91459	.0092027	.0042	-0.9	0.7	14.4053
40	0.024515	-0.91459	.0092027	.0042	-0.9	0.8	14.4094
41	0.024515	-0.91459	.0092027	.0042	-0.9	0.9	14.3960
42	0.024515	-0.91459	.0092027	.0042	-0.9	1.0	14.3621

21:02 Monday, October 7, 1996 26

OBS	B0	B1	B2	B3	B4	B5
43	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

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OBS	B0	B1	B2	B3	B4	B5
44	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
45	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
46	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
47	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
48	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
49	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
43	0.024515	-0.91459	.0092027	.0042	-0.8	-1.00000	17.0904
44	0.024515	-0.91459	.0092027	.0042	-0.8	-0.90000	16.5470
45	0.024515	-0.91459	.0092027	.0042	-0.8	-0.80000	16.0722
46	0.024515	-0.91459	.0092027	.0042	-0.8	-0.70000	15.6605
47	0.024515	-0.91459	.0092027	.0042	-0.8	-0.60000	15.3306
48	0.024515	-0.91459	.0092027	.0042	-0.8	-0.50000	15.0524
49	0.024515	-0.91459	.0092027	.0042	-0.8	-0.40000	14.8290

21:02 Monday, October 7, 1996 27

OBS	B0	B1	B2	B3	B4	B5
50	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
51	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
52	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
53	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
54	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
55	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
56	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
50	0.024515	-0.91459	.0092027	.0042	-0.8	-0.30000	14.6540
51	0.024515	-0.91459	.0092027	.0042	-0.8	-0.20000	14.5242
52	0.024515	-0.91459	.0092027	.0042	-0.8	-0.10000	14.4317
53	0.024515	-0.91459	.0092027	.0042	-0.8	-0.00000	14.3719
54	0.024515	-0.91459	.0092027	.0042	-0.8	0.10000	14.3393
55	0.024515	-0.91459	.0092027	.0042	-0.8	0.20000	14.3205
56	0.024515	-0.91459	.0092027	.0042	-0.8	0.30000	14.3330

21:02 Monday, October 7, 1996 28

OBS	B0	B1	B2	B3	B4	B5
57	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
58	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
59	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
60	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
61	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
62	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
63	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
57	0.024515	-0.91459	.0092027	.0042	-0.8	0.4	14.3490
58	0.024515	-0.91459	.0092027	.0042	-0.8	0.5	14.3711
59	0.024515	-0.91459	.0092027	.0042	-0.8	0.6	14.3921
60	0.024515	-0.91459	.0092027	.0042	-0.8	0.7	14.4073
61	0.024515	-0.91459	.0092027	.0042	-0.8	0.8	14.4114
62	0.024515	-0.91459	.0092027	.0042	-0.8	0.9	14.3987
63	0.024515	-0.91459	.0092027	.0042	-0.8	1.0	14.3630

21:02 Monday, October 7, 1996 29

OBS	B0	B1	B2	B3	B4	B5
64	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
65	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
66	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
67	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
68	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
69	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
70	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
64	0.024515	-0.91459	.0092027	.0042	-0.7	-1.00000	17.1024
65	0.024515	-0.91459	.0092027	.0042	-0.7	-0.90000	16.5500
66	0.024515	-0.91459	.0092027	.0042	-0.7	-0.80000	16.0757
67	0.024515	-0.91459	.0092027	.0042	-0.7	-0.70000	15.6710
68	0.024515	-0.91459	.0092027	.0042	-0.7	-0.60000	15.3335
69	0.024515	-0.91459	.0092027	.0042	-0.7	-0.50000	15.0553
70	0.024515	-0.91459	.0092027	.0042	-0.7	-0.40000	14.8317

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OBS	B0	B1	B2	B3	B4	B5
71	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
72	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
73	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
74	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
75	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
76	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
77	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
71	0.024515	-0.91459	.0092027	.0042	-0.7	-0.30000	14.6572
72	0.024515	-0.91459	.0092027	.0042	-0.7	-0.20000	14.5265
73	0.024515	-0.91459	.0092027	.0042	-0.7	-0.10000	14.4330
74	0.024515	-0.91459	.0092027	.0042	-0.7	-0.00000	14.3739
75	0.024515	-0.91459	.0092027	.0042	-0.7	0.10000	14.3412
76	0.024515	-0.91459	.0092027	.0042	-0.7	0.20000	14.3301
77	0.024515	-0.91459	.0092027	.0042	-0.7	0.30000	14.3353

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OBS	B0	B1	B2	B3	B4	B5
78	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
79	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
80	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
81	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
82	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
83	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
84	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
78	0.024515	-0.91459	.0092027	.0042	-0.7	0.4	14.3512
79	0.024515	-0.91459	.0092027	.0042	-0.7	0.5	14.3723
80	0.024515	-0.91459	.0092027	.0042	-0.7	0.6	14.3932
81	0.024515	-0.91459	.0092027	.0042	-0.7	0.7	14.4084
82	0.024515	-0.91459	.0092027	.0042	-0.7	0.8	14.4123
83	0.024515	-0.91459	.0092027	.0042	-0.7	0.9	14.3995
84	0.024515	-0.91459	.0092027	.0042	-0.7	1.0	14.3646

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OBS	B0	B1	B2	B3	B4	B5
85	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
86	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
87	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
88	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
89	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
90	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
91	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
85	0.024515	-0.91459	.0092027	.0042	-0.6	-1.00000	17.1052
86	0.024515	-0.91459	.0092027	.0042	-0.6	-0.90000	16.5533
87	0.024515	-0.91459	.0092027	.0042	-0.6	-0.80000	16.0781
88	0.024515	-0.91459	.0092027	.0042	-0.6	-0.70000	15.6740
89	0.024515	-0.91459	.0092027	.0042	-0.6	-0.60000	15.3354
90	0.024515	-0.91459	.0092027	.0042	-0.6	-0.50000	15.0570
91	0.024515	-0.91459	.0092027	.0042	-0.6	-0.40000	14.8333

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OBS	B0	B1	B2	B3	B4	B5
92	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
93	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
94	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
95	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
96	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
97	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
98	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
92	0.024515	-0.91459	.0092027	.0042	-0.6	-0.30000	14.6586
93	0.024515	-0.91459	.0092027	.0042	-0.6	-0.20000	14.5277
94	0.024515	-0.91459	.0092027	.0042	-0.6	-0.10000	14.4349
95	0.024515	-0.91459	.0092027	.0042	-0.6	-0.00000	14.3740
96	0.024515	-0.91459	.0092027	.0042	-0.6	0.10000	14.3419
97	0.024515	-0.91459	.0092027	.0042	-0.6	0.20000	14.3300
98	0.024515	-0.91459	.0092027	.0042	-0.6	0.30000	14.3350

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OBS	B0	B1	B2	B3	B4	B5
99	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
100	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
101	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
102	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
103	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
104	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
105	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
99	0.024515	-0.91459	.0092027	.0042	-0.6	0.4	14.3516
100	0.024515	-0.91459	.0092027	.0042	-0.6	0.5	14.3726
101	0.024515	-0.91459	.0092027	.0042	-0.6	0.6	14.3934
102	0.024515	-0.91459	.0092027	.0042	-0.6	0.7	14.4085
103	0.024515	-0.91459	.0092027	.0042	-0.6	0.8	14.4124
104	0.024515	-0.91459	.0092027	.0042	-0.6	0.9	14.3995
105	0.024515	-0.91459	.0092027	.0042	-0.6	1.0	14.3645

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OBS	B0	B1	B2	B3	B4	B5
106	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
107	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
108	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
109	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
110	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
111	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
112	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
106	0.024515	-0.91459	.0092027	.0042	-0.5	-1.00000	17.1069
107	0.024515	-0.91459	.0092027	.0042	-0.5	-0.90000	16.5549
108	0.024515	-0.91459	.0092027	.0042	-0.5	-0.80000	16.0794
109	0.024515	-0.91459	.0092027	.0042	-0.5	-0.70000	15.6751
110	0.024515	-0.91459	.0092027	.0042	-0.5	-0.60000	15.3364
111	0.024515	-0.91459	.0092027	.0042	-0.5	-0.50000	15.0578
112	0.024515	-0.91459	.0092027	.0042	-0.5	-0.40000	14.8339

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OBS	B0	B1	B2	B3	B4	B5
113	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
114	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
115	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
116	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
117	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
118	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
119	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
113	0.024515	-0.91459	.0092027	.0042	-0.5	-0.30000	14.6591
114	0.024515	-0.91459	.0092027	.0042	-0.5	-0.20000	14.5280
115	0.024515	-0.91459	.0092027	.0042	-0.5	-0.10000	14.4351
116	0.024515	-0.91459	.0092027	.0042	-0.5	-0.00000	14.3749
117	0.024515	-0.91459	.0092027	.0042	-0.5	0.10000	14.3419
118	0.024515	-0.91459	.0092027	.0042	-0.5	0.20000	14.3306
119	0.024515	-0.91459	.0092027	.0042	-0.5	0.30000	14.3355

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OBS	B0	B1	B2	B3	B4	B5
120	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
121	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
122	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
123	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
124	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
125	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
126	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
120	0.024515	-0.91459	.0092027	.0042	-0.5	0.4	14.3512
121	0.024515	-0.91459	.0092027	.0042	-0.5	0.5	14.3722
122	0.024515	-0.91459	.0092027	.0042	-0.5	0.6	14.3929

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OBS	B6	B7	B8	B9	UL	SU	PREDICT
123	0.024515	-0.91459	.0092027	.0042	-0.5	0.7	14.4079
124	0.024515	-0.91459	.0092027	.0042	-0.5	0.8	14.4117
125	0.024515	-0.91459	.0092027	.0042	-0.5	0.9	14.3988
126	0.024515	-0.91459	.0092027	.0042	-0.5	1.0	14.3637

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OBS	B0	B1	B2	B3	B4	B5
127	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
128	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
129	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
130	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
131	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
132	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
133	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
127	0.024515	-0.91459	.0092027	.0042	-0.4	-1.00000	17.1077
128	0.024515	-0.91459	.0092027	.0042	-0.4	-0.90000	16.5555
129	0.024515	-0.91459	.0092027	.0042	-0.4	-0.80000	16.0799
130	0.024515	-0.91459	.0092027	.0042	-0.4	-0.70000	15.6754
131	0.024515	-0.91459	.0092027	.0042	-0.4	-0.60000	15.3365
132	0.024515	-0.91459	.0092027	.0042	-0.4	-0.50000	15.0578
133	0.024515	-0.91459	.0092027	.0042	-0.4	-0.40000	14.8337

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OBS	B0	B1	B2	B3	B4	B5
134	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
135	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
136	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
137	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
138	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
139	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
140	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
134	0.024515	-0.91459	.0092027	.0042	-0.4	-0.30000	14.6580
135	0.024515	-0.91459	.0092027	.0042	-0.4	-0.20000	14.5276
136	0.024515	-0.91459	.0092027	.0042	-0.4	-0.10000	14.4346
137	0.024515	-0.91459	.0092027	.0042	-0.4	-0.00000	14.3742
138	0.024515	-0.91459	.0092027	.0042	-0.4	0.10000	14.3411
139	0.024515	-0.91459	.0092027	.0042	-0.4	0.20000	14.3297
140	0.024515	-0.91459	.0092027	.0042	-0.4	0.30000	14.3346

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OBS	B0	B1	B2	B3	B4	B5
141	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
142	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
143	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
144	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
145	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
146	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
147	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
141	0.024515	-0.91459	.0092027	.0042	-0.4	0.4	14.3502
142	0.024515	-0.91459	.0092027	.0042	-0.4	0.5	14.3711
143	0.024515	-0.91459	.0092027	.0042	-0.4	0.6	14.3917
144	0.024515	-0.91459	.0092027	.0042	-0.4	0.7	14.4067
145	0.024515	-0.91459	.0092027	.0042	-0.4	0.8	14.4106
146	0.024515	-0.91459	.0092027	.0042	-0.4	0.9	14.3975
147	0.024515	-0.91459	.0092027	.0042	-0.4	1.0	14.3624

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OBS	B0	B1	B2	B3	B4	B5
148	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
149	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
150	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
151	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
152	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
153	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
154	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT

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148	0.024515	-0.91459	.0092027	.0042	-0.3	-1.00000	17.1077
149	0.024515	-0.91459	.0092027	.0042	-0.3	-0.90000	16.5554
150	0.024515	-0.91459	.0092027	.0042	-0.3	-0.80000	16.0796
151	0.024515	-0.91459	.0092027	.0042	-0.3	-0.70000	15.6749
152	0.024515	-0.91459	.0092027	.0042	-0.3	-0.60000	15.3359
153	0.024515	-0.91459	.0092027	.0042	-0.3	-0.50000	15.0571
154	0.024515	-0.91459	.0092027	.0042	-0.3	-0.40000	14.8329

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OBS	B0	B1	B2	B3	B4	B5
155	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
156	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
157	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
158	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
159	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
160	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
161	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
155	0.024515	-0.91459	.0092027	.0042	-0.3	-0.30000	14.6579
156	0.024515	-0.91459	.0092027	.0042	-0.3	-0.20000	14.5265
157	0.024515	-0.91459	.0092027	.0042	-0.3	-0.10000	14.4334
158	0.024515	-0.91459	.0092027	.0042	-0.3	-0.00000	14.3730
159	0.024515	-0.91459	.0092027	.0042	-0.3	0.10000	14.3398
160	0.024515	-0.91459	.0092027	.0042	-0.3	0.20000	14.3283
161	0.024515	-0.91459	.0092027	.0042	-0.3	0.30000	14.3331

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OBS	B0	B1	B2	B3	B4	B5
162	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
163	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
164	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
165	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
166	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
167	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
168	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
162	0.024515	-0.91459	.0092027	.0042	-0.3	0.4	14.3487
163	0.024515	-0.91459	.0092027	.0042	-0.3	0.5	14.3695
164	0.024515	-0.91459	.0092027	.0042	-0.3	0.6	14.3901
165	0.024515	-0.91459	.0092027	.0042	-0.3	0.7	14.4050
166	0.024515	-0.91459	.0092027	.0042	-0.3	0.8	14.4087
167	0.024515	-0.91459	.0092027	.0042	-0.3	0.9	14.3950
168	0.024515	-0.91459	.0092027	.0042	-0.3	1.0	14.3607

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OBS	B0	B1	B2	B3	B4	B5
169	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
170	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
171	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
172	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
173	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
174	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
175	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
169	0.024515	-0.91459	.0092027	.0042	-0.2	-1.00000	17.1072
170	0.024515	-0.91459	.0092027	.0042	-0.2	-0.90000	16.5546
171	0.024515	-0.91459	.0092027	.0042	-0.2	-0.80000	16.0787
172	0.024515	-0.91459	.0092027	.0042	-0.2	-0.70000	15.6739
173	0.024515	-0.91459	.0092027	.0042	-0.2	-0.60000	15.3348
174	0.024515	-0.91459	.0092027	.0042	-0.2	-0.50000	15.0558
175	0.024515	-0.91459	.0092027	.0042	-0.2	-0.40000	14.8315

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OBS	B0	B1	B2	B3	B4	B5
176	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
177	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
178	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
179	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
180	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

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181	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
182	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
176	0.024515	-0.91459	.0092027	.0042	-0.2	-0.30000	14.6564
177	0.024515	-0.91459	.0092027	.0042	-0.2	-0.20000	14.5250
178	0.024515	-0.91459	.0092027	.0042	-0.2	-0.10000	14.4318
179	0.024515	-0.91459	.0092027	.0042	-0.2	-0.00000	14.3713
180	0.024515	-0.91459	.0092027	.0042	-0.2	0.10000	14.3380
181	0.024515	-0.91459	.0092027	.0042	-0.2	0.20000	14.3265
182	0.024515	-0.91459	.0092027	.0042	-0.2	0.30000	14.3313

21:02 Monday, October 7, 1996 46

OBS	B0	B1	B2	B3	B4	B5
183	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
184	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
185	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
186	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
187	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
188	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
189	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
183	0.024515	-0.91459	.0092027	.0042	-0.2	0.4	14.3460
184	0.024515	-0.91459	.0092027	.0042	-0.2	0.5	14.3676
185	0.024515	-0.91459	.0092027	.0042	-0.2	0.6	14.3881
186	0.024515	-0.91459	.0092027	.0042	-0.2	0.7	14.4030
187	0.024515	-0.91459	.0092027	.0042	-0.2	0.8	14.4068
188	0.024515	-0.91459	.0092027	.0042	-0.2	0.9	14.3930
189	0.024515	-0.91459	.0092027	.0042	-0.2	1.0	14.3587

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OBS	B0	B1	B2	B3	B4	B5
190	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
191	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
192	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
193	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
194	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
195	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
196	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
190	0.024515	-0.91459	.0092027	.0042	-0.1	-1.00000	17.1061
191	0.024515	-0.91459	.0092027	.0042	-0.1	-0.90000	16.5535
192	0.024515	-0.91459	.0092027	.0042	-0.1	-0.80000	16.0774
193	0.024515	-0.91459	.0092027	.0042	-0.1	-0.70000	15.6725
194	0.024515	-0.91459	.0092027	.0042	-0.1	-0.60000	15.3333
195	0.024515	-0.91459	.0092027	.0042	-0.1	-0.50000	15.0542
196	0.024515	-0.91459	.0092027	.0042	-0.1	-0.40000	14.8290

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OBS	B0	B1	B2	B3	B4	B5	B6
197	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
198	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
199	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
200	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
201	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
202	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
203	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515

OBS	B7	B8	B9	UL	SU	PREDICT
197	-0.91459	.0092027	.0042	-0.10000	-0.30000	14.6546
198	-0.91459	.0092027	.0042	-0.10000	-0.20000	14.5231
199	-0.91459	.0092027	.0042	-0.10000	-0.10000	14.4299
200	-0.91459	.0092027	.0042	-0.10000	-0.00000	14.3693
201	-0.91459	.0092027	.0042	-0.10000	0.10000	14.3360
202	-0.91459	.0092027	.0042	-0.10000	0.20000	14.3244
203	-0.91459	.0092027	.0042	-0.10000	0.30000	14.3292

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OBS	B0	B1	B2	B3	B4	B5
204	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

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mdirisar0c50030-201ps.i   lncb2.out   10/17/96 14:16   13/21

OBS	B0	B1	B2	B3	B4	B5
205	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
206	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
207	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
208	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
209	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
210	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
204	0.024515	-0.91459	.0092027	.0042	-0.10000	0.4	14.3446
205	0.024515	-0.91459	.0092027	.0042	-0.10000	0.5	14.3454
206	0.024515	-0.91459	.0092027	.0042	-0.10000	0.6	14.3860
207	0.024515	-0.91459	.0092027	.0042	-0.10000	0.7	14.4009
208	0.024515	-0.91459	.0092027	.0042	-0.10000	0.8	14.4047
209	0.024515	-0.91459	.0092027	.0042	-0.10000	0.9	14.3917
210	0.024515	-0.91459	.0092027	.0042	-0.10000	1.0	14.3567

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OBS	B0	B1	B2	B3	B4	B5	B6
211	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
212	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
213	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
214	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
215	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
216	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
217	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515

OBS	B7	B8	B9	UL	SU	PREDICT
211	-0.91459	.0092027	.0042	-1.3078E-16	-1.00000	17.1048
212	-0.91459	.0092027	.0042	-1.3078E-16	-0.90000	16.5520
213	-0.91459	.0092027	.0042	-1.3078E-16	-0.80000	16.0758
214	-0.91459	.0092027	.0042	-1.3078E-16	-0.70000	15.6709
215	-0.91459	.0092027	.0042	-1.3078E-16	-0.60000	15.3315
216	-0.91459	.0092027	.0042	-1.3078E-16	-0.50000	15.0524
217	-0.91459	.0092027	.0042	-1.3078E-16	-0.40000	14.8279

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OBS	B0	B1	B2	B3	B4	B5	B6
218	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
219	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
220	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
221	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
222	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
223	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515
224	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251	0.024515

OBS	B7	B8	B9	UL	SU	PREDICT
218	-0.91459	.0092027	.0042	-0.00000	-0.30000	14.6516
219	-0.91459	.0092027	.0042	-0.00000	-0.20000	14.5211
220	-0.91459	.0092027	.0042	-0.00000	-0.10000	14.4270
221	-0.91459	.0092027	.0042	-0.00000	-0.00000	14.3672
222	-0.91459	.0092027	.0042	-0.00000	0.10000	14.3330
223	-0.91459	.0092027	.0042	-0.00000	0.20000	14.3223
224	-0.91459	.0092027	.0042	-0.00000	0.30000	14.3270

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OBS	B0	B1	B2	B3	B4	B5
225	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
226	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
227	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
228	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
229	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
230	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
231	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
225	0.024515	-0.91459	.0092027	.0042	-0.00000	0.4	14.3625
226	0.024515	-0.91459	.0092027	.0042	-0.00000	0.5	14.3632
227	0.024515	-0.91459	.0092027	.0042	-0.00000	0.6	14.3830
228	0.024515	-0.91459	.0092027	.0042	-0.00000	0.7	14.3988
229	0.024515	-0.91459	.0092027	.0042	-0.00000	0.8	14.4025
230	0.024515	-0.91459	.0092027	.0042	-0.00000	0.9	14.3896
231	0.024515	-0.91459	.0092027	.0042	-0.00000	1.0	14.3546

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OBS	B0	B1	B2	B3	B4	B5
232	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
233	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
234	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
235	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
236	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
237	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
238	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
232	0.024515	-0.91459	.0092027	.0042	0.1	-1.00000	17.1032
233	0.024515	-0.91459	.0092027	.0042	0.1	-0.90000	16.5503
234	0.024515	-0.91459	.0092027	.0042	0.1	-0.80000	16.0741
235	0.024515	-0.91459	.0092027	.0042	0.1	-0.70000	15.6690
236	0.024515	-0.91459	.0092027	.0042	0.1	-0.60000	15.3296
237	0.024515	-0.91459	.0092027	.0042	0.1	-0.50000	15.0504
238	0.024515	-0.91459	.0092027	.0042	0.1	-0.40000	14.8259

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OBS	B0	B1	B2	B3	B4	B5
239	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
240	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
241	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
242	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
243	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
244	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
245	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
239	0.024515	-0.91459	.0092027	.0042	0.1	-0.30000	14.6506
240	0.024515	-0.91459	.0092027	.0042	0.1	-0.20000	14.5190
241	0.024515	-0.91459	.0092027	.0042	0.1	-0.10000	14.4257
242	0.024515	-0.91459	.0092027	.0042	0.1	-0.00000	14.3651
243	0.024515	-0.91459	.0092027	.0042	0.1	0.10000	14.3317
244	0.024515	-0.91459	.0092027	.0042	0.1	0.20000	14.3201
245	0.024515	-0.91459	.0092027	.0042	0.1	0.30000	14.3249

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OBS	B0	B1	B2	B3	B4	B5
246	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
247	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
248	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
249	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
250	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
251	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
252	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
246	0.024515	-0.91459	.0092027	.0042	0.1	0.4	14.3604
247	0.024515	-0.91459	.0092027	.0042	0.1	0.5	14.3612
248	0.024515	-0.91459	.0092027	.0042	0.1	0.6	14.3810
249	0.024515	-0.91459	.0092027	.0042	0.1	0.7	14.3960
250	0.024515	-0.91459	.0092027	.0042	0.1	0.8	14.4006
251	0.024515	-0.91459	.0092027	.0042	0.1	0.9	14.3877
252	0.024515	-0.91459	.0092027	.0042	0.1	1.0	14.3520

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OBS	B0	B1	B2	B3	B4	B5
253	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
254	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
255	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
256	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
257	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
258	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
259	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
253	0.024515	-0.91459	.0092027	.0042	0.2	-1.00000	17.1016
254	0.024515	-0.91459	.0092027	.0042	0.2	-0.90000	16.5487
255	0.024515	-0.91459	.0092027	.0042	0.2	-0.80000	16.0724
256	0.024515	-0.91459	.0092027	.0042	0.2	-0.70000	15.6673
257	0.024515	-0.91459	.0092027	.0042	0.2	-0.60000	15.3278
258	0.024515	-0.91459	.0092027	.0042	0.2	-0.50000	15.0486
259	0.024515	-0.91459	.0092027	.0042	0.2	-0.40000	14.8240

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OBS	B0	B1	B2	B3	B4	B5
260	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
261	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
262	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
263	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
264	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
265	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
266	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
260	0.024515	-0.91459	.0092027	.0042	0.2	-0.30000	14.6487
261	0.024515	-0.91459	.0092027	.0042	0.2	-0.20000	14.5171
262	0.024515	-0.91459	.0092027	.0042	0.2	-0.10000	14.4237
263	0.024515	-0.91459	.0092027	.0042	0.2	-0.00000	14.3631
264	0.024515	-0.91459	.0092027	.0042	0.2	0.10000	14.3298
265	0.024515	-0.91459	.0092027	.0042	0.2	0.20000	14.3182
266	0.024515	-0.91459	.0092027	.0042	0.2	0.30000	14.3229

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OBS	B0	B1	B2	B3	B4	B5
267	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
268	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
269	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
270	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
271	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
272	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
273	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
267	0.024515	-0.91459	.0092027	.0042	0.2	0.4	14.3385
268	0.024515	-0.91459	.0092027	.0042	0.2	0.5	14.3593
269	0.024515	-0.91459	.0092027	.0042	0.2	0.6	14.3808
270	0.024515	-0.91459	.0092027	.0042	0.2	0.7	14.3958
271	0.024515	-0.91459	.0092027	.0042	0.2	0.8	14.3989
272	0.024515	-0.91459	.0092027	.0042	0.2	0.9	14.3862
273	0.024515	-0.91459	.0092027	.0042	0.2	1.0	14.3513

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OBS	B0	B1	B2	B3	B4	B5
274	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
275	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
276	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
277	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
278	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
279	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
280	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
274	0.024515	-0.91459	.0092027	.0042	0.3	-1.00000	17.1002
275	0.024515	-0.91459	.0092027	.0042	0.3	-0.90000	16.5472
276	0.024515	-0.91459	.0092027	.0042	0.3	-0.80000	16.0700
277	0.024515	-0.91459	.0092027	.0042	0.3	-0.70000	15.6657
278	0.024515	-0.91459	.0092027	.0042	0.3	-0.60000	15.3262
279	0.024515	-0.91459	.0092027	.0042	0.3	-0.50000	15.0469
280	0.024515	-0.91459	.0092027	.0042	0.3	-0.40000	14.8221

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OBS	B0	B1	B2	B3	B4	B5
281	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
282	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
283	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
284	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
285	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
286	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
287	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
281	0.024515	-0.91459	.0092027	.0042	0.3	-0.30000	14.6470
282	0.024515	-0.91459	.0092027	.0042	0.3	-0.20000	14.5154
283	0.024515	-0.91459	.0092027	.0042	0.3	-0.10000	14.4228

OBS	B6	B7	B8	B9	UL	SU	PREDICT
284	0.024515	-0.91459	.0092027	.0042	0.3	-0.00000	14.3614
285	0.024515	-0.91459	.0092027	.0042	0.3	0.10000	14.3281
286	0.024515	-0.91459	.0092027	.0042	0.3	0.20000	14.3166
287	0.024515	-0.91459	.0092027	.0042	0.3	0.30000	14.3214

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OBS	B0	B1	B2	B3	B4	B5
288	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
289	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
290	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
291	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
292	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
293	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
294	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
288	0.024515	-0.91459	.0092027	.0042	0.3	0.4	14.3370
289	0.024515	-0.91459	.0092027	.0042	0.3	0.5	14.3579
290	0.024515	-0.91459	.0092027	.0042	0.3	0.6	14.3786
291	0.024515	-0.91459	.0092027	.0042	0.3	0.7	14.3937
292	0.024515	-0.91459	.0092027	.0042	0.3	0.8	14.3977
293	0.024515	-0.91459	.0092027	.0042	0.3	0.9	14.3850
294	0.024515	-0.91459	.0092027	.0042	0.3	1.0	14.3503

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OBS	B0	B1	B2	B3	B4	B5
295	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
296	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
297	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
298	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
299	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
300	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
301	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
295	0.024515	-0.91459	.0092027	.0042	0.4	-1.00000	17.0990
296	0.024515	-0.91459	.0092027	.0042	0.4	-0.90000	16.5459
297	0.024515	-0.91459	.0092027	.0042	0.4	-0.80000	16.0696
298	0.024515	-0.91459	.0092027	.0042	0.4	-0.70000	15.6644
299	0.024515	-0.91459	.0092027	.0042	0.4	-0.60000	15.3269
300	0.024515	-0.91459	.0092027	.0042	0.4	-0.50000	15.0456
301	0.024515	-0.91459	.0092027	.0042	0.4	-0.40000	14.8210

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OBS	B0	B1	B2	B3	B4	B5
302	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
303	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
304	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
305	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
306	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
307	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
308	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT
302	0.024515	-0.91459	.0092027	.0042	0.4	-0.30000	14.6457
303	0.024515	-0.91459	.0092027	.0042	0.4	-0.20000	14.5141
304	0.024515	-0.91459	.0092027	.0042	0.4	-0.10000	14.4200
305	0.024515	-0.91459	.0092027	.0042	0.4	-0.00000	14.3602
306	0.024515	-0.91459	.0092027	.0042	0.4	0.10000	14.3270
307	0.024515	-0.91459	.0092027	.0042	0.4	0.20000	14.3155
308	0.024515	-0.91459	.0092027	.0042	0.4	0.30000	14.3203

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OBS	B0	B1	B2	B3	B4	B5
309	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
310	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
311	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
312	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
313	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
314	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251
315	14.3672	-0.021405	-0.46040	-.0023767	.00020916	1.36251

OBS	B6	B7	B8	B9	UL	SU	PREDICT

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This results correspond to the inverse at experiment (branch) 04:

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OBS	TR	QL	MA	ST	LT	UL	SU	TRAC
1	28	-1	-1	1	1	-1	-1	.000605
2	28	-1	-1	1	1	-1	-1	.000629
3	28	-1	-1	1	1	-1	-1	.000546
4	29	-1	-1	1	1	-1	0	.005850
5	29	-1	-1	1	1	-1	0	.005820
6	29	-1	-1	1	1	-1	0	.005770
7	30	-1	-1	1	1	-1	1	.005700
8	30	-1	-1	1	1	-1	1	.005750
9	30	-1	-1	1	1	-1	1	.005740
10	31	-1	-1	1	1	0	-1	.000649
11	31	-1	-1	1	1	0	-1	.000660
12	31	-1	-1	1	1	0	-1	.000509
13	32	-1	-1	1	1	0	0	.005860
14	32	-1	-1	1	1	0	0	.005840
15	32	-1	-1	1	1	0	0	.005730
16	33	-1	-1	1	1	0	1	.005820
17	33	-1	-1	1	1	0	1	.005900

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OBS	TR	QL	MA	ST	LT	UL	SU	TRAC
18	33	-1	-1	1	1	0	1.00	.005650
19	34	-1	-1	1	1	1	-1.00	.000653
20	34	-1	-1	1	1	1	-1.00	.000825
21	34	-1	-1	1	1	1	-1.00	.000587
22	35	-1	-1	1	1	1	0.00	.005850
23	35	-1	-1	1	1	1	0.00	.005830
24	35	-1	-1	1	1	1	0.00	.005730
25	36	-1	-1	1	1	1	1.00	.005760
26	36	-1	-1	1	1	1	1.00	.005790
27	36	-1	-1	1	1	1	1.00	.005670
28	40	-1	-1	1	1	0	0.25	.005830
29	40	-1	-1	1	1	0	0.25	.005770
30	40	-1	-1	1	1	0	0.25	.005600
31	40	-1	-1	1	1	0	0.50	.005750
32	40	-1	-1	1	1	0	0.50	.005790
33	40	-1	-1	1	1	0	0.50	.005820
34	40	-1	-1	1	1	0	0.75	.005860

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OBS	TR	QL	MA	ST	LT	UL	SU	TRAC
35	40	-1	-1	1	1	0.0000	0.75	.00585
36	40	-1	-1	1	1	0.0000	0.75	.00582
37	41	-1	-1	1	1	0.5625	0.20	.00565
38	41	-1	-1	1	1	0.5625	0.20	.00560
39	41	-1	-1	1	1	0.5625	0.20	.00575
40	41	-1	-1	1	1	-0.5710	0.20	.00581
41	41	-1	-1	1	1	-0.5710	0.20	.00579
42	41	-1	-1	1	1	-0.5710	0.20	.00586

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General Linear Models Procedure

Number of observations in data set = 42

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General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	0.00018683	0.00002076	2527.15	0.0001
Error	32	0.00000026	0.00000001		

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
			(0.125E-09)		
Corrected Total	41	0.00018710			

R-Square	C.V.	Root MSE	TRAC Mean
0.998595	1.937203	0.00009	0.00460

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General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Source	DF	Type I SS	Mean Square	F Value	Pr > F
UL	1	0.00000000	0.00000000	0.01	0.9207
SU	1	0.00013665	0.00013665	16636.61	0.0001
UL*SU	1	0.00000001	0.00000001	1.48	0.2334
UL*UL	1	0.00000095	0.00000095	115.08	0.0001
SU*SU	1	0.00004803	0.00004803	5847.00	0.0001
UL*UL*UL	1	0.00000002	0.00000002	2.81	0.1033
SU*SU*SU	1	0.00000117	0.00000117	142.10	0.0001
UL*UL*SU	1	0.00000001	0.00000001	0.97	0.3325
UL*SU*SU	1	0.00000000	0.00000000	0.29	0.5964

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General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Source	DF	Type III SS	Mean Square	F Value	Pr > F
UL	1	0.00000002	0.00000002	2.54	0.1211
SU	1	0.00000035	0.00000035	42.03	0.0001
UL*SU	1	0.00000001	0.00000001	1.14	0.2946
UL*UL	1	0.00000000	0.00000000	0.01	0.9309
SU*SU	1	0.00004727	0.00004727	5756.50	0.0001
UL*UL*UL	1	0.00000002	0.00000002	1.89	0.1787
SU*SU*SU	1	0.00000111	0.00000111	135.08	0.0001
UL*UL*SU	1	0.00000001	0.00000001	0.97	0.3326
UL*SU*SU	1	0.00000000	0.00000000	0.29	0.5964

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General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
pred. at mp	0.00577017	138.96	0.0001	0.00004150

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT	0.0057521273	158.02	0.0001	0.00003632
UL	-.0001556256	-1.59	0.1211	0.00009772
SU	0.0008860808	6.48	0.0001	0.00013679
UL*SU	-.0000278801	-1.07	0.2946	0.00002616
UL*UL	0.0000031950	0.09	0.9309	0.00003656

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General Linear Models Procedure

Dependent Variable: TRAC Annualized cost

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
SU*SU	-.0025475651	-75.86	0.0001	0.00003358
UL*UL*UL	0.0001509765	1.37	0.1787	0.00010988
SU*SU*SU	0.0017079346	11.62	0.0001	0.00014708
UL*UL*SU	-.0000637395	-0.98	0.3326	0.00006464

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UL*SO*SO	0.0000242390	0.53	0.5964	0.00004532

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
1	0.00060500	0.00060920	-0.00000420
2	0.00062900	0.00060920	0.00001980
3	0.00054600	0.00060920	-0.00006320
4	0.00505000	0.00575997	0.00009003
5	0.00502000	0.00575997	0.00006003
6	0.00577000	0.00575997	0.00001003
7	0.00578000	0.00576713	0.00001287
8	0.00575000	0.00576713	-0.00001713
9	0.00574000	0.00576713	-0.00002713
10	0.00064900	0.00060974	0.00003926
11	0.00066000	0.00060974	0.00005026
12	0.00058900	0.00060974	-0.00002074
13	0.00506000	0.00575213	0.00010787
14	0.00584000	0.00575213	0.00008787

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
15	0.00573000	0.00575213	-0.00002213
16	0.00582000	0.00579939	0.00002061
17	0.00580000	0.00579939	0.00000061
18	0.00565000	0.00579939	-0.00014939
19	0.00065300	0.00070414	-0.00005114
20	0.00082500	0.00070414	0.00012086
21	0.00058700	0.00070414	-0.00011714
22	0.00585000	0.00575067	0.00009933
23	0.00583000	0.00575067	0.00007933
24	0.00573000	0.00575067	-0.00002067
25	0.00576000	0.00575055	0.00000945
26	0.00579000	0.00575055	0.00003945
27	0.00567000	0.00575055	-0.00000055
28	0.00583000	0.00584131	-0.00001131

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General Linear Models Procedure

Observation	Observed Value	Predicted Value	Residual
29	0.00577000	0.00584131	-0.00007131
30	0.00568000	0.00584131	-0.00016131
31	0.00575000	0.00577217	-0.00002217
32	0.00579000	0.00577217	0.00001783
33	0.00582000	0.00577217	0.00004783
34	0.00586000	0.00570482	0.00015518
35	0.00585000	0.00570482	0.00014518
36	0.00582000	0.00570482	0.00011518
37	0.00565000	0.00577625	-0.00012625
38	0.00568000	0.00577625	-0.00009625
39	0.00575000	0.00577625	-0.00002625
40	0.00581000	0.00590205	-0.00009205
41	0.00579000	0.00590205	-0.00011205
42	0.00586000	0.00590205	-0.00004205

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General Linear Models Procedure

Sum of Residuals	0.00000000
Sum of Squared Residuals	0.00000026
Sum of Squared Residuals - Error SS	-0.00000000
First Order Autocorrelation	0.24670202
Durbin-Watson D	1.49954585

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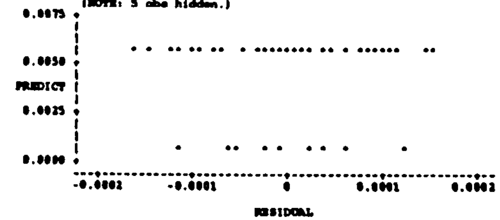
Plot of PREDICT*RESIDUAL. Symbol used is '*'.
(NOTE: 5 obs hidden.)



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Univariate Procedure

Variable=RESIDUAL

Moments

N	42	Sum Wgts	42
Mean	0	Sum	0
Std Dev	0.00008	Variance	6.411E-9
Skewness	-0.04046	Kurtosis	-0.56606
USS	2.629E-7	CSS	2.629E-7
CV	.	Std Mean	0.000012
T:Mean=0	0	Pr>|T|	1.0000
Num ^= 0	42	Num > 0	21
M(Sign)	0	Pr>=|M|	1.0000
Sgn Rank	-10.5	Pr>=|S|	0.8974
W:Normal	0.975975	Pr<W	0.6406

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Univariate Procedure

Variable=RESIDUAL

Quantiles(Def=5)

100% Max	0.000155	99%	0.000155
75% Q3	0.000050	95%	0.000121
50% Med	-1.79E-6	90%	0.000100
25% Q1	-0.00005	10%	-0.00011
0% Min	-0.00016	5%	-0.00013
		1%	-0.00016
Range	0.000316		
Q3-Q1	0.000109		
Mode	-0.00016		

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Univariate Procedure

Variable=RESIDUAL

Extremes

Lowest	Obs	Highest	Obs
-0.00016(	30)	0.000108(	13)
-0.00015(	18)	0.000115(	36)
-0.00013(	37)	0.000121(	20)
-0.00012(	21)	0.000145(	35)

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-0.00011(41) 0.000155(34)

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Univariate Procedure

Variable=RESIDUAL

```
   Stem Leaf                  #         Boxplot
      1 56                    2            |
      1 0122                  4            |
      0 566889                6         +-----+
      0 011122244             9         |  +  |
     -0 4332222210           10         *-----*
     -0 98765                 5         +-----+
     -1 3210                  4            |
     -1 65                    2            |
        ----+----+----+----+
   Multiply Stem.Leaf by 10**-4
```

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Univariate Procedure

Variable=RESIDUAL

```
                     Normal Probability Plot
   0.000175+                                          +++*++
           |                                    *+**++*
           |                               *****+
           |                         *******
           |                   *******
           |              +*****
           |        *++**+*
  -0.00010+ ++*+++
           +----+----+----+----+----+----+----+----+----+----+
                -2        -1         0        +1        +2
```

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OBS	B0	B1	B2	B3	B4	B5
1	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
2	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
3	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
4	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
5	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
6	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
7	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
1	.00015098	.0017079	-.00004374	.000023250	-1	-1.00000	.0006102
2	.00015098	.0017079	-.00004374	.000023250	-1	-0.90000	.0016486
3	.00015098	.0017079	-.00004374	.000023250	-1	-0.80000	.0025434
4	.00015098	.0017079	-.00004374	.000023250	-1	-0.70000	.0033047
5	.00015098	.0017079	-.00004374	.000023250	-1	-0.60000	.0039429
6	.00015098	.0017079	-.00004374	.000023250	-1	-0.50000	.0044683
7	.00015098	.0017079	-.00004374	.000023250	-1	-0.40000	.0048909

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OBS	B0	B1	B2	B3	B4	B5
8	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
9	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
10	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
11	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
12	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
13	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
14	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS B6 B7 B8 B9 UL SU PREDICT

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OBS	B6	B7	B8	B9	UL	SU	PREDICT
8	.00015098	.0017079	-.00004374	.000023250	-1.0	-0.30000	.0052213
9	.00015098	.0017079	-.00004374	.000023250	-1.0	-0.20000	.0054693
10	.00015098	.0017079	-.00004374	.000023250	-1.0	-0.10000	.0056455
11	.00015098	.0017079	-.00004374	.000023250	-1.0	-0.00000	.0057600
12	.00015098	.0017079	-.00004374	.000023250	-1.0	0.10000	.0058231
13	.00015098	.0017079	-.00004374	.000023250	-1.0	0.20000	.0058450
14	.00015098	.0017079	-.00004374	.000023250	-1.0	0.30000	.0058360

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OBS	B0	B1	B2	B3	B4	B5
15	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
16	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
17	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
18	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
19	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
20	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
21	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
15	.00015098	.0017079	-.00004374	.000023250	-1.0	0.4	.0058064
16	.00015098	.0017079	-.00004374	.000023250	-1.0	0.5	.0057663
17	.00015098	.0017079	-.00004374	.000023250	-1.0	0.6	.0057260
18	.00015098	.0017079	-.00004374	.000023250	-1.0	0.7	.0056950
19	.00015098	.0017079	-.00004374	.000023250	-1.0	0.8	.0056859
20	.00015098	.0017079	-.00004374	.000023250	-1.0	0.9	.0057066
21	.00015098	.0017079	-.00004374	.000023250	-1.0	1.0	.0057681

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OBS	B0	B1	B2	B3	B4	B5
22	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
23	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
24	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
25	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
26	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
27	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
28	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
22	.00015098	.0017079	-.00004374	.000023250	-0.9	-1.00000	.0006317
23	.00015098	.0017079	-.00004374	.000023250	-0.9	-0.90000	.0016703
24	.00015098	.0017079	-.00004374	.000023250	-0.9	-0.80000	.0025652
25	.00015098	.0017079	-.00004374	.000023250	-0.9	-0.70000	.0033267
26	.00015098	.0017079	-.00004374	.000023250	-0.9	-0.60000	.0039652
27	.00015098	.0017079	-.00004374	.000023250	-0.9	-0.50000	.0044908
28	.00015098	.0017079	-.00004374	.000023250	-0.9	-0.40000	.0049138

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OBS	B0	B1	B2	B3	B4	B5
29	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
30	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
31	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
32	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
33	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
34	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
35	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
29	.00015098	.0017079	-.00004374	.000023250	-0.9	-0.30000	.0052465
30	.00015098	.0017079	-.00004374	.000023250	-0.9	-0.20000	.0054938
31	.00015098	.0017079	-.00004374	.000023250	-0.9	-0.10000	.0056697
32	.00015098	.0017079	-.00004374	.000023250	-0.9	-0.00000	.0057867
33	.00015098	.0017079	-.00004374	.000023250	-0.9	0.10000	.0058484
34	.00015098	.0017079	-.00004374	.000023250	-0.9	0.20000	.0058710
35	.00015098	.0017079	-.00004374	.000023250	-0.9	0.30000	.0058626

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OBS	B0	B1	B2	B3	B4	B5
36	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
37	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

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38	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
39	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
40	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
41	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
42	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
36	.00015090	.0017079	-.00004374	.000023250	-0.9	0.4	.0058337
37	.00015090	.0017079	-.00004374	.000023250	-0.9	0.5	.0057946
38	.00015090	.0017079	-.00004374	.000023250	-0.9	0.6	.0057549
39	.00015090	.0017079	-.00004374	.000023250	-0.9	0.7	.0057256
40	.00015090	.0017079	-.00004374	.000023250	-0.9	0.8	.0057166
41	.00015090	.0017079	-.00004374	.000023250	-0.9	0.9	.0057302
42	.00015090	.0017079	-.00004374	.000023250	-0.9	1.0	.0058007

317
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OBS	B0	B1	B2	B3	B4	B5
43	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
44	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
45	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
46	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
47	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
48	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
49	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
43	.00015090	.0017079	-.00004374	.000023250	-0.8	-1.00000	.0006441
44	.00015090	.0017079	-.00004374	.000023250	-0.8	-0.90000	.0016046
45	.00015090	.0017079	-.00004374	.000023250	-0.8	-0.80000	.0025796
46	.00015090	.0017079	-.00004374	.000023250	-0.8	-0.70000	.0033413
47	.00015090	.0017079	-.00004374	.000023250	-0.8	-0.60000	.0039799
48	.00015090	.0017079	-.00004374	.000023250	-0.8	-0.50000	.0045057
49	.00015090	.0017079	-.00004374	.000023250	-0.8	-0.40000	.0049290

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OBS	B0	B1	B2	B3	B4	B5
50	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
51	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
52	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
53	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
54	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
55	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
56	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
50	.00015090	.0017079	-.00004374	.000023250	-0.8	-0.30000	.0052599
51	.00015090	.0017079	-.00004374	.000023250	-0.8	-0.20000	.0055080
52	.00015090	.0017079	-.00004374	.000023250	-0.8	-0.10000	.0056859
53	.00015090	.0017079	-.00004374	.000023250	-0.8	-0.00000	.0058014
54	.00015090	.0017079	-.00004374	.000023250	-0.8	0.10000	.0058635
55	.00015090	.0017079	-.00004374	.000023250	-0.8	0.20000	.0059006
56	.00015090	.0017079	-.00004374	.000023250	-0.8	0.30000	.0058809

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OBS	B0	B1	B2	B3	B4	B5
57	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
58	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
59	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
60	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
61	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
62	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
63	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
57	.00015090	.0017079	-.00004374	.000023250	-0.8	0.4	.0058526
58	.00015090	.0017079	-.00004374	.000023250	-0.8	0.5	.0058139
59	.00015090	.0017079	-.00004374	.000023250	-0.8	0.6	.0057752
60	.00015090	.0017079	-.00004374	.000023250	-0.8	0.7	.0057466
61	.00015090	.0017079	-.00004374	.000023250	-0.8	0.8	.0057306
62	.00015090	.0017079	-.00004374	.000023250	-0.8	0.9	.0057609
63	.00015090	.0017079	-.00004374	.000023250	-0.8	1.0	.0058243

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OBS	B0	B1	B2	B3	B4	B5
64	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
65	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
66	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
67	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
68	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
69	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
70	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
64	.00015090	.0017079	-.00004374	.000023250	-0.7	-1.00000	.0006541
65	.00015090	.0017079	-.00004374	.000023250	-0.7	-0.90000	.0016926
66	.00015090	.0017079	-.00004374	.000023250	-0.7	-0.80000	.0025075
67	.00015090	.0017079	-.00004374	.000023250	-0.7	-0.70000	.0033493
68	.00015090	.0017079	-.00004374	.000023250	-0.7	-0.60000	.0039888
69	.00015090	.0017079	-.00004374	.000023250	-0.7	-0.50000	.0045139
70	.00015090	.0017079	-.00004374	.000023250	-0.7	-0.40000	.0049373

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OBS	B0	B1	B2	B3	B4	B5
71	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
72	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
73	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
74	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
75	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
76	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
77	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
71	.00015090	.0017079	-.00004374	.000023250	-0.7	-0.30000	.0052685
72	.00015090	.0017079	-.00004374	.000023250	-0.7	-0.20000	.0055176
73	.00015090	.0017079	-.00004374	.000023250	-0.7	-0.10000	.0056950
74	.00015090	.0017079	-.00004374	.000023250	-0.7	-0.00000	.0058100
75	.00015090	.0017079	-.00004374	.000023250	-0.7	0.10000	.0058754
76	.00015090	.0017079	-.00004374	.000023250	-0.7	0.20000	.0058990
77	.00015090	.0017079	-.00004374	.000023250	-0.7	0.30000	.0058917

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OBS	B0	B1	B2	B3	B4	B5
78	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
79	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
80	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
81	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
82	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
83	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
84	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
78	.00015090	.0017079	-.00004374	.000023250	-0.7	0.4	.0058639
79	.00015090	.0017079	-.00004374	.000023250	-0.7	0.5	.0058259
80	.00015090	.0017079	-.00004374	.000023250	-0.7	0.6	.0057870
81	.00015090	.0017079	-.00004374	.000023250	-0.7	0.7	.0057599
82	.00015090	.0017079	-.00004374	.000023250	-0.7	0.8	.0057524
83	.00015090	.0017079	-.00004374	.000023250	-0.7	0.9	.0057757
84	.00015090	.0017079	-.00004374	.000023250	-0.7	1.0	.0058399

323
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OBS	B0	B1	B2	B3	B4	B5
85	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
86	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
87	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
88	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
89	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
90	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
91	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
85	.00015090	.0017079	-.00004374	.000023250	-0.6	-1.00000	.0006567

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86	.00015090	.0017079	-.00004374	.000023250	-0.6	-0.90000	.0016950
87	.00015090	.0017079	-.00004374	.000023250	-0.6	-0.80000	.0025099
88	.00015090	.0017079	-.00004374	.000023250	-0.6	-0.70000	.0033516
89	.00015090	.0017079	-.00004374	.000023250	-0.6	-0.60000	.0039903
90	.00015090	.0017079	-.00004374	.000023250	-0.6	-0.50000	.0045162
91	.00015090	.0017079	-.00004374	.000023250	-0.6	-0.40000	.0049397

324
19:50 Wednesday, October 2, 1996

OBS	B0	B1	B2	B3	B4	B5
92	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
93	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
94	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
95	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
96	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
97	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
98	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
92	.00015090	.0017079	-.00004374	.000023250	-0.6	-0.30000	.0052710
93	.00015090	.0017079	-.00004374	.000023250	-0.6	-0.20000	.0055203
94	.00015090	.0017079	-.00004374	.000023250	-0.6	-0.10000	.0056979
95	.00015090	.0017079	-.00004374	.000023250	-0.6	-0.00000	.0058140
96	.00015090	.0017079	-.00004374	.000023250	-0.6	0.10000	.0058709
97	.00015090	.0017079	-.00004374	.000023250	-0.6	0.20000	.0059028
98	.00015090	.0017079	-.00004374	.000023250	-0.6	0.30000	.0058960

325
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OBS	B0	B1	B2	B3	B4	B5
99	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
100	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
101	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
102	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
103	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
104	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
105	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
99	.00015090	.0017079	-.00004374	.000023250	-0.6	0.4	.0058607
100	.00015090	.0017079	-.00004374	.000023250	-0.6	0.5	.0058311
101	.00015090	.0017079	-.00004374	.000023250	-0.6	0.6	.0057935
102	.00015090	.0017079	-.00004374	.000023250	-0.6	0.7	.0057662
103	.00015090	.0017079	-.00004374	.000023250	-0.6	0.8	.0057594
104	.00015090	.0017079	-.00004374	.000023250	-0.6	0.9	.0057836
105	.00015090	.0017079	-.00004374	.000023250	-0.6	1.0	.0058483

326
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OBS	B0	B1	B2	B3	B4	B5
106	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
107	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
108	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
109	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
110	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
111	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
112	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
106	.00015090	.0017079	-.00004374	.000023250	-0.5	-1.00000	.0006540
107	.00015090	.0017079	-.00004374	.000023250	-0.5	-0.90000	.0016929
108	.00015090	.0017079	-.00004374	.000023250	-0.5	-0.80000	.0025076
109	.00015090	.0017079	-.00004374	.000023250	-0.5	-0.70000	.0033491
110	.00015090	.0017079	-.00004374	.000023250	-0.5	-0.60000	.0039077
111	.00015090	.0017079	-.00004374	.000023250	-0.5	-0.50000	.0045136
112	.00015090	.0017079	-.00004374	.000023250	-0.5	-0.40000	.0049371

327
19:50 Wednesday, October 2, 1996

OBS	B0	B1	B2	B3	B4	B5
113	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
114	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
115	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

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116	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
117	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
118	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
119	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
113	.00015090	.0017079	-.00004374	.000023250	-0.5	-0.30000	.0052605
114	.00015090	.0017079	-.00004374	.000023250	-0.5	-0.20000	.0055179
115	.00015090	.0017079	-.00004374	.000023250	-0.5	-0.10000	.0056956
116	.00015090	.0017079	-.00004374	.000023250	-0.5	-0.00000	.0058119
117	.00015090	.0017079	-.00004374	.000023250	-0.5	0.10000	.0058770
118	.00015090	.0017079	-.00004374	.000023250	-0.5	0.20000	.0059011
119	.00015090	.0017079	-.00004374	.000023250	-0.5	0.30000	.0058946

328
19:50 Wednesday, October 2, 1996

OBS	B0	B1	B2	B3	B4	B5
120	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
121	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
122	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
123	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
124	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
125	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
126	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
120	.00015090	.0017079	-.00004374	.000023250	-0.5	0.4	.0058677
121	.00015090	.0017079	-.00004374	.000023250	-0.5	0.5	.0058305
122	.00015090	.0017079	-.00004374	.000023250	-0.5	0.6	.0057934
123	.00015090	.0017079	-.00004374	.000023250	-0.5	0.7	.0057666
124	.00015090	.0017079	-.00004374	.000023250	-0.5	0.8	.0057604
125	.00015090	.0017079	-.00004374	.000023250	-0.5	0.9	.0057849
126	.00015090	.0017079	-.00004374	.000023250	-0.5	1.0	.0058505

329
19:50 Wednesday, October 2, 1996

OBS	B0	B1	B2	B3	B4	B5
127	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
128	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
129	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
130	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
131	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
132	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
133	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
127	.00015090	.0017079	-.00004374	.000023250	-0.4	-1.00000	.0006494
128	.00015090	.0017079	-.00004374	.000023250	-0.4	-0.90000	.0016071
129	.00015090	.0017079	-.00004374	.000023250	-0.4	-0.80000	.0025015
130	.00015090	.0017079	-.00004374	.000023250	-0.4	-0.70000	.0033420
131	.00015090	.0017079	-.00004374	.000023250	-0.4	-0.60000	.0039812
132	.00015090	.0017079	-.00004374	.000023250	-0.4	-0.50000	.0045070
133	.00015090	.0017079	-.00004374	.000023250	-0.4	-0.40000	.0049304

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OBS	B0	B1	B2	B3	B4	B5
134	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
135	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
136	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
137	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
138	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
139	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
140	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
134	.00015090	.0017079	-.00004374	.000023250	-0.4	-0.30000	.0052617
135	.00015090	.0017079	-.00004374	.000023250	-0.4	-0.20000	.0055111
136	.00015090	.0017079	-.00004374	.000023250	-0.4	-0.10000	.0056888
137	.00015090	.0017079	-.00004374	.000023250	-0.4	-0.00000	.0058052
138	.00015090	.0017079	-.00004374	.000023250	-0.4	0.10000	.0058705
139	.00015090	.0017079	-.00004374	.000023250	-0.4	0.20000	.0058948
140	.00015090	.0017079	-.00004374	.000023250	-0.4	0.30000	.0058885

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OBS	B0	B1	B2	B3	B4	B5
141	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
142	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
143	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
144	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
145	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
146	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
147	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
141	.00015090	.0017079	-.00004374	.000023250	-0.4	0.4	.0058619
142	.00015090	.0017079	-.00004374	.000023250	-0.4	0.5	.0058250
143	.00015090	.0017079	-.00004374	.000023250	-0.4	0.6	.0057883
144	.00015090	.0017079	-.00004374	.000023250	-0.4	0.7	.0057619
145	.00015090	.0017079	-.00004374	.000023250	-0.4	0.8	.0057561
146	.00015090	.0017079	-.00004374	.000023250	-0.4	0.9	.0057812
147	.00015090	.0017079	-.00004374	.000023250	-0.4	1.0	.0058473

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OBS	B0	B1	B2	B3	B4	B5
148	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
149	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
150	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
151	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
152	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
153	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
154	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
148	.00015090	.0017079	-.00004374	.000023250	-0.3	-1.00000	.0006412
149	.00015090	.0017079	-.00004374	.000023250	-0.3	-0.90000	.0016786
150	.00015090	.0017079	-.00004374	.000023250	-0.3	-0.80000	.0025726
151	.00015090	.0017079	-.00004374	.000023250	-0.3	-0.70000	.0033336
152	.00015090	.0017079	-.00004374	.000023250	-0.3	-0.60000	.0039717
153	.00015090	.0017079	-.00004374	.000023250	-0.3	-0.50000	.0044972
154	.00015090	.0017079	-.00004374	.000023250	-0.3	-0.40000	.0049205

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OBS	B0	B1	B2	B3	B4	B5
155	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
156	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
157	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
158	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
159	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
160	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
161	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
155	.00015090	.0017079	-.00004374	.000023250	-0.3	-0.30000	.0052516
156	.00015090	.0017079	-.00004374	.000023250	-0.3	-0.20000	.0055009
157	.00015090	.0017079	-.00004374	.000023250	-0.3	-0.10000	.0056786
158	.00015090	.0017079	-.00004374	.000023250	-0.3	-0.00000	.0057958
159	.00015090	.0017079	-.00004374	.000023250	-0.3	0.10000	.0058603
160	.00015090	.0017079	-.00004374	.000023250	-0.3	0.20000	.0058848
161	.00015090	.0017079	-.00004374	.000023250	-0.3	0.30000	.0058786

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OBS	B0	B1	B2	B3	B4	B5
162	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
163	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
164	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
165	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
166	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
167	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
168	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
162	.00015090	.0017079	-.00004374	.000023250	-0.3	0.4	.0058521
163	.00015090	.0017079	-.00004374	.000023250	-0.3	0.5	.0058155

OBS	B6	B7	B8	B9	UL	SU	PREDICT
164	.00015090	.0017079	-.00004374	.000023250	-0.3	0.6	.0057791
165	.00015090	.0017079	-.00004374	.000023250	-0.3	0.7	.0057530
166	.00015090	.0017079	-.00004374	.000023250	-0.3	0.8	.0057476
167	.00015090	.0017079	-.00004374	.000023250	-0.3	0.9	.0057731
168	.00015090	.0017079	-.00004374	.000023250	-0.3	1.0	.0058397

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OBS	B0	B1	B2	B3	B4	B5
169	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
170	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
171	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
172	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
173	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
174	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
175	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
169	.00015090	.0017079	-.00004374	.000023250	-0.2	-1.00000	.0006313
170	.00015090	.0017079	-.00004374	.000023250	-0.2	-0.90000	.0016602
171	.00015090	.0017079	-.00004374	.000023250	-0.2	-0.80000	.0025617
172	.00015090	.0017079	-.00004374	.000023250	-0.2	-0.70000	.0033223
173	.00015090	.0017079	-.00004374	.000023250	-0.2	-0.60000	.0039608
174	.00015090	.0017079	-.00004374	.000023250	-0.2	-0.50000	.0044853
175	.00015090	.0017079	-.00004374	.000023250	-0.2	-0.40000	.0049082

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OBS	B0	B1	B2	B3	B4	B5
176	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
177	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
178	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
179	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
180	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
181	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
182	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
176	.00015090	.0017079	-.00004374	.000023250	-0.2	-0.30000	.0052191
177	.00015090	.0017079	-.00004374	.000023250	-0.2	-0.20000	.0054083
178	.00015090	.0017079	-.00004374	.000023250	-0.2	-0.10000	.0056659
179	.00015090	.0017079	-.00004374	.000023250	-0.2	-0.00000	.0057822
180	.00015090	.0017079	-.00004374	.000023250	-0.2	0.10000	.0058474
181	.00015090	.0017079	-.00004374	.000023250	-0.2	0.20000	.0058719
182	.00015090	.0017079	-.00004374	.000023250	-0.2	0.30000	.0058658

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OBS	B0	B1	B2	B3	B4	B5
183	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
184	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
185	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
186	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
187	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
188	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
189	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
183	.00015090	.0017079	-.00004374	.000023250	-0.2	0.4	.0058394
184	.00015090	.0017079	-.00004374	.000023250	-0.2	0.5	.0058030
185	.00015090	.0017079	-.00004374	.000023250	-0.2	0.6	.0057667
186	.00015090	.0017079	-.00004374	.000023250	-0.2	0.7	.0057489
187	.00015090	.0017079	-.00004374	.000023250	-0.2	0.8	.0057358
188	.00015090	.0017079	-.00004374	.000023250	-0.2	0.9	.0057616
189	.00015090	.0017079	-.00004374	.000023250	-0.2	1.0	.0058286

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OBS	B0	B1	B2	B3	B4	B5
190	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
191	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
192	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
193	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

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OBS	B0	B1	B2	B3	B4	B5
194	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
195	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
196	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
190	.00015098	.0017079	-.00004374	.000023250	-0.1	-1.00000	.0006205
191	.00015098	.0017079	-.00004374	.000023250	-0.1	-0.90000	.0016560
192	.00015098	.0017079	-.00004374	.000023250	-0.1	-0.80000	.0025490
193	.00015098	.0017079	-.00004374	.000023250	-0.1	-0.70000	.0033098
194	.00015098	.0017079	-.00004374	.000023250	-0.1	-0.60000	.0039472
195	.00015098	.0017079	-.00004374	.000023250	-0.1	-0.50000	.0044728
196	.00015098	.0017079	-.00004374	.000023250	-0.1	-0.40000	.0048946

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OBS	B0	B1	B2	B3	B4	B5
197	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
198	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
199	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
200	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
201	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
202	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
203	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
197	.00015098	.0017079	-.00004374	.000023250	-0.10000	-0.30000	.0052252
198	.00015098	.0017079	-.00004374	.000023250	-0.10000	-0.20000	.0054761
199	.00015098	.0017079	-.00004374	.000023250	-0.10000	-0.10000	.0056516
200	.00015098	.0017079	-.00004374	.000023250	-0.10000	-0.00000	.0057676
201	.00015098	.0017079	-.00004374	.000023250	-0.10000	0.10000	.0058327
202	.00015098	.0017079	-.00004374	.000023250	-0.10000	0.20000	.0058571
203	.00015098	.0017079	-.00004374	.000023250	-0.10000	0.30000	.0058510

340
19:50 Wednesday, October 2, 1996

OBS	B0	B1	B2	B3	B4	B5
204	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
205	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
206	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
207	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
208	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
209	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
210	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
204	.00015098	.0017079	-.00004374	.000023250	-0.10000	0.4	.0058246
205	.00015098	.0017079	-.00004374	.000023250	-0.10000	0.5	.0057882
206	.00015098	.0017079	-.00004374	.000023250	-0.10000	0.6	.0057521
207	.00015098	.0017079	-.00004374	.000023250	-0.10000	0.7	.0057264
208	.00015098	.0017079	-.00004374	.000023250	-0.10000	0.8	.0057215
209	.00015098	.0017079	-.00004374	.000023250	-0.10000	0.9	.0057476
210	.00015098	.0017079	-.00004374	.000023250	-0.10000	1.0	.0058149

341
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OBS	B0	B1	B2	B3	B4	B5
211	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
212	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
213	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
214	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
215	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
216	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
217	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
211	.00015098	.0017079	-.00004374	.000023250	-1.3878E-16	-1.00000	.0006097
212	.00015098	.0017079	-.00004374	.000023250	-1.3878E-16	-0.90000	.0016453
213	.00015098	.0017079	-.00004374	.000023250	-1.3878E-16	-0.80000	.0025377
214	.00015098	.0017079	-.00004374	.000023250	-1.3878E-16	-0.70000	.0032972
215	.00015098	.0017079	-.00004374	.000023250	-1.3878E-16	-0.60000	.0039348
216	.00015098	.0017079	-.00004374	.000023250	-1.3878E-16	-0.50000	.0044583
217	.00015098	.0017079	-.00004374	.000023250	-1.3878E-16	-0.40000	.0048805

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OBS	B0	B1	B2	B3	B4	B5
218	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
219	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
220	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
221	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
222	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
223	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
224	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
218	.00015098	.0017079	-.00004374	.000023250	-0.00000	-0.30000	.0052187
219	.00015098	.0017079	-.00004374	.000023250	-0.00000	-0.20000	.0054593
220	.00015098	.0017079	-.00004374	.000023250	-0.00000	-0.10000	.0056363
221	.00015098	.0017079	-.00004374	.000023250	-0.00000	-0.00000	.0057521
222	.00015098	.0017079	-.00004374	.000023250	-0.00000	0.10000	.0058178
223	.00015098	.0017079	-.00004374	.000023250	-0.00000	0.20000	.0058413
224	.00015098	.0017079	-.00004374	.000023250	-0.00000	0.30000	.0058350

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OBS	B0	B1	B2	B3	B4	B5
225	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
226	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
227	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
228	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
229	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
230	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
231	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
225	.00015098	.0017079	-.00004374	.000023250	-0.00000	0.4	.0058086
226	.00015098	.0017079	-.00004374	.000023250	-0.00000	0.5	.0057722
227	.00015098	.0017079	-.00004374	.000023250	-0.00000	0.6	.0057361
228	.00015098	.0017079	-.00004374	.000023250	-0.00000	0.7	.0057105
229	.00015098	.0017079	-.00004374	.000023250	-0.00000	0.8	.0057057
230	.00015098	.0017079	-.00004374	.000023250	-0.00000	0.9	.0057319
231	.00015098	.0017079	-.00004374	.000023250	-0.00000	1.0	.0057994

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OBS	B0	B1	B2	B3	B4	B5
232	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
233	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
234	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
235	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
236	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
237	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
238	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
232	.00015098	.0017079	-.00004374	.000023250	0.1	-1.00000	.0005999
233	.00015098	.0017079	-.00004374	.000023250	0.1	-0.90000	.0016347
234	.00015098	.0017079	-.00004374	.000023250	0.1	-0.80000	.0025264
235	.00015098	.0017079	-.00004374	.000023250	0.1	-0.70000	.0032852
236	.00015098	.0017079	-.00004374	.000023250	0.1	-0.60000	.0039213
237	.00015098	.0017079	-.00004374	.000023250	0.1	-0.50000	.0044451
238	.00015098	.0017079	-.00004374	.000023250	0.1	-0.40000	.0048667

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OBS	B0	B1	B2	B3	B4	B5
239	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
240	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
241	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
242	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
243	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
244	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476
245	.0057521	-.00015563	.00000689	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
239	.00015098	.0017079	-.00004374	.000023250	0.1	-0.30000	.0051965
240	.00015098	.0017079	-.00004374	.000023250	0.1	-0.20000	.0054445
241	.00015098	.0017079	-.00004374	.000023250	0.1	-0.10000	.0056212

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242	.00015090	.0017079	-.00004374	.000023250	0.1	-0.00000	.0057367
243	.00015090	.0017079	-.00004374	.000023250	0.1	0.10000	.0058014
244	.00015090	.0017079	-.00004374	.000023250	0.1	0.20000	.0058253
245	.00015090	.0017079	-.00004374	.000023250	0.1	0.30000	.0058189

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OBS	B0	B1	B2	B3	B4	B5
246	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
247	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
248	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
249	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
250	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
251	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
252	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
246	.00015090	.0017079	-.00004374	.000023250	0.1	0.4	.0057923
247	.00015090	.0017079	-.00004374	.000023250	0.1	0.5	.0057550
248	.00015090	.0017079	-.00004374	.000023250	0.1	0.6	.0057196
249	.00015090	.0017079	-.00004374	.000023250	0.1	0.7	.0056940
250	.00015090	.0017079	-.00004374	.000023250	0.1	0.8	.0056893
251	.00015090	.0017079	-.00004374	.000023250	0.1	0.9	.0057155
252	.00015090	.0017079	-.00004374	.000023250	0.1	1.0	.0057031

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OBS	B0	B1	B2	B3	B4	B5
253	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
254	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
255	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
256	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
257	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
258	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
259	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
253	.00015090	.0017079	-.00004374	.000023250	0.2	-1.00000	.0005919
254	.00015090	.0017079	-.00004374	.000023250	0.2	-0.90000	.0016259
255	.00015090	.0017079	-.00004374	.000023250	0.2	-0.80000	.0025160
256	.00015090	.0017079	-.00004374	.000023250	0.2	-0.70000	.0032740
257	.00015090	.0017079	-.00004374	.000023250	0.2	-0.60000	.0039102
258	.00015090	.0017079	-.00004374	.000023250	0.2	-0.50000	.0044333
259	.00015090	.0017079	-.00004374	.000023250	0.2	-0.40000	.0048543

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OBS	B0	B1	B2	B3	B4	B5
260	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
261	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
262	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
263	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
264	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
265	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
266	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
260	.00015090	.0017079	-.00004374	.000023250	0.2	-0.30000	.0051035
261	.00015090	.0017079	-.00004374	.000023250	0.2	-0.20000	.0054310
262	.00015090	.0017079	-.00004374	.000023250	0.2	-0.10000	.0056072
263	.00015090	.0017079	-.00004374	.000023250	0.2	-0.00000	.0057223
264	.00015090	.0017079	-.00004374	.000023250	0.2	0.10000	.0057866
265	.00015090	.0017079	-.00004374	.000023250	0.2	0.20000	.0058102
266	.00015090	.0017079	-.00004374	.000023250	0.2	0.30000	.0058035

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OBS	B0	B1	B2	B3	B4	B5
267	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
268	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
269	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
270	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
271	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

272	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
273	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
267	.00015090	.0017079	-.00004374	.000023250	0.2	0.4	.0057766
268	.00015090	.0017079	-.00004374	.000023250	0.2	0.5	.0057399
269	.00015090	.0017079	-.00004374	.000023250	0.2	0.6	.0057035
270	.00015090	.0017079	-.00004374	.000023250	0.2	0.7	.0056778
271	.00015090	.0017079	-.00004374	.000023250	0.2	0.8	.0056730
272	.00015090	.0017079	-.00004374	.000023250	0.2	0.9	.0056993
273	.00015090	.0017079	-.00004374	.000023250	0.2	1.0	.0057669

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OBS	B0	B1	B2	B3	B4	B5
274	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
275	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
276	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
277	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
278	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
279	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
280	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
274	.00015090	.0017079	-.00004374	.000023250	0.3	-1.00000	.0005067
275	.00015090	.0017079	-.00004374	.000023250	0.3	-0.90000	.0016197
276	.00015090	.0017079	-.00004374	.000023250	0.3	-0.80000	.0025097
277	.00015090	.0017079	-.00004374	.000023250	0.3	-0.70000	.0032669
278	.00015090	.0017079	-.00004374	.000023250	0.3	-0.60000	.0039015
279	.00015090	.0017079	-.00004374	.000023250	0.3	-0.50000	.0044239
280	.00015090	.0017079	-.00004374	.000023250	0.3	-0.40000	.0048442

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OBS	B0	B1	B2	B3	B4	B5
281	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
282	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
283	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
284	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
285	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
286	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
287	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
281	.00015090	.0017079	-.00004374	.000023250	0.3	-0.30000	.0051727
282	.00015090	.0017079	-.00004374	.000023250	0.3	-0.20000	.0054196
283	.00015090	.0017079	-.00004374	.000023250	0.3	-0.10000	.0055952
284	.00015090	.0017079	-.00004374	.000023250	0.3	-0.00000	.0057090
285	.00015090	.0017079	-.00004374	.000023250	0.3	0.10000	.0057736
286	.00015090	.0017079	-.00004374	.000023250	0.3	0.20000	.0057960
287	.00015090	.0017079	-.00004374	.000023250	0.3	0.30000	.0057896

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OBS	B0	B1	B2	B3	B4	B5
288	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
289	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
290	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
291	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
292	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
293	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
294	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
288	.00015090	.0017079	-.00004374	.000023250	0.3	0.4	.0057625
289	.00015090	.0017079	-.00004374	.000023250	0.3	0.5	.0057254
290	.00015090	.0017079	-.00004374	.000023250	0.3	0.6	.0056889
291	.00015090	.0017079	-.00004374	.000023250	0.3	0.7	.0056639
292	.00015090	.0017079	-.00004374	.000023250	0.3	0.8	.0056580
293	.00015090	.0017079	-.00004374	.000023250	0.3	0.9	.0056841
294	.00015090	.0017079	-.00004374	.000023250	0.3	1.0	.0057517

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OBS	B0	B1	B2	B3	B4	B5
295	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
296	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
297	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
298	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
299	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
300	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
301	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
295	.00015090	.0017079	-.00004374	.000023250	0.4	-1.00000	.0005051
296	.00015090	.0017079	-.00004374	.000023250	0.4	-0.90000	.0016171
297	.00015090	.0017079	-.00004374	.000023250	0.4	-0.80000	.0025061
298	.00015090	.0017079	-.00004374	.000023250	0.4	-0.70000	.0032624
299	.00015090	.0017079	-.00004374	.000023250	0.4	-0.60000	.0038961
300	.00015090	.0017079	-.00004374	.000023250	0.4	-0.50000	.0044176
301	.00015090	.0017079	-.00004374	.000023250	0.4	-0.40000	.0048371

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OBS	B0	B1	B2	B3	B4	B5
302	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
303	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
304	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
305	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
306	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
307	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
308	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
302	.00015090	.0017079	-.00004374	.000023250	0.4	-0.30000	.0051649
303	.00015090	.0017079	-.00004374	.000023250	0.4	-0.20000	.0054111
304	.00015090	.0017079	-.00004374	.000023250	0.4	-0.10000	.0055861
305	.00015090	.0017079	-.00004374	.000023250	0.4	-0.00000	.0057001
306	.00015090	.0017079	-.00004374	.000023250	0.4	0.10000	.0057632
307	.00015090	.0017079	-.00004374	.000023250	0.4	0.20000	.0057859
308	.00015090	.0017079	-.00004374	.000023250	0.4	0.30000	.0057783

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OBS	B0	B1	B2	B3	B4	B5
309	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
310	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
311	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
312	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
313	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
314	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
315	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
309	.00015090	.0017079	-.00004374	.000023250	0.4	0.4	.0057507
310	.00015090	.0017079	-.00004374	.000023250	0.4	0.5	.0057133
311	.00015090	.0017079	-.00004374	.000023250	0.4	0.6	.0056764
312	.00015090	.0017079	-.00004374	.000023250	0.4	0.7	.0056502
313	.00015090	.0017079	-.00004374	.000023250	0.4	0.8	.0056450
314	.00015090	.0017079	-.00004374	.000023250	0.4	0.9	.0056710
315	.00015090	.0017079	-.00004374	.000023250	0.4	1.0	.0057385

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OBS	B0	B1	B2	B3	B4	B5
316	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
317	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
318	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
319	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
320	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
321	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
322	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
316	.00015090	.0017079	-.00004374	.000023250	0.5	-1.00000	.0005081
317	.00015090	.0017079	-.00004374	.000023250	0.5	-0.90000	.0016198
318	.00015090	.0017079	-.00004374	.000023250	0.5	-0.80000	.0025069
319	.00015090	.0017079	-.00004374	.000023250	0.5	-0.70000	.0032621

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320	.00015090	.0017079	-.00004374	.000023250	0.5	-0.60000	.0038969
321	.00015090	.0017079	-.00004374	.000023250	0.5	-0.50000	.0044155
322	.00015090	.0017079	-.00004374	.000023250	0.5	-0.40000	.0048361

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OBS	B0	B1	B2	B3	B4	B5
323	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
324	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
325	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
326	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
327	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
328	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
329	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
323	.00015090	.0017079	-.00004374	.000023250	0.5	-0.30000	.0051610
324	.00015090	.0017079	-.00004374	.000023250	0.5	-0.20000	.0054065
325	.00015090	.0017079	-.00004374	.000023250	0.5	-0.10000	.0055807
326	.00015090	.0017079	-.00004374	.000023250	0.5	-0.00000	.0056940
327	.00015090	.0017079	-.00004374	.000023250	0.5	0.10000	.0057565
328	.00015090	.0017079	-.00004374	.000023250	0.5	0.20000	.0057786
329	.00015090	.0017079	-.00004374	.000023250	0.5	0.30000	.0057785

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OBS	B0	B1	B2	B3	B4	B5
330	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
331	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
332	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
333	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
334	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
335	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
336	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
330	.00015090	.0017079	-.00004374	.000023250	0.5	0.4	.0057423
331	.00015090	.0017079	-.00004374	.000023250	0.5	0.5	.0057045
332	.00015090	.0017079	-.00004374	.000023250	0.5	0.6	.0056672
333	.00015090	.0017079	-.00004374	.000023250	0.5	0.7	.0056406
334	.00015090	.0017079	-.00004374	.000023250	0.5	0.8	.0056351
335	.00015090	.0017079	-.00004374	.000023250	0.5	0.9	.0056600
336	.00015090	.0017079	-.00004374	.000023250	0.5	1.0	.0057200

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OBS	B0	B1	B2	B3	B4	B5
337	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
338	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
339	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
340	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
341	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
342	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
343	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
337	.00015090	.0017079	-.00004374	.000023250	0.6	-1.00000	.0005965
338	.00015090	.0017079	-.00004374	.000023250	0.6	-0.90000	.0016363
339	.00015090	.0017079	-.00004374	.000023250	0.6	-0.80000	.0025138
340	.00015090	.0017079	-.00004374	.000023250	0.6	-0.70000	.0032671
341	.00015090	.0017079	-.00004374	.000023250	0.6	-0.60000	.0038988
342	.00015090	.0017079	-.00004374	.000023250	0.6	-0.50000	.0044184
343	.00015090	.0017079	-.00004374	.000023250	0.6	-0.40000	.0048361

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OBS	B0	B1	B2	B3	B4	B5
344	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
345	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
346	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
347	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
348	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
349	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

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350	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
344	.00015090	.0017079	-.00004374	.000023250	0.6	-0.30000	.0051620
345	.00015090	.0017079	-.00004374	.000023250	0.6	-0.20000	.0054066
346	.00015090	.0017079	-.00004374	.000023250	0.6	-0.10000	.0055800
347	.00015090	.0017079	-.00004374	.000023250	0.6	-0.00000	.0056925
348	.00015090	.0017079	-.00004374	.000023250	0.6	0.10000	.0057563
349	.00015090	.0017079	-.00004374	.000023250	0.6	0.20000	.0057757
350	.00015090	.0017079	-.00004374	.000023250	0.6	0.30000	.0057669

361
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OBS	B0	B1	B2	B3	B4	B5
351	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
352	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
353	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
354	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
355	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
356	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
357	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
351	.00015090	.0017079	-.00004374	.000023250	0.6	0.4	.0057302
352	.00015090	.0017079	-.00004374	.000023250	0.6	0.5	.0056990
353	.00015090	.0017079	-.00004374	.000023250	0.6	0.6	.0056620
354	.00015090	.0017079	-.00004374	.000023250	0.6	0.7	.0056350
355	.00015090	.0017079	-.00004374	.000023250	0.6	0.8	.0056290
356	.00015090	.0017079	-.00004374	.000023250	0.6	0.9	.0056543
357	.00015090	.0017079	-.00004374	.000023250	0.6	1.0	.0057212

362
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OBS	B0	B1	B2	B3	B4	B5
358	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
359	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
360	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
361	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
362	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
363	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
364	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
358	.00015090	.0017079	-.00004374	.000023250	0.7	-1.00000	.0006114
359	.00015090	.0017079	-.00004374	.000023250	0.7	-0.90000	.0016390
360	.00015090	.0017079	-.00004374	.000023250	0.7	-0.80000	.0025253
361	.00015090	.0017079	-.00004374	.000023250	0.7	-0.70000	.0032702
362	.00015090	.0017079	-.00004374	.000023250	0.7	-0.60000	.0039000
363	.00015090	.0017079	-.00004374	.000023250	0.7	-0.50000	.0044273
364	.00015090	.0017079	-.00004374	.000023250	0.7	-0.40000	.0048430

363
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OBS	B0	B1	B2	B3	B4	B5
365	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
366	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
367	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
368	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
369	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
370	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
371	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
365	.00015090	.0017079	-.00004374	.000023250	0.7	-0.30000	.0051600
366	.00015090	.0017079	-.00004374	.000023250	0.7	-0.20000	.0054124
367	.00015090	.0017079	-.00004374	.000023250	0.7	-0.10000	.0055869
368	.00015090	.0017079	-.00004374	.000023250	0.7	-0.00000	.0056965
369	.00015090	.0017079	-.00004374	.000023250	0.7	0.10000	.0057575
370	.00015090	.0017079	-.00004374	.000023250	0.7	0.20000	.0057701
371	.00015090	.0017079	-.00004374	.000023250	0.7	0.30000	.0057606

364
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OBS	B0	B1	B2	B3	B4	B5
372	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
373	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
374	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
375	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
376	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
377	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
378	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
372	.00015090	.0017079	-.00004374	.000023250	0.7	0.4	.0057392
373	.00015090	.0017079	-.00004374	.000023250	0.7	0.5	.0057002
374	.00015090	.0017079	-.00004374	.000023250	0.7	0.6	.0056618
375	.00015090	.0017079	-.00004374	.000023250	0.7	0.7	.0056342
376	.00015090	.0017079	-.00004374	.000023250	0.7	0.8	.0056277
377	.00015090	.0017079	-.00004374	.000023250	0.7	0.9	.0056526
378	.00015090	.0017079	-.00004374	.000023250	0.7	1.0	.0057191

365
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OBS	B0	B1	B2	B3	B4	B5
379	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
380	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
381	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
382	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
383	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
384	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
385	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
379	.00015090	.0017079	-.00004374	.000023250	0.8	-1.00000	.0006335
380	.00015090	.0017079	-.00004374	.000023250	0.8	-0.90000	.0016605
381	.00015090	.0017079	-.00004374	.000023250	0.8	-0.80000	.0025447
382	.00015090	.0017079	-.00004374	.000023250	0.8	-0.70000	.0032963
383	.00015090	.0017079	-.00004374	.000023250	0.8	-0.60000	.0039257
384	.00015090	.0017079	-.00004374	.000023250	0.8	-0.50000	.0044429
385	.00015090	.0017079	-.00004374	.000023250	0.8	-0.40000	.0048584

366
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OBS	B0	B1	B2	B3	B4	B5
386	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
387	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
388	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
389	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
390	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
391	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
392	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
386	.00015090	.0017079	-.00004374	.000023250	0.8	-0.30000	.0051023
387	.00015090	.0017079	-.00004374	.000023250	0.8	-0.20000	.0054240
388	.00015090	.0017079	-.00004374	.000023250	0.8	-0.10000	.0055963
389	.00015090	.0017079	-.00004374	.000023250	0.8	-0.00000	.0057070
390	.00015090	.0017079	-.00004374	.000023250	0.8	0.10000	.0057670
391	.00015090	.0017079	-.00004374	.000023250	0.8	0.20000	.0057860
392	.00015090	.0017079	-.00004374	.000023250	0.8	0.30000	.0057765

367
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OBS	B0	B1	B2	B3	B4	B5
393	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
394	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
395	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
396	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
397	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
398	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
399	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
393	.00015090	.0017079	-.00004374	.000023250	0.8	0.4	.0057483
394	.00015090	.0017079	-.00004374	.000023250	0.8	0.5	.0057065
395	.00015090	.0017079	-.00004374	.000023250	0.8	0.6	.0056674
396	.00015090	.0017079	-.00004374	.000023250	0.8	0.7	.0056392
397	.00015090	.0017079	-.00004374	.000023250	0.8	0.8	.0056322

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398	.00015090	.0017079	-.00004374	.000023250	0.8	0.9	.0056565
399	.00015090	.0017079	-.00004374	.000023250	0.8	1.0	.0057225

368
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OBS	B0	B1	B2	B3	B4	B5
400	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
401	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
402	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
403	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
404	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
405	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
406	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
400	.00015090	.0017079	-.00004374	.000023250	0.9	-1.00000	.0006630
401	.00015090	.0017079	-.00004374	.000023250	0.9	-0.90000	.0016093
402	.00015090	.0017079	-.00004374	.000023250	0.9	-0.80000	.0025721
403	.00015090	.0017079	-.00004374	.000023250	0.9	-0.70000	.0033226
404	.00015090	.0017079	-.00004374	.000023250	0.9	-0.60000	.0039504
405	.00015090	.0017079	-.00004374	.000023250	0.9	-0.50000	.0044664
406	.00015090	.0017079	-.00004374	.000023250	0.9	-0.40000	.0048086

369
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OBS	B0	B1	B2	B3	B4	B5
407	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
408	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
409	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
410	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
411	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
412	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
413	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
407	.00015090	.0017079	-.00004374	.000023250	0.9	-0.30000	.0052033
408	.00015090	.0017079	-.00004374	.000023250	0.9	-0.20000	.0054447
409	.00015090	.0017079	-.00004374	.000023250	0.9	-0.10000	.0056151
410	.00015090	.0017079	-.00004374	.000023250	0.9	-0.00000	.0057247
411	.00015090	.0017079	-.00004374	.000023250	0.9	0.10000	.0057838
412	.00015090	.0017079	-.00004374	.000023250	0.9	0.20000	.0058026
413	.00015090	.0017079	-.00004374	.000023250	0.9	0.30000	.0057913

370
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OBS	B0	B1	B2	B3	B4	B5
414	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
415	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
416	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
417	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
418	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
419	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
420	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
414	.00015090	.0017079	-.00004374	.000023250	0.9	0.4	.0057603
415	.00015090	.0017079	-.00004374	.000023250	0.9	0.5	.0057197
416	.00015090	.0017079	-.00004374	.000023250	0.9	0.6	.0056799
417	.00015090	.0017079	-.00004374	.000023250	0.9	0.7	.0056509
418	.00015090	.0017079	-.00004374	.000023250	0.9	0.8	.0056432
419	.00015090	.0017079	-.00004374	.000023250	0.9	0.9	.0056670
420	.00015090	.0017079	-.00004374	.000023250	0.9	1.0	.0057326

371
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OBS	B0	B1	B2	B3	B4	B5
421	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
422	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
423	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
424	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
425	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
426	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
427	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
421	.00015090	.0017079	-.00004374	.000023250	1	-1.00000	.0007032
422	.00015090	.0017079	-.00004374	.000023250	1	-0.90000	.0017272
423	.00015090	.0017079	-.00004374	.000023250	1	-0.80000	.0026084
424	.00015090	.0017079	-.00004374	.000023250	1	-0.70000	.0033572
425	.00015090	.0017079	-.00004374	.000023250	1	-0.60000	.0039838
426	.00015090	.0017079	-.00004374	.000023250	1	-0.50000	.0044905
427	.00015090	.0017079	-.00004374	.000023250	1	-0.40000	.0049114

372
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OBS	B0	B1	B2	B3	B4	B5
428	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
429	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
430	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
431	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
432	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
433	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
434	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
428	.00015090	.0017079	-.00004374	.000023250	1	-0.30000	.0052320
429	.00015090	.0017079	-.00004374	.000023250	1	-0.20000	.0054730
430	.00015090	.0017079	-.00004374	.000023250	1	-0.10000	.0056422
431	.00015090	.0017079	-.00004374	.000023250	1	-0.00000	.0057507
432	.00015090	.0017079	-.00004374	.000023250	1	0.10000	.0058007
433	.00015090	.0017079	-.00004374	.000023250	1	0.20000	.0058264
434	.00015090	.0017079	-.00004374	.000023250	1	0.30000	.0058142

373
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OBS	B0	B1	B2	B3	B4	B5
435	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
436	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
437	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
438	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
439	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
440	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476
441	.0057521	-.00015563	.00000609	-.00002700	.0000031950	-.0025476

OBS	B6	B7	B8	B9	UL	SU	PREDICT
435	.00015090	.0017079	-.00004374	.000023250	1	0.40000	.0057822
436	.00015090	.0017079	-.00004374	.000023250	1	0.50000	.0057407
437	.00015090	.0017079	-.00004374	.000023250	1	0.60000	.0057000
438	.00015090	.0017079	-.00004374	.000023250	1	0.70000	.0056703
439	.00015090	.0017079	-.00004374	.000023250	1	0.80000	.0056618
440	.00015090	.0017079	-.00004374	.000023250	1	0.90000	.0056840
441	.00015090	.0017079	-.00004374	.000023250	1	1.00000	.0057496

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