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The use of choice strategies in decision support system design:
An empirical investigation of decision maker performance and
perceptions

McCommon, Kathy Lynn, Ph.D.

The Florida State University, 1992

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300 N. Zeeb Rd.
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COLLEGE OF BUSINESS

THE USE OF CHOICE STRATEGIES IN DECISION

SUPPORT SYSTEM DESIGN: AN EMPIRICAL INVESTIGATION
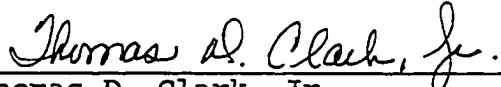
OF DECISION MAKER PERFORMANCE AND PERCEPTIONS

BY

KATHY L. MCCOMMON

A Dissertation submitted to the
Department of Information and Management Sciences
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

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The members of the Committee approve the dissertation of Kathy L. McCommon defended on March 10, 1992.
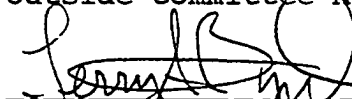
Thomas D. Clark, Jr.
Thomas D. Clark, Jr.
Professor Directing Dissertation

Gloria A. Grizzle
Gloria A. Grizzle
Outside Committee Member
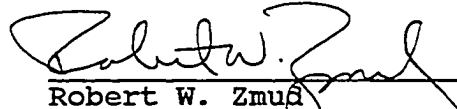
Terry A. Byrd
Terry A. Byrd
Committee Member
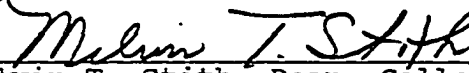
V. Sambamurthy
V. Sambamurthy
Committee Member

Robert W. Zmud
Robert W. Zmud
Committee Member

Approved:

Melvin T. Stith
Melvin T. Stith, Dean, College of Business

I dedicate this dissertation to Mom, Dad and Karen for their love and support through my doctoral program, and also to Robert for loving me and putting up with me during this long and seemingly endless process. It's finally over!

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I would like to thank every member of my committee for providing direction for my dissertation. Particularly I would like to thank my chairman, Tom Clark, for his guidance not only in my dissertation, but throughout my doctoral program.

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THE USE OF CHOICE STRATEGIES IN DECISION SUPPORT SYSTEM DESIGN: AN EMPIRICAL INVESTIGATION OF DECISION MAKER PERFORMANCE AND PERCEPTIONS

Kathy L. McCommon, Ph.D.
Florida State University, 1992
Major Professor: Thomas D. Clark, Jr., D.B.A.

Decision support systems are interactive information systems which incorporate both data and modeling capabilities in an effort to support and improve human decision making. The goal of a decision support system is to support the entire decision making process. In order to do this, an understanding of each phase of the decision making process is necessary. This study focuses on the choice phase of decision making in order to provide useful information to more comprehensive decision support systems. Specifically, the effects of embedding choice strategies into the design of decision aids on decision maker performance and perceptions were examined. Three decision aids were used in a laboratory experiment for a consumer selection task. The first imposed a compensatory choice strategy, another imposed a non-compensatory strategy, and the third allowed the decision maker flexibility to use one or both of those strategies.

The experiment resulted in the following findings. First, performance effectiveness was highest with the non-

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compensatory decision aid, however, the evaluation method had a tendency to bias those results. This finding indicates that several evaluation methods are necessary for a complete understanding of effectiveness. As for efficiency, both imposed strategy decision aids were more efficient than the flexible aid. For this particular task, a structured approach is preferred for both effectiveness and efficiency. Finally, the perceptions were not significantly different for subjects using any of the three decision aids. This finding is particularly useful so that the most appropriate strategy can be employed without fear of negative impressions which could lead to lack of system use.

CHAPTER 1

INTRODUCTION AND RESEARCH OVERVIEW

Introduction

Designing any type of information system is an inter-disciplinary task. Knowledge contributing to the development, implementation, and operation of the information system can be drawn from fields such as computer science, engineering, physics, economics, sociology, and psychology among others. These fields contribute to both the technical and social aspects of an information system. While it is obvious that technical aspects of information systems must receive careful study for increased effectiveness and efficiency, it is also important to study social aspects given the essential interaction with humans as developers, operators, users, and clientele of the information systems.

Decision Support Systems

One particular information system which has a high level of interaction with the user is a decision support system (DSS). A DSS "meshes human judgement and the power of computer technology in ways that can improve the effectiveness of the decision maker" (Keen 1987). The aim of a DSS is to

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support and improve the decision making process (Hackathorn and Keen 1981).

Research in the area of decision support systems has been continually evolving over the last two decades. Early research offered several definitions of a DSS including the following:

> . . . interactive computer-based systems, which help decision makers utilize data and models to solve unstructured problems. (Scott-Morton 1971)

> Decision support systems couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer-based support system for management decision makers who deal with semi-structured problems. (Keen and Scott-Morton 1978)

> Decision support systems (DSS) are interactive computer based aids designed to assist managers in complex tasks requiring human judgment. (Hackathorn and Keen 1981)

Definitions such as these were considered somewhat restrictive by many researchers. In an attempt to overcome this problem, characteristics drawn from both the previous definitions and examples of systems were used to describe decision support systems (Turban 1988, Sprague 1980). A set of DSS characteristics generally included the following:

- interactive systems aimed at less structured problems;
- incorporate both data and modeling capabilities;
- support, rather than replace human judgment;
- emphasize the flexibility to adapt to changes; and
- strive to improve effectiveness rather than efficiency of decision making.

Although the human decision maker is recognized as part of a DSS, research initially followed a technological approach focusing on the system. More recently, however, attention has

shifted toward the need to concentrate on the decision component of the decision support system (Keen 1987). DSS research should move from providing passive support to actively stimulating changes in an attempt to improve the decision making process (Jelassi et. al. 1987, Keen 1987). Silver (1990) considers the inevitable changes caused by decision support systems on the decision making process by examining both non-directed and directed change. Directed change is a deliberate attempt to force the direction of a change through a decision support system, whereas, non-directed change allows the decision maker to determine the change without using the decision support system to force the direction of the change. "System restrictiveness" and "decisional guidance" are two attributes of a decision support system which may be manipulated to accomplish either directed or non-directed change. These attributes have been defined as (Silver 1990):

> System Restrictiveness: the degree to which and the manner in which a Decision Support System limits its users' decision-making processes to a subset of all possible processes.

> Decisional Guidance: the degree to which and the manner in which a Decision Support System guides its users in constructing and executing decision-making processes, by assisting them in choosing and using its operators.

From these definitions, it is apparent that knowledge of the human decision making process is necessary as a basis for the system design effort.

Human Decision Making

Several streams of research have been directed toward the understanding of human decision making. Early work followed a classical economic perspective of rational decision making. Truly rational decision makers are able to evaluate all of the finite, identifiable options available with complete information about the future outcomes associated with each. However, this type of decision making is idealistic given most decision making opportunities. Simon (1960) suggested that due to uncertainties and limitations, individuals exhibit "bounded rationality" in decision making. Bounded rationality is characterized by constraints, aspiration levels and satisficing behavior. These characteristics occur within the frame of four decision making phases: intelligence, design, choice and implementation. These phases are interwoven, and each is a process within itself. Figure 1 presents the theoretical model surrounding the decision making process. Each phase of the decision making process is influenced by the other phases of the process, as well as the context within which the decision making occurs.

The context, or "problem domain" consists of decision aid, task and individual characteristics. Decision aids, or support tools range from pencil and paper to computerized decision aids with elaborate capabilities. The characteristics of the task include complexity (size, similarity of alternatives and uncertainty), response mode (judgement or

Problem Domain

Decision Making
Process

Decision outcomes

Decision Aid
Characteristics

Task
Characteristics

Individual
Characteristics

Intelligence
Phase

Design
Phase

Choice
Phase

Implementation
Phase

Performance

- goal attainment
  (effectiveness)
- time
  (efficiency)

Perceptions

- confidence
- satisfaction
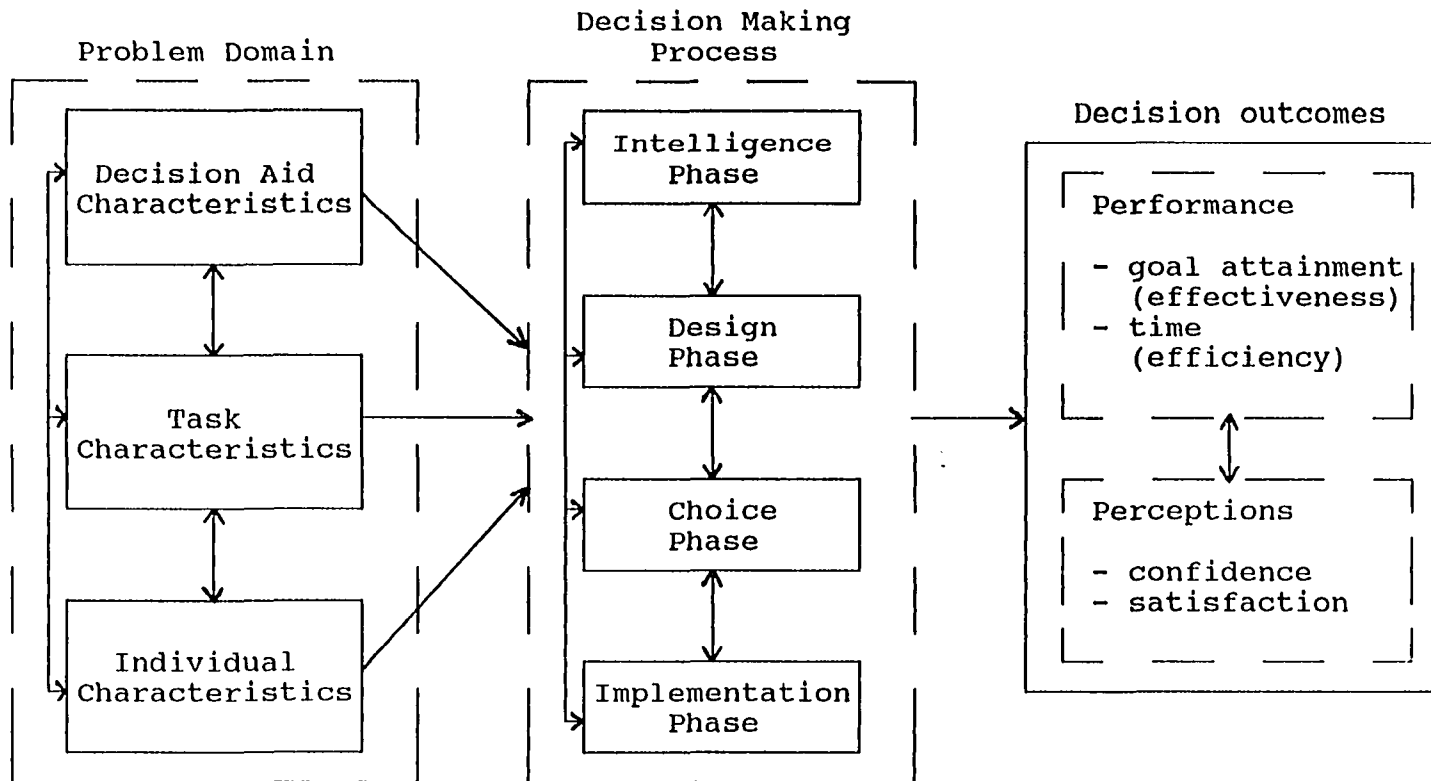
Figure 1. Theoretical Model of the Decision Making Process

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choice) and possible time constraints. Finally, individual characteristics include ability levels, decision making styles, familiarity with the task and demographic variables. All three of these categories of variables interact with each other to produce a unique problem domain which affects any decision making process. Therefore, to design support tools such as a DSS for more effective decision making, these effects on the decision making process must be studied.

To gain a complete understanding of these effects, several approaches could be taken. One approach would be a comprehensive study encompassing all phases of decision making within a combination of different problem domains. Another would be to study one phase of the decision making process in a variety of problem domains. Alternatively, one variable of the problem domain could be examined in relation to the entire decision making process.

At this point, most DSS research focuses on decision outcomes, not specifically dealing with the processes or the phases of decision making separately. Most decision making research, on the other hand, focuses on processes used during the choice phase. Both the processes and outcomes of decision making are important. However, undertaking a study of the entire decision making process, concentrating on both the outcomes and processes involved in each phase may be too broad to provide valuable information. Instead, an iterative approach would offer greater control in order to understand

the link between process and outcome, and provide an opportunity to build a foundation for more comprehensive studies.

Using an iterative approach based on previous work, the current study will focus on how changes in the problem domain, specifically the support tool, affect the **choice** phase of the decision making process. During this phase, choices are made between feasible alternatives with varying attribute values. Choice strategies can be classified as either compensatory or non-compensatory approaches to alternative selection (Hogarth 1980). Compensatory methods, with deliberate explicit rating of alternatives, are characterized by greater amounts of information used and less variability of search across different alternatives. Generally the same aspects of each alternative are searched for and evaluated. Characteristics of non-compensatory methods include less information used and more variability of search across different alternatives. Some alternatives are evaluated on many aspects, while others are not (Hogarth 1980). Further explanation of both compensatory and non-compensatory strategies, including examples, will be presented in Chapter 2. Understanding these strategies is critical to understanding the overall decision making process, and ultimately designing DSS to support that process.

The use of these strategies in the current study will be in the form of both directed and non-directed change.

Specifically, system restrictiveness will be manipulated in an effort to begin examining the questions presented in the following section.

Problem statement

How will different choice strategies incorporated in DSS design affect decision maker performance and perceptions under varying levels of task complexity?

This research question will be investigated through a more detailed search of the literature concerning decision support systems and human decision making. Specific research questions and hypotheses will be developed in conjunction with an explanatory research model based on existing theory and empirical research. The goal is to make an important contribution to knowledge and practice by enhancing the understanding of how decision outcomes are impacted by choice strategies. More specifically, to understand how these outcomes might change when decision makers faced with various task settings interact with DSS utilizing different choice strategies. Some decision support systems are flexible, with the ability to follow the alternative selection (choice) strategy chosen by the user (lower system restrictiveness), whereas other decision support systems impose either a compensatory or non-compensatory alternative selection strategy (higher system restrictiveness). Due to the

diversity of individuals, tasks and systems, a complex set of relationships exists.

To better understand these relationships, both performance (goal attainment, time) and perceptual (satisfaction, confidence) outcomes will be measured to answer several questions. For instance, how is decision maker performance affected by a DSS imposing either a compensatory or non-compensatory strategy? How is decision maker performance affected by a DSS allowing the flexibility to choose individual alternative selection strategies? How are these changes affected by differences in task complexity? In addition, how are perceptions concerning the task and support tool affected in each of these situations?

Answers to questions like these will provide valuable insight into the interactions between elements of the problem domain (individual, task, support tool) occurring within the choice phase of the decision making process. Consequently, a better understanding of these relationships will aid in the design of decision support systems for more effective decision making.

Purpose of the study

"Decision making is an integral part of the management of any kind of organization" (Harrison 1987). Effective decision making is the key to success for both individuals and the organizations in which they work. Since decision support

systems have the potential to aid in a more effective decision making process, this dissertation should provide information of widespread interest.

By addressing the use of decision aids with different choice strategies, this dissertation will combine knowledge from both cognitive psychology and information systems to provide a link between decision making process and outcome in an effort to improve DSS design. The "process of selection" or choice strategy will be intentionally designed into the decision aid. In this way, process effects on decision outcomes can be investigated within the context of varying task complexity.

Methodology Overview

A laboratory experiment, detailed in Chapter 3, is selected as the methodology for this dissertation in order to provide a high level of control and measurement precision. The experiment will involve upper division undergraduate student subjects making an apartment selection using different decision aids.

Subjects will be asked to complete a questionnaire describing their personal priorities and preferences with respect to apartments on two separate occasions occurring at one to two week intervals prior to using the decision aid. On one of these occasions, measures of analytic ability and prior experience with the problem will be taken. These measures may

be used as covariates during the analysis of experimental results.

Subjects will be scheduled for laboratory sessions to perform the apartment selection task. At this session, the subject will choose an apartment from among a set of predefined alternatives using one of the three decision aids. The task will be one of either high complexity (many alternatives and a high degree of alternative similarity) or low complexity (few alternatives and a low degree of alternative similarity). The task will be pretested to assure a differentiation in task complexity.

The decision aid will either impose a compensatory choice strategy, impose a non-compensatory choice strategy, or allow the decision maker the flexibility to choose a strategy for alternative selection. After making the selection, the subjects will complete a questionnaire designed to measure their perceptions of confidence in the selection made, satisfaction with the selection process and satisfaction with the decision aid.

On two separate occasions after this session, subjects will again be asked to complete a questionnaire describing their personal priorities and preferences with respect to apartments. In this way, any inconsistencies or changes in preferences and/or priorities can be determined to establish the validity of using goal attainment as a performance measure.

Both performance and perceptual outcomes will be used to compare the effects of each of the three decision aids. Compensatory versus non-compensatory strategies, and imposed versus flexible strategies will be evaluated. The influence of task complexity in each of these relationships will also be investigated.

Plan of Presentation

The introduction and research overview of Chapter 1 is followed by a review of the relevant literature in Chapter 2. The literature drawn from the fields of information systems and cognitive psychology provide a basis for the experimental model and specific hypotheses presented in Chapter 3. The details of the research methodology complete the third chapter.

Explained in Chapter 4 are the features of the decision aid design based on the different choice strategies. A description of the laboratory setting, and data gathered during the experiment are presented in Chapter 5, along with the analysis of experimental data and results of the hypothesis tests.

A summary of the investigation is presented in Chapter 6, relating conclusions reached and their impact on the research questions, as well as decision support system design. Limitations of the research and additional plans for future study are also discussed.

CHAPTER 2

LITERATURE REVIEW

Introduction

The review of relevant literature will be presented based
on the problem domain discussed in Chapter 1. Before looking
at the literature with respect to each area of the problem
domain, a brief introduction will explain how the research in
each area fits within the theoretical model of decision
making. Decision making has been studied in different ways in
several disciplines. Decision making research in the fields
of cognitive psychology and marketing (consumer behavior) have
tended to study the areas of the problem domain as they affect
the decision making **process**, without concern for the decision
outcomes. Whereas, DSS research in the field of information
systems has tended to study the areas of the problem domain
focusing on support tools and how they affect decision making
outcomes, without mention of the underlying process. Very few
studies have focused on the problem domain variables as they
affect the outcomes, considering the process as a part of that
effect. A more detailed explanation of both process and
outcomes follows in order to better understand these

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relationships before turning to the empirical findings for each variable in the problem domain.

Process

The decision making process is made up of four inter-dependent phases: intelligence, design, choice and implementation (Simon 1960). The intelligence phase involves searching or scanning the environment for problems and opportunities. A prerequisite to this activity is knowledge of objectives or goals. The decision maker must be aware of these objectives, as well as the current position in order to recognize problems. Once a problem is identified it should be analyzed for better understanding.

Design phase activities include searching for, developing and analyzing possible alternative courses of actions. At this point, criteria which will be used for selection in the choice phase are set. During the choice phase, further analysis is performed and an alternative is selected. The implementation phase involves carrying out the chosen alternative and monitoring the results.

The phases of the process often overlap and the steps taken are not always sequential. Movement back and forth between the phases is sometimes necessary to gather additional information or change earlier specifications. In addition, the process is not complete with implementation. Continuous monitoring will eventually lead the decision maker to uncover

new problems resulting in a cycle back to the intelligence phase.

Much of the current research in the area of decision making does not deal with the entire decision making process. The "process" generally studied in the cognitive psychology literature is the "decision strategy" of the decision maker. As used in this literature, these strategies are methods for alternative selection. The decision maker chooses an alternative by acquiring and evaluating information from a previously collected and structured set of alternatives. Technically this only involves the choice phase of the overall decision making process. While this one stage is important to decision making, it is not the only phase in the process. Therefore, "decision strategy" should more correctly be referred to as "choice strategy." This terminology will be used throughout the current research.

The processes of the choice phase are studied through protocol analysis and/or process tracing techniques. Researchers measure behavioral indicators such as patterns of information acquisition and search, as well as total information searched to determine the choice strategy being used.

Many different choice strategies have been identified in the literature. Svenson (1979) presents 14 different rules for alternative selection. In many cases, only subtle differences distinguish these rules from one another. Hogarth

(1980) captures these rules in seven categories of choice strategies which have been widely used in subsequent studies. As previously mentioned, these choice strategies can be classified as either compensatory or non-compensatory. Compensatory strategies confront conflicts by allowing trade-offs among dimensions (attributes) of an alternative. The decision maker can balance a very high value on one attribute against a low value on another. This type of strategy generally leads to greater amounts of information used and less variability of search across alternatives. In other words, the same dimensions for each alternative are usually searched for and used in evaluation. Non-compensatory strategies do not allow trade-offs among dimensions, and therefore they avoid conflicts. The decision maker will not consider alternatives with low values on critical dimensions. This type of strategy generally leads to less information used and greater variability of search across alternatives. Search and evaluation does not necessarily include the same dimensions for each alternative (Hogarth 1980).

Compensatory strategies include the linear, additive difference and ideal point models. The **linear (LIN)** model, also referred to as the additive model, is one of the most extensive. Each attribute must be, on some scale, measurable with a weighting of relative importance assigned to it. The sum of weighted attributes is calculated for each alternative, and the alternative with the highest value is selected. This

approach requires the use of all information for every alternative, and enables trade-offs between attributes. Following this strategy requires an inter-dimensional or alternative based pattern of information search.

The **additive difference (AD)** model, on the other hand, follows an intra-dimensional or attribute based pattern of information search. Pairs of alternatives are examined one attribute at a time in order to evaluate the difference between each attribute. The aggregate net difference is used to select the best alternative. This alternative is then compared to the next until only one alternative remains. Relative importance weightings may also be used with this strategy.

The third compensatory strategy is the **ideal point (IP)** model. Using this model, the decision maker must have a conceptual idea of the "perfect" alternative. The distances between the ideal points and the actual values for each attribute are used to evaluate every alternative. An inter-dimensional/alternative based pattern of information search results from this strategy.

Non-compensatory strategies include the conjunctive, disjunctive, elimination-by-aspects and lexicographic models. The **conjunctive (CNJ)** model uses cut-off points specified by the decision maker to select an alternative. Any alternative not meeting the minimum cut-off point on an attribute is eliminated. The first alternative meeting all the minimum

cut-off values is the one selected, resulting in a 'satisficing' type behavior. This strategy follows an inter-dimensional pattern of information search, but does not necessarily lead to a complete search of all available information.

The **disjunctive (DSJ)** model evaluates an alternative only on its strongest attribute. With this approach the alternative does not need to meet minimum standards on each attribute. An inter-dimensional pattern of information search and inconsistent use of available information results.

A third model, **elimination-by-aspects (EBA)** follows an intra-dimensional pattern of information search. The most important aspect or attribute is determined. Any alternative not having or meeting a minimum on this attribute will be eliminated. If more than one alternative remains, the next most important attribute is determined, and the procedure continues until only one alternative prevails.

The final non-compensatory strategy is the **lexicographic (LEX)** model. Similar to the EBA model, the decision maker must determine the most important attribute. The alternative with the highest value on this attribute is chosen. If, however, more than one alternative ties on this attribute, the second most important attribute is used as a tie breaker. This continues until one alternative dominates all of the others and this one is selected. Again, like the EBA model, an intra-dimensional pattern of information search occurs.

Compensatory strategies require a greater amount of processing, typically use more of the available information, and consequently demand more time. As a result compensatory strategies are generally considered to be more accurate, but also more difficult to use than non-compensatory strategies. This is an important issue when considering a framework in which to conduct research.

Payne (1982) presents three frameworks commonly used in the study of factors affecting the selection of a choice strategy. The first framework is a perceptual model where changes in the task and context affect the cognitive frames of the decision maker. These cognitive frames affect the choice made by the decision maker, however, explicit choice strategies are not necessarily investigated. This model has been the basis of many empirical studies by Kahneman, Tversky and others (Tversky and Kahneman 1981, Kahneman and Tversky 1982, 1984, 1986, Levin et. al. 1985, 1986, Fischer et. al. 1986, Mowen and Mowen 1986, Budescu and Weiss 1987, Cohen et. al. 1987). The second framework is a production system model (Pitz 1977). In this model, changes in task and context lead to different productions (condition-action pairs) being activated. Little research has been conducted in the context of this framework. The current study will be based on the third framework, first presented by Beach and Mitchell (1978), which has been used most often for research similar to that

involved with this dissertation. Further explanation of the first two models may be found in Payne (1982).

Beach and Mitchell (1978) presented a contingency model of strategy selection based on cost/benefit principles. The cost of the strategy is the effort required to use that strategy, while the benefit is the accuracy level resulting from use of that strategy. The model states that the selection of a choice strategy is contingent on characteristics of both the decision task and the decision maker. Variations in these characteristics change the effort and accuracy involved in using a particular choice strategy. In each case, some form of cost/benefit analysis must be performed in order to select the appropriate choice strategy.

Task and individual characteristics, as well as their effects will be explained in more detail in the section containing the empirical research relating to each area. Before turning to the empirical research, however, commonly used measures of decision making outcomes will be described.

Outcomes

The previous models from cognitive psychology are used to study decision making processes in the choice phase. With only a few exceptions (to be discussed in subsequent sections), the empirical research in this area does not consider the outcomes of the decision making process. Alternatively, most of the DSS research in the field of

information systems involves the variables of the problem domain with a focus on support tools (DSS), and how they affect decision making outcomes (performance and perceptions). The decision making process used to arrive at the outcomes is generally not considered as anything other than a "black box."

Performance. The outcomes measured in many of these studies include both performance and perceptions. Performance is judged by variables attempting to measure effectiveness and/or efficiency depending on the emphasis of the support tool. The evaluation of effectiveness may be accomplished in many different ways. The relative performance of a decision may be assessed by a panel of independent raters, or through comparison of an objective performance measure such as profit level achieved. The absolute performance of a decision may be obtained through an accuracy/error rate measure such as the percentage of correct responses on a series of choices. In addition to either of these methods, the variability of performance levels across time also may be included in the evaluation. The performance goal may be something less concrete, however, such as the level of decision maker understanding which results from decision making, or a completely different type of approach may be taken which does not measure a performance level at all. Instead, the purpose may be to measure the changes in alternative selection which result from variations in the problem domain. In any case,

the attempt is to judge how effective a support tool, generally a DSS, may be under varying conditions.

Other studies stress the efficiency of decision making as an important performance variable. Efficiency is commonly measured in terms of effort and productivity levels, with time being the overwhelming surrogate used for effort. Productivity would include such things as the number of ideas generated, the number of alternatives considered, the amount of information used, or the percentage of available information used.

Perceptions. Many times the perceptions of individual decision makers are as important as the level of performance. Perceptions refer to the way an individual decision maker understands or views some aspect of the decision. In previous information systems research, perceptions such as user satisfaction have been used as a surrogate for effectiveness. This practice has been criticized as an inadequate representation of effectiveness (Melone 1990). With respect to decision making research, however, perceptions are not intended to represent effectiveness or performance of the system per se. Instead, perceptions are measured as another type of outcome variable which results from decision making. Perceptions are important because they have been shown to affect information system usage (Baroudi et. al. 1986, Davis 1989). Use of the system is imperative in order to gain any of the performance benefits which may be associated with the

particular DSS. Therefore, perceptions may affect performance (and vice versa), but perceptions are not intended to act as a surrogate for performance.

One of the more common perceptual measures is the decision maker's opinion of his own decision performance. This information may be gathered through confidence measures, or by directly asking for predictions of performance levels. Perceptions of the difficulty or confusion felt by the decision maker, as well as changes in opinions toward the problem addressed are of interest for assessing the task setting. Finally, decision maker perceptions of the decision aid are of great importance. Satisfaction with the decision aid, perceived usefulness of the information provided, and any changes in opinions toward computerized decision tools help to measure these perceptions.

Both performance and perceptions are of interest in the design of decision support systems, especially systems which are optional for the decision maker. These measures enable the information systems researcher to better understand how variables of the problem domain, specifically support tools, affect decision making **outcomes**. Problem domain effects on the **process** of decision making have been mainly studied by cognitive psychologists. Together these two areas provide important insight for the development of decision making research which addresses both process and outcomes. The next section will detail the specific effects of problem domain

variables on decision making which have been found in the literature.

Problem Domain

The review of relevant literature will begin with support tool effects, followed by task, individual, and finally interaction effects. These empirical findings are drawn from the fields of information systems, cognitive psychology and marketing. A summarization of the findings will be presented in the final section.

Support Tool

Support tools range from pencil and paper to computerized decision aids with elaborate capabilities. A common decision aid used in choice strategy research is an information board. An information board provides a matrix type presentation of alternatives and attributes. Typically alternatives are placed in rows, while attributes make up the columns. Initially all information is hidden from view. During the experiment, subjects turn over index cards to acquire information concerning the attributes and alternatives displayed on the board. This approach allows a process tracing mechanism to determine patterns of information search.

Computerized decision aids vary greatly in their information processing capabilities. At the lowest level, the computer screen may be used simply as a "computerized information board" with subjects gathering the same

information by selecting cells on the screen to "uncover." At a slightly higher level, computerized aids provide a variety of possible displays, without processing functions. At the highest level computerized decision aids would provide diverse display methods, as well as the necessary processing and modeling functions required to complete the decision task.

Support tool effects have predominantly been studied in laboratory experiments following two basic streams of research. First, many studies have examined the effects of support tool "availability" by testing decisions made with and without the aid of computerized support (Aldag and Power 1986, Dickmeyer 1983, Goslar et. al. 1986). In fact, these studies were actually investigating the effects of various levels of support tools (Bettman and Zins 1979, Paquette and Kida 1988), ranging from pencil and paper to complex computerized decision support systems. The studies often include more than one computerized tool with different levels of processing capability (Dos Santos and Bariff 1988, Cats-Baril and Huber 1987, Kleinmuntz and Thomas 1987). The differences in support level result in changes to the amount of cognitive processing necessary by the decision maker, and may also change the content of the information provided.

The second stream of research investigates variations in support tool display or presentation effects such as form (Johnson et. al. 1988), organization of information (Bettman and Zins 1979, Jarvanpaa 1989), tabular versus graphical

support (Benbasat and Dexter 1985, Te'eni 1989), sequential versus simultaneous display of information (Huber et. al. 1990), or paper versus computer presentation of information (Cats-Baril and Huber 1987, Lucas and Nielsen 1980, Lucas 1981). In other words, the same information is provided to the decision maker, although the manner in which that information is presented may differ. The results of these studies will be described under the topic headings of Support Level and Display Characteristics, respectively.

Support Level. Empirical findings with respect to the effects of support level have varied widely. Dickmeyer (1983) found that the availability of a computerized decision aid enabling the decision maker to test policy changes in a budget planning problem increased performance over the use of long range forecast printouts without the ability to test policy changes. Subjects with the computerized aid increased problem understanding through policy test feedback which aided the reformulation of preference functions, and as a result they revised preferred policy choices.

In a medical diagnostic task, computerized decision aids with and without a section containing calculated figures to aid the interpretation of outcome feedback were tested (Kleinmuntz and Thomas 1987). Again, use of a decision aid with enhanced feedback capabilities increased the accuracy of the choices made by the decision makers. With or without the additional aid, decision makers used judgment-oriented

(judgement) strategies as opposed to action-oriented (choice) strategies, evidenced by substantial reliance on testing prior to action. (Judgment and choice are response modes which will be explained in the task section).

Mixed performance results were found concerning the use of a decision aid heuristic for an ill-structured career planning problem (Cats-Baril and Huber 1987). The availability of the aid, computerized or not, increased the quality of decision maker choices as evaluated by independent raters, although decision maker confidence in the choice did not change. However, user satisfaction with the decision aid and attitudes toward the task decreased.

The opposite results were shown for decision makers using a computerized decision tool which enabled decision analysis structuring and provided modeling capabilities for a strategic management problem (Aldag and Power 1986). In this setting, users had favorable perceptions of the computerized decision analysis aid, however, no difference in performance (as judged by independent raters) between decisions made with or without the aid resulted.

Todd and Benbasat (1991) studied support level focusing on the decision making process instead of the decision making outcome. In a series of laboratory experiments, subjects were given decision aids similar to a computerized information board with various information processing capabilities for an apartment selection task. Choice strategies were influenced

by decision aid. Subjects tended to use the choice processing strategies which were strongly supported by the particular decision aid. In other words, subjects adapted their choice processing to reduce effort since less effort would be required by following the strategy supported by the decision aid. This result suggests that effort is an important consideration in decision aid design.

In another study, subjects were instructed to use either a LIN, AD, EBA or mixed processing strategy, and monitored for compliance (Paquette and Kida 1988). Although a decrease in accuracy resulted from an increase in task size, the particular choice strategy applied had no effect on the accuracy level. The choice strategy did have an effect on the selection time, however, with the EBA strategy taking significantly less time. These results would suggest a non-compensatory strategy such as EBA may be useful for reducing effort while still maintaining the same level of accuracy as the compensatory strategies. In an earlier study with a consumer choice problem, Bettman and Zins (1979) also found that a non-compensatory strategy (LEX) required less time and was perceived favorably due to lower confusion. This study did not, however, look at the effectiveness of decision outcomes.

Goslar, Green and Hughes (1986) found no changes in performance or perceptions due the use of a DSS with enhanced capabilities as opposed to computer printout use. For an ill-

structured marketing problem, the decision making time, amount of data considered, and confidence in the decision each showed no significant changes with DSS use. In fact, subjects without the DSS considered more alternatives.

Dos Santos and Bariff (1988) followed a different kind of approach to support-level testing which contrasted two different types of support for each of three different aspects of DSS design. Their study is included in this category because the changes affected the actual content of information provided to the decision maker, not just the presentation form. First, system guided model manipulation outperformed user guided model manipulation as measured by the ability of decision makers to identify and prioritize problems in a simulated business environment. In addition, display of incremental changes outperformed the presentation of actual outcomes. Variable versus exception based report content was also tested, but without significant results.

Subjects using the decision support systems were undergraduate business students enrolled in an information systems course, which provided a fairly homogenous group with respect to problem and computer experience. However, a lack of actual managerial/business experience may explain why the structured systems improved decision making performance. These findings are counter to the idea that providing the user with flexibility in DSS design will improve decision making performance. Instead, the appropriate level of DSS

flexibility may be influenced by individual characteristics such as knowledge and familiarity with the problem.

Display Characteristics. Many different variations of information presentation effects have been explored. The majority of the research investigates these effects on decision making outcomes, however, Jarvanpaa (1989) takes a decision making process approach. This study used different formats of information presentation for a restaurant site selection problem to determine effects on processing strategy. The formats were graphical displays by attribute, alternative or matrix arrangement. Choice processing behavior included both information acquisition and information evaluation stages. The type of format significantly affected the processing strategy as indicated by the direction of information acquisition. Attribute and matrix display formats promoted an attribute based or intra-dimensional pattern of information acquisition, whereas alternative display formats promoted an alternative based or inter-dimensional pattern of information acquisition. These findings suggest that information acquisition strategies are sensitive to the cost/benefit changes resulting from changes in information presentation format. Information acquisition strategies tend to follow the same pattern as the information presentation format in an effort to minimize costs when benefits remain constant. This result would indicate that the cost/benefit

framework is a valid approach to study the effects of decision aid characteristics such as embedded choice strategies.

Bettman and Zins (1979) used similar formats in a tabular layout for a consumer choice problem, although the format effects were measured for performance variables. Significant time effects were reported with matrix display taking the least amount of time, followed by alternative display and finally attribute display. User perceptions were most favorable for alternative displays which were considered least confusing.

In a different type of study, pairs of numbers for simple gambles were presented to decision makers in several forms ranging from decimal values and easy fractions to difficult fractions (Johnson, Payne and Bettman 1988). Both performance and perceptions were affected. Selection time, inconsistency in choice (preference reversals), and perceived task difficulty increased when decision makers were faced with numbers in the form of complicated fractions.

In another form of display manipulation, Huber et. al. (1990) tested sequential versus simultaneous display effects on decision outcomes. In a candidate selection decision, more candidates were selected, lower threshold levels were allowed, and less time resulted from sequential presentation.

The previous studies did not employ or address computer presentation of information. The following research either uses computerized presentation with variations in format, or

specifically examines the effect of computerized presentation versus non-computerized presentation on decision outcomes.

Cats-Baril and Huber (1987), as previously mentioned, found significant performance effects for the decision aid heuristic, but the use of a computerized presentation mode had no effect on these outcomes. Lower satisfaction with the decision aid and a negative change in attitude toward the computer resulted from the computerized presentation mode.

Both computer presentation and graphical display effects were studied in a logistics management game setting (Lucas and Nielsen 1980). Limited support for CRT display and no support for graphical display effects on profit performance and learning were reported. Lucas (1981) addressed these same issues for a reorder quantity selection problem with mixed results. CRT users were divided into groups with various combinations of graphical and/or tabular display for two different variables, while one group used only hardcopy output. Hardcopy users, as compared to all CRT users, showed significantly better performance (lowest cost) and problem understanding. These same results were found for CRT users with both graphical and tabular displays, as opposed to graphical alone. In addition, graphical CRT users had greater problem understanding than non-graphical CRT users, but performance and perceptions of information usefulness were not different.

Graphical versus tabular and multi-color versus mono-

color presentation effects were investigated using an allocation problem (Benbasat and Dexter 1985). Tabular versus graphical display had no effect on profit performance or time, but decision makers perceived tabular as more accurate and graphical as more relevant to the problem. Multi-color versus mono-color display had no effect on time, but multi-color presentations increased profit performance and perceptual ratings of problem understanding. No interaction effects between color and format were significant.

Graphical and tabular displays were the focus of another study, this time in conjunction with the number of windows (Te'eni 1989). Graphics reduced complexity and increased effectiveness, but not efficiency in an information system design task. In contrast, more windows (4 instead of 2) reduced complexity and increased efficiency, but not effectiveness. The correlation between number of windows and efficiency was shown to be stronger for tables than graphs.

Together these studies present mixed results. Higher levels of support increased performance in some cases, but not in others. Even when higher performance was achieved, perceptions of performance were not necessarily affected. Perceptions were often higher when performance did not actually increase. Results from support level studies are too inconsistent to draw conclusions.

Research concerning display characteristics, however, provides some insight into support tool design. Performance

increases do not generally result by simply presenting the same information in computerized form. Changes in tabular versus graphical support have mixed effects on both performance and perceptions, while multi-color display appears to increase both performance and perceptions. Increases in time result from format changes such as difficult fractions or attribute organization. In addition, the organization of the information affects the manner in which information acquisition processing occurs.

Mixed results may partially be explained by interactions between the support level or display, and characteristics of the task or individual. Some of the previous studies addressed these interactions, and will be reviewed in the section pertaining to interaction effects.

Task

Tasks which are contained primarily in the choice phase of the decision making process are ones which require the decision maker to make selections from a predefined set of alternatives. Variations of this type of task include choosing the "best" or most appropriate alternative or solution, rating alternatives or even categorizing alternatives. Categorization would involve both the classification of alternatives, and decisions as to whether or not an alternative belongs in a category. Research involving choice tasks demonstrates that changes in task characteristics

significantly influence both decision making processes and outcomes.

Payne (1982) divides these task characteristics into two groups, task and context effects. Task effects pertain to the general structure of the decision problem such as response mode required, problem size, time pressure, presentation mode, and agenda constraints. Context effects apply to the values of the objects in the decision set such as similarity of alternatives and overall attractiveness of alternatives (quality of the option set).

Earlier, Beach and Mitchell (1978) used similar categories, but several different variables to define task characteristics affecting decision making. Task characteristics which are inherent in the decision problem include unfamiliarity, ambiguity, complexity (measured with several dimensions including problem size), and instability. Task characteristics which describe the decision environment include irreversibility, significance, accountability, and time/money constraints. These two categories are similar to Payne's task (structure) and context effects, respectively.

Based in part on these two models, empirical decision making research involving changes in task characteristics will be presented in this section. Included as task characteristics are many of the previous variables, although a few modifications have been made.

Problem size is generally specified by both the number of

alternatives and attributes, while the closeness or inter-action between attribute values defines the similarity of alternatives. Uncertainty of alternatives refers to the probability associated with attribute values. These three variables could be combined to form a single measure of task "complexity."

Another possible task characteristic is a time constraint that may be placed on completion of the task. Additionally, the response mode may be stated, specifically requiring either a choice or judgment to be performed.

Judgement requires the explicit evaluation of each alternative. This process involves a more deliberate and time consuming type of effort, which encourages the use of all information regarding each alternative. On the other hand, choice only requires that one alternative is selected, while the others are rejected. Choice involves comparisons between alternatives by focusing on distinguishing features of each alternative, which requires much less time and effort than judgment (Hogarth 1980). In many situations, judgment will be used as the basis for choice, although either can be performed alone (Einhorn and Hogarth 1981). The distinction between judgment and choice response modes is not necessarily made in every study presented.

Variables which are not classified as task characteristics of the current study are presentation mode, significance, and familiarity (previous experience). Presentation mode was

described and included as a support tool characteristic in the previous section. Significance and experience are dependent on the individual, and therefore are included as interaction effects between the task and the individual.

Complexity. A consistent result of several studies, including a classification problem (Larichev and Moshkovich 1988), a business problem (Paquette and Kida 1988), a time allocation decision (McIntyre and Ryans 1983), and a consumer choice problem (Henry 1980), is the reduction in performance due to an increase in task size. Typically the increase in task size lowers both the decision effectiveness and efficiency (more time taken).

Another factor which reduces performance is the risk or uncertainty level associated with the task. Kleinmuntz and Thomas (1987) predicted that subjects faced with a low risk medical diagnostic task would follow more action-oriented (less deliberate processing) strategies, as well as achieve higher accuracy levels than those facing the high risk setting. The low risk performance was significantly better, but subjects did not switch from judgment-oriented to action-oriented strategies as expected. Even in the low risk condition, subjects relied on substantial testing before action.

Waller and Mitchell (1984) found that decision makers did select more analytic (judgment oriented) strategies as uncertainty increased. However, the strategies were to be

performed by an information system not the individual. This may suggest that decision makers recognize a need for more analytic strategies, but does not necessarily suggest they would be willing or able to execute these strategies personally.

In subsequent research, however, both children and adults were shown to modify choice strategies due to changes in task characteristics. As task size increased, the percentage of information acquired decreased, while the variability of information acquired per alternative and the use of non-compensatory strategies (CNJ and EBA) increased for children (Klayman 1985), as well as experts (Biggs et. al. 1985) confronted with a choice situation. The experts were also presented with varying levels of similarity between alternatives. In equal task sizes, the percentage of information acquired and the use of compensatory (LIN and AD) strategies increased, whereas the variability of information acquired per alternative decreased as similarity between alternatives increased.

Response Mode. Response mode required also affects the behavioral indicators of processing strategy (Billings and Scherer 1986). In a selection decision, the requirement of an explicit judgment, as opposed to a simple choice, increased the amount of information searched, decreased the variability of search across alternatives, and promoted more inter-dimensional patterns of information search. These indicators

suggest that an explicit requirement of judgment leads to more compensatory choice strategies.

Results of empirical research on task effects has been much more consistent than research on support tool effects. Increases in any of the dimensions of task complexity consistently reduce effectiveness and efficiency performance measures. In addition, more non-compensatory choice strategies and behaviors result from an increase in task size. Whereas, compensatory choice strategies result from an increase in uncertainty, alternative similarity and the requirement of a judgment response mode. These results show that both the processes and outcomes of decision making are affected by changes in task characteristics.

Individual

Many studies in the information systems literature have included the influence of individual differences on MIS success. (Zmud (1979) provides a review of this literature up to that time.) With regard to the decision making literature, however, individual difference effects on the decision making process are not usually examined separately, but rather as they interact with a task characteristic or support tool feature. For that reason, this section is relatively short. The majority of the studies involving any type of individual difference will be reviewed in the following section containing interaction effects.

In any case, research in the area of individual

differences can be classified in three main areas: cognitive style, cognitive ability and previous background/experience. Cognitive style research views individual decision maker habits in a very broad sense, and as a function of personality type. Common measures include the Myers-Briggs Type Indicator (Myers 1963), and the heuristic/analytic categorization proposed by Huysman (1970).

The Myers-Briggs Type Indicator is based on the Jungian typology (Jung 1970) which states that individuals differ along two dimensions: information acquisition and modes of data processing. The information acquisition dimension ranges from the sensation-oriented person who prefers detailed, structured problems and routine, precise work to the intuitive individual who views problems in their entirety, not as isolated elements. The intuitive person prefers non-routine, less precise work and ill-structured problems. The dimension concerning the mode of data processing goes from "feeling" to "thinking" individuals. The "feeling" person is guided by emotions and values, whereas the "thinking" person is impersonal and logical in evaluation. These two dimensions are considered independent and are combined to form the four different cognitive styles measured by the Myers-Briggs Type Indicator.

The heuristic/analytic breakdown is another measure used to represent cognitive style. Heuristic decision makers rely on common sense, intuition, and practical solutions, often

from previous use in a similar situation. Analytic decision makers isolate underlying events and relationships to form models for decision making.

Cognitive ability differs from cognitive style by referring to cognitive structure and an individual's ability to assimilate, retain, and integrate information to form judgments (Henry 1980). Measures such as the "integrative complexity" scale (Schroeder et al. 1967) and Group Embedded Figures Test (Witkin 1967) have been used for this purpose. Neither of these measures completely capture all that is involved in cognitive ability. Instead, they could more correctly be called measures of analytic ability which is just part of the more complex cognitive ability of any individual. The term cognitive ability will continue to be used as a category of research to leave open the possibility of other cognitive ability measures. Currently, however, this area includes only studies focusing on analytic ability.

The integrative complexity scale is a paragraph completion test designed to assess a person's inherent level of integrative complexity:

> Low levels of integrative complexity are associated with limited use of available attributes describing a stimulus, little differentiation between the stimuli along the attributes processed, and a rigid and relatively simple structure for organizing the perceived information. At the other extreme, individuals are assumed to be able to accept large numbers of attributes, deal with relatively fine shadings of differences among the attributes, and use an organizing structure that simultaneously utilizes a number of alternative comparison rules to generate complex stimulus relationships. (Henry 1980, p. 43)

The Group Embedded Figures Test (GEFT) categorizes individuals as either field dependent or field independent. Field independents have the ability to separate objects from their environment, whereas field dependents have less of this ability. As a consequence, field independents prefer detail for problem solving and field dependents prefer a global approach to problem solving.

Finally, previous knowledge and experience as it relates to the task or support tool under investigation could have a significant effect on both the process and outcomes associated with decision making. Studies involving previous knowledge and experience exclusively involve interactions with either the task, support tool or both. Therefore, this group of studies will be presented in the interaction section.

Cognitive style. Cognitive style has been criticized as a basis for DSS design (Huber 1983) due to the inconsistent research results. Differences in cognitive style have been shown to affect choices made in some studies (Henderson and Nutt 1980, Hunt et. al. 1989), but in other cases no significant changes occurred (Ruble and Cosier 1990).

Cognitive Ability. Henry (1980) used an integrative complexity scale (Schroeder et. al. 1967) to measure individual analytic ability to process information. Differences in individual analytic ability had a direct effect on the accuracy level achieved in a consumer choice task. In

fact, differences in individual ability explained more of the variation in accuracy than the changes in task complexity.

Research in the area of analytic ability appears to have more potential for meaningful results than cognitive style research. However, either of these areas alone may not be as interesting as how individual differences moderate task and support tool effects. Consequently, most of the work dealing with individual differences has been in conjunction with either task or support tool effects, and will be presented in the next section.

Interactions

Each of the previous three problem domain variables interact with each other to produce three sets of two-way interaction effects. Empirical studies involving these interaction effects are discussed next.

Individual x Support Tool. Display features of the support tool have been the main focus of research on interactions with both cognitive style and analytic ability. Lucas (1981) used a reorder quantity selection decision to study the style/display interaction. Heuristic decision makers had improved performance (lower costs) with graphical versus tabular information displays as predicted. However, analytic decision makers did not have the predicted performance increase with tabular as opposed to graphical presentation. Overall, heuristic decision makers were more

confident and satisfied with the decision than analytic decision makers.

The ability/display interaction was studied by Benbasat and Dexter (1985) for an allocation decision using multi-color versus mono-color and graphical versus tabular information displays. Field dependents had significantly higher profit with multi-color, but field independents showed no significant differences. Performance for field dependents with mono-color display were lower than any other group. The use of multi-color display brought field dependent profit levels up to the level of field independents using either display. Neither group had significant changes in time based on display. The tabular versus graphical presentation mode did not have an interactive effect with cognitive ability for either performance or time. Perceptual ratings for field dependents were significantly higher for tabular over graphical presentation, although field dependents showed no preference. This study suggests that although field independents tend to outperform field dependents, the appropriate presentation mode can help field dependents achieve levels equal to those of field independents.

Interaction effects for analytic ability and support level have also been studied. Pracht and Courtney (1988) found that the availability of a graphics based DSS with problem structuring capabilities increased decision understanding for field independents, but not dependents.

The previous results show that differences in individuals significantly influence support tool effects on decision making outcomes. Consequently, individual differences must be considered in the support tool design effort. Further research on how analytic ability and other aspects of cognitive ability interact with different levels of support tools is necessary to fully understand these relationships.

Individual x Task. Henry (1980) used a consumer choice problem to test for interaction effects between analytic ability and task size. Low ability subjects faced with increased task size did not have a decrease in accuracy compared to high ability subjects as expected.

Significant interactions between experience and task, however, have been demonstrated. Lucas and Nielsen (1980) show that differences in experience and professional background affect the rate of performance change (learning), but not the actual performance levels in a logistics management game.

More specifically, in a selection decision, consumers with a moderate amount of experience with the particular purchase item demonstrated the greatest amount of processing with the available information, while consumers with a high level of experience relied on previous knowledge and more brand processing (Bettman and Park 1980). Consumers in the low experience group processed less information due to a lack of base knowledge.

Arkes et. al. (1986) provided subjects with an optional decision rule for a categorization type task. Subjects with high expertise in the area performed worse by choosing not to employ the rule and relying on their own knowledge, while subjects with less expertise used the rule and had a higher accuracy rate. In a related experiment, when subjects were provided with a monetary incentive, they attempted to outperform the rule. Again, without the rule, lower accuracy rates resulted. Monetary incentives were used in an effort to manipulate decision significance.

Waller and Mitchell (1984) attempted to manipulate task significance through task descriptions. Subjects were to select the most appropriate information system for a cost variance investigation problem under varying levels of importance to the firm and themselves. In the high importance conditions, subjects tended to choose systems providing more analytical strategies. Billings and Scherer (1988) also used task descriptions to vary significance and found that increased significance resulted in more inter-dimensional patterns of information search.

Again, individual differences are an importance influence in decision making. Task characteristic effects on decision outcomes are affected by analytic ability, previous experience and perceived significance of the task to the individual. Therefore, support tool research must deal not only with the

task for which it is being designed, but also the individual who must perform the task.

Task x Support Tool. Research on support tool/task interactions have predominantly involved the display features of the support tool. The assumption is that displays which are congruent with the task requirements will improve performance (McIntyre and Ryans 1983). Umanath and Scamell (1988) found that a graphics presentation mode enhanced recall in spatially oriented tasks, but recall of specific facts is indifferent to graphical and tabular display forms.

With the choice process imposed in a consumer choice problem, information format (alternative, attribute or matrix) congruence had no effect on accuracy levels (Bettman and Park 1979). In addition, when subjects were asked to choose a format, the selection was not related to the process required by the task. Although, congruence positively affected perceptions and lowered selection time.

Jarvanpaa (1989) produced similar results for a restaurant site selection. Congruence between the graphical format (alternative, attribute or matrix) and the process required had no effect on accuracy, but the pattern of evaluation was influenced, and decision time was lowered slightly.

The results of previous research suggest that information presentation congruence with task requirements have little effect on decision making outcomes, particularly

effectiveness. Although efficiency and decision maker perceptions may increase. Further research in this area should be directed at support level/task interactions to provide additional information for support tool design.

Summarization of Findings

The most consistent results are provided by research concerning task effects on both decision making processes and outcomes. Increases in task complexity lower decision making performance. Task size increases produce more non-compensatory choice strategy behavior, while increases in uncertainty and similarity of alternatives produce more compensatory choice strategy behavior. Compensatory strategies also result from the requirement of a judgment response mode.

Support tool research has produced inconsistent results, especially with regard to support level effects on both performance and perceptions. Display or presentation effects are somewhat more consistent. Simply computerizing information does not increase performance, and may even lower perceptions. Format features such as tabular versus graphical, color enhancements, and organization changes have been shown to affect performance, perceptions, or both. These features might best be studied in conjunction with task and individual characteristics for a greater understanding of the relationships.

Typically individual difference effects are investigated as interaction effects with the task and/or support tool. Significant interaction effects have been shown in both areas. Additionally, task/support tool interaction effects have also been found. These findings have serious implications for the design of support tools or decision aids aimed at a particular problem and set of users. Both the task and individuals must be well understood in order to produce the desired results with the support tool.

Although the review of the literature has been separated into support tool, task and individual effects, two distinct streams of research have been included. The information systems research has primarily focused on manipulating the tool in an effort to study the outcomes of decision making. Whereas, the cognitive psychology research has primarily focused on manipulating the task to study effects on the processes or choice strategies employed by the decision maker. (Some exceptions to this generalization have occurred, and these were noted throughout the literature review.)

The purpose of presenting both streams of research is to provide the foundation for the current study. This study will embed choice strategies into the decision aid in an effort to learn how the computerization of these processes will effect the outcomes (performance and perceptions) of decision making. Previous studies dealing with the choice process have focused on the manual use of choice strategies. By computerizing

these strategies, different effects on performance and perceptions may be discovered. The expected outcomes are listed as hypotheses and explained in detail in the following chapter. The results, presented in Chapter 5, will add to both knowledge concerning choice processing strategies, as well as, the design of decision aids for alternative selection.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

Research Model and Hypotheses

The research question addressed in this dissertation is whether a difference in decision maker performance and perceptions exists between decisions made using different computerized decision aids, and how task complexity affects these relationships. Within the context of directed and non-directed change, these decision aids are either highly restrictive, imposing a choice strategy (compensatory or non-compensatory), or are less restrictive, allowing flexibility to select one or both choice strategies. This question will be investigated within the framework of the model presented in Figure 2.

Decision aid effects were studied in two different ways. One approach examined the effects of decision aids imposing a compensatory versus a non-compensatory choice strategy. The other approach focused on the effects of decision aids imposing either type of strategy versus one allowing the decision maker the flexibility to choose a strategy.

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Problem Domain within the Choice
Phase of the Decision Making Process

```
+------------------------------------+          +--------------------------------+
|  +------------------------------+  |          |  Decision Outcomes             |
|  | Decision Aid                 |  |          |                                |
|  |                              |  |          |  Performance                   |
|  | Imposed choice strategy      |  |          |                                |
|  |    (Comp. or Non-Comp.)      |  |          |    Goal attainment             |
|  | Flexible choice strategy     |  |          |      (effectiveness)           |
|  +------------------------------+  |          |                                |
|                                    |          |    Time (efficiency)           |
|  +------------------------------+  |          |                                |
|  | Task Complexity              |  |          |  Perceptions                   |
|  |                              |  |          |                                |
|  | High task complexity         |  |          |    Confidence in               |
|  | Low task complexity          |  |          |      the selection             |
|  +------------------------------+  |          |                                |
|                                    |          |    Satisfaction with           |
|  +------------------------------+  |          |      selection process         |
|  | Individual Differences       |  |          |                                |
|  |                              |  |          |    Satisfaction with           |
|  | Analytic Ability             |  |          |      decision aid              |
|  | Experience with problem      |  |          |                                |
|  +------------------------------+  |          +--------------------------------+
+------------------------------------+
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Figure 2:   Research Model

Effects on Performance

Compensatory strategies are commonly viewed as producing higher performance levels than non-compensatory strategies, although compensatory methods are not always employed due to the extra effort required for calculations (Hogarth 1980). This experiment, however, differs from previous research. The selection process is built into and imposed on the decision maker in two of the three decision aids. Most previous research presents a task setting to a decision maker in an effort to determine which process will be employed (Billings and Scherer 1986, Biggs et. al. 1985, Klayman 1985, Waller and Mitchell 1984). In the studies which dictate a particular strategy in order to study outcomes, the choice processing is performed without the aid of a computer (Paquette and Kida 1988, Bettman and Zins 1979). By utilizing a computerized aid for compensatory processing, poor performance due to subject inability to understand and/or perform the necessary calculations may be eliminated. Therefore, consistent with prior research, subjects using the decision aid imposing a compensatory strategy are expected to achieve higher levels of goal attainment than subjects using the decision aid imposing a non-compensatory strategy. However, contrary to prior research, subjects using the decision aid imposing a compensatory strategy are not expected to take longer for the selection process than subjects using the decision aid imposing a non-compensatory strategy. The computerization of

previously manual calculations should eliminate the time difference.

With respect to the flexible decision aid, prior research demonstrates that flexibility does not necessarily result in higher performance as intuitively might be expected (Dos Santos and Bariff 1988). Instead, decision makers with less guidance have lower performance. Again, this finding may be the result of inexperienced decision makers requiring additional structure to enhance performance. However, other studies show that subjects claiming to be experts and choosing not to use structured decision aids do not perform as well as non-experts who use the structured decision aid (Arkes et. al. 1986, Bettman and Park 1980). For this reason, subjects using the decision aid allowing flexibility to choose a selection strategy are expected to achieve lower levels of goal attainment than subjects using the decision aids imposing a strategy, particularly the compensatory strategy. The time required to make a selection, however, is expected to be greater for subjects using a decision aid allowing flexibility as opposed to subjects using a decision aid imposing either type of choice strategy. The lack of structure allows the opportunity for subjects to experiment with different options and subsequently will take longer to execute.

The relationships between decision aids and both performance measures are expected to be moderated by task complexity (size, similarity, uncertainty). Findings suggest

that when confronted with an increase in task size, subjects avoid the effort required for compensatory strategies and use non-compensatory strategies instead (Klayman 1985, Biggs et. al. 1985). Whereas, an increase in uncertainty or similarity of alternatives leads to more non-compensatory processing (Waller and Mitchell 1984, Biggs et. al. 1985). Therefore, a change in task complexity (size, uncertainty and similarity of alternatives) suggests conflicting changes in the choice processing strategy employed. However, as previously mentioned, subjects are using a strategy dictated by the decision aid and a change in strategy is not the question. Additionally, the performance decreases typically associated with increases in task complexity may in part be a result of switching to less accurate non-compensatory strategies. With an imposed compensatory strategy, subject performance should decrease less as compared to subjects using the non-compensatory or flexible decision aids because they do not have the option to switch to the non-compensatory strategy. Therefore, at the high level of task complexity the difference in goal attainment between subjects using the compensatory decision aid and either of the other two decision aids is expected to be greater than at the low level of task complexity. Similarly, the time difference between the subjects using the flexible versus the imposed decision aids should also be greater at the high level of task complexity due to an increase in available options which multiplies the

possible manipulations causing even greater time for the flexible decision aid.

If these interaction effects are present, the main effects must be interpreted within that context. However, the main effect hypotheses are included in the interest of completeness and in the event that interactions do not occur.

Effects on Perceptions

Previous research suggests that more favorable decision maker perceptions result from the use of non-compensatory processing than compensatory processing when manually employing the strategy (Bettman and Zins 1979). Non-compensatory strategies are considered easier to understand and perform, and as a result subjects are more confident in their selections and satisfied with the process. Again, the use of computerized decision aids to perform the alternative selection could change the results, particularly the way choice strategies are perceived by decision makers. The computerized support to manipulate alternatives and perform necessary calculations will minimize if not eliminate the differences in effort, ability and knowledge required to carry out a strategy. Therefore, with regard to decision aids which impose either a compensatory or non-compensatory choice strategy, no difference in decision maker perceptions are expected. Decision makers in each of these two groups should have the same level of confidence in the selection made,

satisfaction with the selection process and satisfaction with the decision aid.

With respect to flexible decision aids, previous research on decision maker perceptions is mixed. First, comparing structured aids to not having an aid, subjects faced with a structured decision aid have lower perception levels than subjects without an aid (Cats-Baril and Huber 1987). Next, comparing flexible to structured aids, subject perceptions were not different between systems (Aldag and Power 1986, Goslar et. al. 1986). Based on limited evidence that subjects prefer flexibility even though performance may decrease, decision makers using the decision aid allowing flexibility are expected to have higher confidence in the selection made and higher satisfaction with both the selection process and the decision aid than subjects using the decision aids imposing a strategy.

There is no previous research to suggest that the relationship between decision aids and decision maker perceptions should or should not be moderated by task complexity. At this point, interaction effects are not expected. The research hypotheses are formally stated in Table 1. (Although not directly the focus of this study, increased task complexity is expected to reduce overall performance, as well as decrease decision maker perceptions. These results have been established in the literature.)

TABLE 1

RESEARCH HYPOTHESES

Main Effects - Performance

H1: Decision makers using a decision aid imposing a compensatory strategy will achieve higher levels of goal attainment than decision makers using a decision aid imposing a non-compensatory strategy.

H2: Decision makers using a decision aid imposing a compensatory strategy will have no difference in time to make a selection than decision makers using a decision aid imposing a non-compensatory strategy.

H3: Decision makers using a flexible decision aid will have lower levels of goal attainment than decision makers using a decision aid imposing a compensatory choice strategy.

H4: Decision makers using a flexible decision aid will take longer to make a selection than decision makers using a decision aid imposing a choice strategy (compensatory or non-compensatory).

Main Effects - Perceptions

H5: Decision makers using a decision aid imposing a compensatory strategy will have the same levels of confidence in the selection made, satisfaction with the selection process, and satisfaction with the decision aid as decision makers using a decision aid imposing a non-compensatory strategy.

H6: Decision makers using a flexible decision aid will have greater confidence in the selection made, satisfaction with the selection process, and satisfaction with the decision aid than decision makers using a decision aid imposing a choice strategy (compensatory or non-compensatory).

Interaction Effects

H7: The difference in goal attainment level between compensatory decision aids and both non-compensatory and flexible decision aids will be greater at the high level of task complexity.

H8: The difference in selection time between flexible decision aids and decision aids imposing a strategy will be greater at the high level of task complexity.

Research Methodology

Details of the research methodology including the task, subjects, research variables, procedure, and analysis are presented in this section. An experimental research methodology was employed in this study. The control of a lab experiment provided the ability to carefully examine the effect of different choice strategies imposed by decision aids on decision making outcomes. Greater precision of measurement was possible in this setting, although a certain amount of generalizability and realism were lost (McGrath 1982). At this point in the research, control over situational variables is important for a better understanding of choice strategy effects on decision outcomes, as well as the impact of task complexity on this relationship. A lab experiment enabled the isolation of these variables for precise measurement and evaluation. The knowledge gained from this research subsequently can be incorporated into the design of more comprehensive decision support systems, and research may extend to field studies providing greater realism.

The Task

The task used in this experiment involved the selection of an alternative from a set of pre-defined alternatives valued along several dimensions. Specifically the decision maker chose an apartment to best meet his/her individual needs. To avoid bias in the selection, the apartments were not named and the subjects were informed that the alternatives

were hypothetical and not meant to represent existing apartments in the surrounding area. The attributes chosen to represent the apartments were developed by surveying upper division undergraduate students enrolled in the same course used for the experiment the semester prior to the experiment.

The Subjects

Undergraduate (upper division) Business Administration students enrolled in an introductory computer course at Florida State University were used as subjects in this study. Upper division students were selected to provide an appropriate match between the decision maker and the task of apartment selection. The task should have been relevant to the subjects since most had some experience selecting and renting an apartment, or would be doing so in the near future. Using this particular course also provided a certain level of similarity between individuals with respect to background and computer experience since computer proficient students have the option to waive this course. Subject participation was included as 10% of the course requirement.

Variables and Their Relationships

Independent variables, performance and perceptual dependent variables, along with covariates to be used in the research are presented in this section.

Independent Variables. Independent variables which were manipulated include the decision aid and the level of task complexity.

Decision Aid is of primary interest in this research. Three different computerized decision aids were available. The first two had either a compensatory (LIN) choice strategy or a non-compensatory (EBA) choice strategy embedded into the system. This strategy dictates the approach used for alternative selection. The third decision aid had both strategies incorporated in the system allowing the decision maker to choose the approach used for alternative selection. The systems provide both modeling and data manipulation capabilities. The design and specific features of these three decision aids is presented in Chapter 4.

Task complexity was manipulated by changing the number and similarity of apartment options available to the decision maker. The number of attributes for each apartment remains the same since previous research has found little effect for this aspect of size on decision making. Two levels of task complexity were used. A high level of complexity (60 alternatives with a high degree of similarity) and a low level of complexity (30 alternatives with a low degree of similarity) provided extremes to increase the chance of significant results. A pretest determined that the two levels of complexity were significantly different.

<u>Dependent variables</u>. Both performance (goal attainment and time) and perceptual (confidence in the selection made, satisfaction with the selection process and satisfaction with the decision aid) dependent variables were measured.

Goal attainment was used to measure decision making effectiveness. On two separate occasions prior to undertaking the apartment selection task, subjects completed a form specifying their preferences and priorities with respect to the dimensions of the problem. Additionally, the same information was collected twice after the task. This method was used to determine if preferences and priorities remain consistent over time, if they change as a result of the task session, or if they randomly change. Subjects with random changes were examined but not eliminated from the analysis. Preferences and priorities obtained after the task session were used in the evaluation of all subjects. Independent raters, as well as, scoring routines (algorithms) were used to evaluate the selection made on a scale of 0 to 100 for goal attainment. Goal attainment was measured by how well the subjects met their specified preferences and priorities. Goal attainment provides a measure of decision quality or "accuracy", which has been used to determine the "benefit" of a choice strategy (cost/benefit framework).

Selection Time was used to measure decision making efficiency. During the task session, selection time was measured from the beginning of the alternative selection process until a choice had been made. Subjects were given as much time as necessary, without constraints. Time serves as a surrogate for decision efficiency, the cost consideration in

the cost/benefit framework. Computer logs were used to maintain a record of time.

Confidence in the selection, satisfaction with the selection process and **satisfaction with the decision aid** were measured by a post-experimental Likert scale questionnaire adapted from Aldag and Power (1986). This questionnaire is presented in Appendix A.

Possible Covariates. The use of covariates is a means of increasing the measurement precision of treatment effects (independent variables) by removing other effects which are not controlled by the experimental design. These effects should be correlated to the dependent variable and not affected by the treatments. The two covariates considered in this study were previous experience with the apartment selection task, and analytic ability. Both were expected to be correlated to goal attainment and selection time. Previous task experience was measured with the questionnaire shown in Appendix B, and analytic ability was measured by the Group Embedded Figures Test (GEFT).

Experimental Procedure

Prior to the laboratory session, subjects were given the Group Embedded Figures Test to measure analytic ability level (Witkin 1967). At the same time, the questionnaire regarding previous apartment selection experience was given, and demographic data were collected. Approximately two weeks prior to the laboratory session, subjects completed a

questionnaire specifying personal priorities and preferences concerning each attribute included in the apartment description. One week later, they were asked to complete a similar questionnaire. Subjects were scheduled for laboratory decision aid sessions beginning the next week. At these sessions, the following procedure took place:

-- First, each group of subjects was randomly assigned to a combination of one of the two task sizes and three decision aids.

-- Next, subjects were trained to use the appropriate computerized decision aid.

-- Following the training, each decision maker made a selection using the decision aid, attempting to choose the apartment which would best meet his/her own needs. A computer log of the session was used to collect process data.

-- After making a selection, subjects completed a Likert-scale questionnaire to measure perceptions of confidence in the selection and satisfaction with both the selection process and decision aid.

On two separate occasions, one week and two weeks after the laboratory session, subjects completed the same preference and priority questionnaire regarding apartments. Appendix C contains all four of the preference/priority questionnaires. These were used to determine the consistency of preferences across time, and check for any changes due to the task session.

Analysis

A full factorial design was used for data analysis. Two levels of task complexity combined with three types of decision aid produced a 2x3 full factorial requiring 6

experimental cells. The functional model is presented in Table 2. Thirty replications for each cell (180 subjects) were required to achieve adequate levels of statistical power and still allow for a 10% loss of subjects. See Appendix D.

Statistical techniques such as factorial analysis of variance (ANOVA), and factorial analysis of covariance (ANCOVA) were used to test the various hypotheses using the following experimental model for each dependent variable (Neter et. al. 1985):

$$Y_{ijk}=\mu..+\alpha_i+\beta_j+(\alpha\beta)_{ij}+\gamma_1(X_{ijk1}-X...)+\gamma_2(X_{ijk2}-X...)+\epsilon_{ijk}$$

Y_{ijk}	=	each response variable (goal attainment, selection time, confidence in the selection, satisfaction with the selection process, or satisfaction with the decision aid)
$\mu..$	=	overall mean
α_i	=	decision aid effect (i=1,2,3)
β_j	=	task complexity effect (j=1,2)
$(\alpha\beta)_{ij}$	=	decision aid x task complexity interaction
γ_1	=	regression coefficient for the relation between the response variable and analytic ability
γ_2	=	regression coefficient for the relation between the response variable and diligence/task commitment
ϵ_{ijk}	=	error

TABLE 2

FUNCTIONAL MODEL

Cell	Task Complexity	Decision Aid
1	Low	Compensatory
2	Low	Non-compensatory
3	Low	Flexible
4	High	Compensatory
5	High	Non-compensatory
6	High	Flexible

The SAS statistical package was used for all of the analyses of variance and covariance. For each dependent variable, an analysis of covariance was performed first in order to check for significance of the covariates. If both covariates were significant, this model would be used in the analysis. This situation, however, did not occur with any of the dependent variables. If only one covariate was significant, a new ANCOVA with just that covariate was performed and this model was used in the analysis. Only two dependent variables had a significant covariate. For most of the dependent variables, neither covariate was significant and an ANOVA model was used in the analysis.

The ANCOVA and ANOVA tables are displayed in Chapter 5, along with the interpretation of these results. Before presenting this information, however, details of the decision aid designs are explained in Chapter 4.

CHAPTER 4

STRUCTURE OF THE DECISION SUPPORT SYSTEMS

Introduction

Three decision aids were developed and utilized in this study. The systems were designed using dBASE III+ application software which supports all three components of a decision support system: data management, model management and dialogue management. Although the use of a common application software package provides consistency in data, model and dialogue management, individual decision support systems depend on specific databases, models and user interfaces. Across the three decision aids used in this study, the databases remain constant, however, the models and user interfaces vary. These components are described in greater detail in this chapter.

Database Component

Originally, the high complexity database would contain 16 alternatives with a high degree of similarity, and the low complexity database would contain 8 alternatives with a low degree of similarity. Previous studies with alternative sets of this size had decision makers using either compensatory or

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non-compensatory strategies without the aid of a computer. Smaller alternative sets were appropriate since a considerable amount of effort is necessary to manually perform this task on a large number of alternatives, particularly when using a compensatory strategy. For the current study, however, the calculations and manipulations are performed by the computer, greatly reducing the effort of the decision maker. For this reason, the decision was made to shift to much larger databases (apartment sets) in an effort to require the decision maker to rely on the system instead of manual effort.

The apartments in each database are described by 8 dimensions or attributes. These attributes, along with the possible values for each, are listed in Table 3. Each apartment alternative was generated through the random assignment of attribute values within the ranges listed in Table 3. An attempt was made to ensure that any one apartment would not dominate in all areas. What is considered an attractive feature in an apartment, however, varies between decision makers.

The first database is composed of 30 apartments. The second database combines the first 30 apartments with an additional 30 apartments developed through random assignment of attribute values within the same ranges as the first set of apartments. By using this procedure, the second database is both larger and has a higher degree of similarity between alternatives. These are two of the three factors which

TABLE 3

APARTMENT ATTRIBUTES AND VALUES

APARTMENT FEATURE	POSSIBLE VALUES
1) Cleanliness level	Exceptionally clean Very clean Fairly clean Slightly dirty Dirty
2) Distance from campus	Between 2 and 37 minutes
3) Length of lease	Month to month Four months Six months Nine months Twelve months
4) Number of bedrooms	1, 2, 3 or 4
5) Number of bathrooms	1, 2 or 3
6) Price (monthly rent)	$250-$975
7) Square footage	550-1550 sq. ft.
8) Laundry (washer/dryer located in the apartment)	Yes or No

increase complexity. The third factor, uncertainty, was not varied between databases. In both databases, the attribute values remain certain. The lack of uncertainty is appropriate for this particular problem because these specific apartment attributes are generally ones which would be known with certainty if a decision maker were selecting a real apartment. Uncertainty often reduces performance, therefore the lack of uncertainty should allow subjects to perform better, both in terms of effectiveness and efficiency.

The perceived complexity of selecting an apartment from these two apartment sets was shown to be significantly different in a pre-test. The two apartment sets are presented in Appendix E.

Model Component

The models developed for the decision aids provide the basis for distinguishing between the three systems. The first decision aid uses a compensatory choice strategy model, the second a non-compensatory choice strategy model, and the third decision aid combines both models to allow the decision maker flexibility in the selection process. Each decision aid model is described in more detail in the following sections.

Compensatory Decision Aid

A linear model was used for the compensatory decision aid. This model performs linear calculations with information entered by the decision maker to produce a rank ordered listing of the apartment set. First, the subjects are required to specify how important any given apartment attribute is, since apartment features have varying importance to individuals. For instance, price may be of no importance to wealthy subjects, while distance from campus may be the only factor of concern for subjects without cars. In any case, these importance values are entered as priority weightings for each of the eight apartment attributes. The priority weightings must necessarily sum to 100% or 1.00.

Next, the subjects are required to state their preferences with respect to the apartment attributes. Specifically the subjects enter information about which values of the attributes (see table 3) are preferred, acceptable, acceptable in limited situations or unacceptable. For example, a 4 bedroom apartment may be preferred, while a 3 bedroom is acceptable, but 1 and 2 bedroom apartments are unacceptable. These responses are converted into a numeric scale and used in the linear calculations according to the following model:

$$AR = \Sigma\ (PV_i * PR_i)$$

AR = Apartment rating calculated for each apartment
PV = Preference value associated with attribute i
PR = Priority weighting associated with attribute i
i = 1,2...8 (each attribute)

The original listing of apartments is then ranked in descending order by apartment ratings and presented to the decision maker. All apartments remain in the listing, none is eliminated. After viewing the rank ordered list, the decision maker has the opportunity to change part or all of the previous responses and repeat the process as many times as necessary before making a final selection. The decision maker can choose any apartment on the list, and is not obligated to choose the highest ranked apartment. The entire program code for this decision aid is presented in Appendix F.

Non-compensatory Aid

The non-compensatory model followed an elimination-by-

aspects strategy. First subjects choose the most important apartment attribute to them. For attributes with discrete possible values (i.e. number of bedrooms), the subjects classify each as acceptable or unacceptable. For attributes on a continuous scale (i.e. square footage, price), subjects state a cut-off point to separate acceptable from unacceptable alternatives. At that time, unacceptable alternatives are eliminated from the listing. Subjects can stop and make a selection from the reduced listing or continue to another attribute to eliminate more alternatives. At any time the subjects may return to the original list and begin the process again. Subjects are not obligated to select an apartment from the reduced listing. The entire program for this decision aid is presented in Appendix G.

Flexible Decision Aid

The term "flexible" is used in this research only in the sense that decision makers may choose either the compensatory, non-compensatory or a combination of both approaches. The concept of flexibility is actually composed of four separate levels (Sprague and Carlson 1982). The first level of flexibility allows the decision maker to confront a problem in a personal way, exploring alternative ways of viewing or solving the problem. This is the level of flexibility provided by the decision aid in this study. The other three levels of flexibility, 1) the ability to modify the decision support system configuration and handle an expanded set of

problems, 2) the ability to <u>adapt</u> to changes that require a completely different decision support system, and 3) the ability of the system to <u>evolve</u> in response to technological changes, are not addressed in the current study. For further explanation of these four levels of flexibility, see Sprague and Carlson (1982).

The flexible decision aid used in this research combines both of the previous models (compensatory and non-compensatory). Subjects have the option of beginning the process by eliminating undesirable apartments to reduce the list, or ranking the current list. Throughout the process, subjects can rank order a reduced list or reduce a rank ordered list. Alternatively, subjects can go back to the original list and begin the process again, possibly changing previous responses. Subjects are not obligated to choose an apartment from the final listing prepared by the decision aid. The entire program is shown in Appendix H.

User Interface

The user interface is consistent across decision aids whenever possible. Due to differences in model and decision aid function, certain explanatory screens as well as data capturing screens differ.

Initially each of the decision aids begins by welcoming the user to the Apartment Selection Guide, and explaining the purpose of the system. Next, the user is allowed to view the

original (complete and unranked) apartment set before being led through a series of screens to elicit information concerning both preferences and priorities with respect to apartments. The questions presented by the interface vary according to the system being used and the information required for that particular model. For instance, the compensatory decision aid asks subjects to classify attribute values into one of four categories (preferred, acceptable, acceptable in limited situations, or unacceptable) to be converted and used numerically. On the other hand, the non-compensatory decision aid asks subjects to classify attribute values simply as acceptable or unacceptable for elimination purposes.

Additionally, the model dictates the initial steps in the process. Process referring to the stepwise progression of screens and information gathered as opposed to the choice strategy employed. One of the main differences is that subjects using the compensatory decision aid, or compensatory portion of the flexible aid, are required to state both preferences and priorities for all eight attributes. This is necessary to perform a linear calculation of ratings. However, subjects using the non-compensatory decision aid, or non-compensatory portion of the flexible aid, may state preferences to reduce the listing by anywhere from one to eight of the attributes. Priority ratings are collected with

each system for consistency, however, these weightings are not used in the elimination-by-aspects model.

Option screens are available to the decision maker in each decision aid. In this way, the subject has some control over the process after the initial steps. Using either the compensatory or non-compensatory aid, the subject will encounter a set of options after generating the first ranked or reduced listing, respectively. The flexible decision aid has several option screens depending on which model is being executed at that time. These option screens, along with the entire user interface for each of the decision aids are presented in Appendices I through K. The number of times an individual decision maker views these screens will depend on his or her unique selection process.

In order to avoid any biased results due to the interface, an attempt is made to keep as much consistency in screen order and design as possible between the three user interfaces. Obviously some differences exist so that the appropriate data will be gathered, as well as, the appropriate explanations and presentations made to the decision maker. It is important to recognize that these differences may impact performance and perceptions to some degree. The possibility of the interface design impacting experimental results will be discussed in more detail as the results are interpreted.

Together, the databases, models and user interfaces make up the decision aids. Following the experimental design, two

databases are used to represent high and low task complexity. Both levels are used consistently through all three decision aids. The models define the specific decision aid (compensatory, non-compensatory or flexible), and the interface allows communication between the user and the system. The three decision aids are the main focus of this study in order to examine how the computerized choice strategies affect decision maker performance and perceptions. The experimental results and interpretation of those results is presented in the following chapter.

CHAPTER 5

EXPERIMENTAL PROCEDURES, RESULTS AND INTERPRETATIONS

Introduction

Details of the experimental procedures such as the composition of the subjects, collection of data and measurement of dependent variables are presented in this chapter. The experimental procedures are followed by a presentation of the findings and the interpretation of these findings, addressing each hypothesis stated in Chapter 3.

Details of the Experiment

As described in Chapter 3, upper division undergraduate students enrolled in an introductory computer course at Florida State University were used as subjects in the study. The task was to select an apartment which would best meet the subject's needs using one of the three decision aids. Participating in this study was a component of the course, not extra credit. This avoided bias associated with students who may have been having grade trouble. Using an introductory computer course provided a certain level of similarity in computer experience, since computer proficient students have the opportunity to waive this course. Initially, 196 subjects

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began the study, however, only 181 subjects completed all portions of the project.

Data Collection

Prior to conducting the laboratory sessions, several data items were gathered. First, the Group Embedded Figures Test (GEFT) was administered. This test provided a measure of analytic ability for each subject based on the score between 0 and 18. For the 181 subjects completing the experiment, Table 4 shows the frequency distribution of subjects at each score. A number of subjects had very low scores, however, only a few of those were probably due to confusion with the task. Very low scores are not a reflection on intelligence, but rather a lack of analytical ability. These subjects would be more likely to look at things as a whole, instead of breaking things down into parts. The characteristic of analytic ability may impact performance and will be entered as a covariate in the statistical analysis.

From the cover of the GEFT booklet, two demographic variables were gathered: age and sex. The average age of subjects was 22 years, with a minimum of 19 and maximum of 35. Of the 181 subjects completing the study, 78 were female and 103 were male. Although not specifically used in the statistical analysis, these variables help to provide a better understanding of the subjects and may be useful for future research.

TABLE 4

FREQUENCY OF GEFT SCORES

GEFT Score	Number of Subjects
0	2
1	3
2	2
3	4
4	4
5	3
6	8
7	7
8	7
9	9
10	8
11	11
12	10
13	17
14	19
15	14
16	22
17	15
18	16

Next, a questionnaire to determine the level of experience with the task (apartment selection) was administered. The responses to this questionnaire were used to categorize subjects into two groups, those with previous task experience and those without. One hundred and forty-nine subjects (82%) had previously been involved in the selection of an apartment, and 32 subjects (18%) had not. The level of previous task experience will also be used as a covariate in the statistical analysis to determine if it impacts any of the dependent variables.

The last two questionnaires administered before the

laboratory session were used to gather each subject's preferences and priorities with respect to apartments. The first preference and priority (P/P) questionnaire was given approximately two weeks before the laboratory session, and the second was given approximately one week before the session. Both P/P questionnaires gathered the same information through a series of similar questions. The information was needed for both evaluation of the final selection, as well as, a check on preference/priority consistency.

After collecting all of these data, groups of 10 or fewer subjects had a laboratory session where each group was randomly assigned to a decision aid/complexity combination. At this time, subjects were given instructions on the use of the system, informed that the apartment sets were completely hypothetical, and asked to individually select the apartment which best meets his or her needs using the system. After making a selection, subjects moved to another area to complete the questionnaire (Appendix A) designed to elicit their perceptions about the system, process and selection.

Approximately one week and two weeks after the laboratory session, the previous two P/P questionnaires were repeated. Again, this information was necessary for both evaluation and consistency checks. As previously mentioned, all four P/P questionnaires are presented in Appendix C.

The consistency checks were performed in order to determine whether subject preferences and priorities remained

the same across all four P/P questionnaires, shifted after the decision aid session, or were inconsistent throughout the study. Originally, subjects who were consistent or shifted would remain in the analysis, while those who were inconsistent would be omitted. Evaluation of consistency is not a simple process, however. Eight apartment attributes with both an associated preference and priority produces 16 possible times a subject could be consistent, shift or be inconsistent. For example, a subject may be consistent across time with regard to the preferred number of bedrooms, but be inconsistent with regard to how important (priority) price is in the decision, etc. A subject may have 12 consistent areas, 3 shifts and one inconsistent area. Should that subject remain in the analysis, or be classified as "inconsistent" and be omitted? Since both consistent and shifting subjects were to remain in the analysis, the focus of the evaluation turned to the number of inconsistencies found for each subject. The number of inconsistencies for each subject (16 possible) will be referred to as the level of inconsistency. A cumulative frequency distribution of subjects at each level of inconsistency is presented in Table 5. To determine if the number of consistencies, shifts and inconsistencies differed between decision aid, a Chi-square analysis was performed. This test showed that the number of consistencies, shifts and inconsistencies were distributed in the same proportion for the three decision aids.

In an effort to determine the level at which subjects should be considered "inconsistent," the statistical analysis was performed at every level. In other words, the statistical analysis was conducted using only the 29 subjects with zero inconsistencies, then for the 63 subjects with one or fewer inconsistencies, and so forth. The results of this analysis were interesting. Although the exact numbers vary a little, the significant and insignificant results, as well as, significant covariates remain the same from 3 inconsistencies (less than 20%) all the way to 10 inconsistencies (the highest level). Below that level, not enough subjects remained in the study to produce reliable results. (See Appendix B detailing the power analysis.)

This finding is important in itself. The decision aid(s) which are found to be most appropriate for this task will apply to relatively consistent decision makers, as well as, relatively inconsistent decision makers. Additionally, highly consistent decision makers are rare, at least with regard to this particular selection. Since the results above two inconsistencies are the same, the analysis of (co)variance tables presented will be based on the complete set of subjects (181).

TABLE 5

LEVELS OF INCONSISTENCY

Level of Inconsistency	Cumulative Number of Subjects
0	29
1	63
2	113
3	149
4	165
5	173
6	176
7	178
8	178
9	179
10	181

Measurement of Dependent Variables

Two categories of dependent variables were measured, performance and perceptions. Performance variables included both effectiveness (goal attainment) and efficiency (time). Perceptual variables were confidence in the selection, satisfaction with the selection process and satisfaction with the decision tool. The measurements of each are described in the following sections.

Performance. Effectiveness, represented by goal attainment, was measured in four ways, two rater evaluations and two algorithmic evaluations. First independent raters were asked to evaluate subject performance, on a scale of 0 to 100, based solely on how well the subject's chosen apartment met his or her stated criteria (preferences and priorities)

for an apartment. This evaluation is called Rating 1. Rating 2 was performed by the same raters. This time the raters were asked to evaluate the subject's goal attainment <u>relative</u> to the apartment set he/she had available. Both ratings are important because several things could be occurring. First, the subject may have selected an apartment which met all of his/her specifications, and in fact this was the "best" apartment on the list for that subject. On the other hand, even though the selected apartment met all of the criteria, a "better" apartment (perhaps larger and less expensive) may have been available. Next, if a subject selected an apartment which did not meet all of his/her specifications, it may be because there was not one, or it may be because the subject simply made a "poor" choice. The rater instructions found in Appendix L provide a more detailed description of the possible scenarios encountered.

Due to the number of subjects and time commitment involved in each set of evaluations (Rating 1 and 2), all raters were not able to rate all subjects. Instead, each of the 10 raters evaluated approximately 36 subjects to provide two evaluations for each subject in order to calculate a generalizability coefficient for inter-rater reliability (Crocker and Algina 1986). Rating 1 had an inter-rater reliability of .81 and Rating 2 had an inter-rater reliability of .84. Therefore, both ratings are reliable and can be used in further analysis.

Two separate algorithmic evaluations also were performed. The first algorithm was based on a compensatory strategy and the second on a non-compensatory strategy. It was necessary to use both types of algorithms in order to avoid the bias which may result from using an algorithm for evaluation based on the same strategy as the decision aid. For instance, the compensatory algorithm may show significantly higher goal attainment levels for the compensatory based decision aid, while the non-compensatory algorithm may show higher goal attainment for the non-compensatory decision aid. If this situation occurs, the 'performance effectiveness' of decision makers using specific decision aids would depend on the mechanism used for evaluation. In which case, little knowledge would be gained, instead performance results could be easily manipulated by choosing the "best" method of evaluation. By interpreting results from all four goal attainment measures, a greater understanding of actual performance associated with different decision aids will be gained.

The second performance measure, selection time, was used as a surrogate measure of decision making efficiency. Computer logs recorded the amount of time each subject spent on the decision aid from the beginning of the process until the apartment selection was made.

Perceptions. The three perceptual dependent variables, confidence in the selection, satisfaction with the selection

process and satisfaction with the tool, were measured using the questionnaire shown in Appendix A. Overall reliability of the questionnaire, measured by Cronbach's Alpha, was .93. Separate reliabilities (Cronbach's Alpha) for the questions divided into confidence in the selection, satisfaction with the selection process and satisfaction with the decision aid were .88, .81 and .86, respectively. An item analysis of the entire questionnaire showed that none of the items was negatively correlated. All items discriminated with correlation values ranging from .3237 to .8063, with most over .5. Therefore, all items remained in the questionnaire. For each subject, confidence in the selection was measured by the average of questions 3, 5, 10, 16 and 17 from Part I, and questions 7, 8 and 9 from Part II. Satisfaction with the selection process was measured by the average of questions 1, 6, 9, 11, 14, 18 and 19 from Part I, and questions 1, 2 and 3 from Part II. Satisfaction with the decision aid was measured by the average of questions 2, 4, 7, 8, 12, 13 and 15 from Part I, and questions 4, 5 and 6 from Part II.

Findings

Presented in this section are the experimental findings of effects on performance, followed by effects on perceptions. Relevant hypotheses will be addressed as appropriate.

Effects on Performance

Effects on performance are divided between effectiveness

and efficiency. Hypotheses 1, 3 and 7 relate to goal attainment, while Hypotheses 2, 4 and 8 address effects on time.

Goal Attainment. In order to test for significant effects on goal attainment, all four measures were examined. Before undertaking the analysis of covariance, the underlying assumptions of the model were checked. First, independence was satisfied by random assignment to experimental cells.

Next, the assumption of normality was checked. Plots of residuals versus normal scores did not show any apparent violation of normality, however, a test statistic produced by the SAS analysis revealed some non-normality for each of the four goal attainment measures. For this reason, plots of the raw data for each measure were examined. The examination revealed that goal attainment scores using all four evaluation methods were left skewed. Raters, as well as, algorithms had a tendency to concentrate subject performance at the upper end of the scale, thus causing the non-normality. The F-test, however, is robust to even moderate violations of normality.

Finally, homogeneity of variance was tested. Due to the non-normality, neither the Bartlett-Box F or Hartley's F-max could be used to test for homogeneity of variance. Instead the Levine L test was used because it is not sensitive to non-normality (Berenson et. al. 1983). For each of the four goal attainment measures, the assumption of homogeneity of variance was valid (insignificant L values). Since only one assumption

was violated and the F-test is robust to even moderate non-normality, the analysis could proceed without problems.

The analysis of covariance (ANCOVA) also requires that covariates are correlated to the dependent variables, but independent of treatment effects. Neither experience or GEFT scores are in any way dependent on the treatments. A correlation analysis of possible covariates and dependent variables showed that the GEFT score was only significantly correlated to the compensatory algorithm, and experience was only significantly correlated to Time. Significant correlations suggest that these may be useful covariates in those two models. No significant correlations between the covariates and any other dependent variable were found.

The initial analysis for each performance measure was a two-way ANCOVA according to the experimental design. This model did not show statistically significant results for any of the goal attainment measures. After careful investigation, it appeared that the complexity levels were not actually differentiating between high and low complexity. Using this variable in the two-way design reduced the degrees of freedom and concealed the effect due to decision aid. Collapsing the data into a one-way analysis of covariance revealed the decision aid effects. A significant difference in goal attainment for at least one of the decision aids resulted with each of the four models. The covariates which were statistically significant varied between the four models, as

expected from the correlation analysis. Only the compensatory algorithm model had a significant covariate (GEFT), the others were simply one-way analyses of variance (ANOVA). Each ANCOVA or ANOVA was followed by pairwise comparisons to determine which decision aid goal attainment level(s) were significantly different.

The results presented for Rating 1 in Table 6 indicate that goal attainment levels were significantly different for at least one of the decision aids. Pairwise comparisons were conducted using Duncan's Multiple Range Test. At the .05 level, this test indicated that subjects using the non-compensatory decision aid achieved significantly higher goal attainment levels than subjects using either the compensatory or flexible decision aids. The goal attainment levels for the compensatory and flexible decision aids were not significantly different.

TABLE 6

ANOVA TABLE FOR RATING 1

Source	DF	Sum of Squares	Mean Square	F value	Prob>F
Model	2	1554.97	777.48	4.82	.0092
Error	178	28738.12	161.45		
Total	180	30293.08			
R-Square	.05				

Rating 2 results, presented in Table 7, also indicate that goal attainment levels were significantly different for at least one of the decision aids. Using Duncan's Multiple Range Test, goal attainment levels for the same decision aids were found to be significantly different as with Rating 1.

TABLE 7

ANOVA TABLE FOR RATING 2

Source	DF	Sum of Squares	Mean Square	F value	Prob>F
Model	2	1687.00	843.50	5.16	.0066
Error	178	29084.45	163.40		
Total	180	30771.45			
R-Square	.05				

The results presented in Table 8, for the compensatory algorithm, also indicate that goal attainment levels were significantly different for at least one of the decision aids. Pairwise comparisons, however, produced different results than the previous two models. The comparisons indicated that subjects using both the non-compensatory and compensatory decision aids achieved significantly higher goal attainment levels than subjects using the flexible decision aid. The goal attainment levels for the compensatory and non-compensatory decision aids were not significantly different.

TABLE 8

ANCOVA TABLE FOR COMPENSATORY ALGORITHM

Source	DF	Sum of Squares	Mean Square	F value	Prob>F
Model	3	2361.88	787.29	4.21	.0066
Error	177	33087.78	186.94		
Total	180	35449.67			
R-Square	.07				

Presented in Table 9 are the results for the non-compensatory algorithm. Again, a significantly different goal attainment level is indicated for at least one of the decision aids. As with Rating 1 and Rating 2, Duncan's Multiple Range Test showed that subjects using the non-compensatory decision aid achieved significantly higher levels of goal attainment than subjects using either the compensatory or flexible decision aids. Goal attainment achieved with the compensatory and flexible decision aids were not significantly different.

TABLE 9

ANOVA TABLE FOR NON-COMPENSATORY ALGORITHM

Source	DF	Sum of Squares	Mean Square	F value	Prob>F
Model	2	3814.64	1907.32	8.13	.0004
Error	178	41738.78	234.49		
Total	180	45553.41			
R-Square	.08				

As displayed in Table 10, the significant differences between decision aids varies according to the method used for evaluation. Examining all four models, the non-compensatory goal attainment levels were significantly higher than goal attainment levels achieved with the flexible decision aid. The significant difference between the compensatory goal attainment levels and the other two decision aids is where the variance occurs. Rating 1, rating 2 and the non-compensatory algorithmic evaluations indicate that the non-compensatory goal attainment was significantly greater than the compensatory goal attainment with no significant difference between compensatory and flexible decision aid goal attainment levels. The compensatory algorithmic evaluation, on the other hand, indicates that the compensatory decision aid goal attainment was not significantly less than the non-compensatory, but rather it was significantly higher than the flexible. Average goal attainment levels for each decision aid by each evaluation method are presented in Figure 3.

These findings were used to test the goal attainment hypotheses stated in Chapter 3. Hypothesis 1, which expected subjects using the compensatory decision aid to achieve higher levels of goal attainment than subjects using the non-compensatory decision aid, was not supported by any of the four analyses. Hypothesis 3, which expected subjects using the flexible decision aid to have lower goal attainment levels than subjects using the imposed compensatory decision aid was

TABLE 10

SIGNIFICANT DIFFERENCES BETWEEN DECISION AIDS
(Goal Attainment)

Decision Aid	Goal Attainment Mean	Grouping*
Rating 1:		
Non-compensatory	92.27	A
Flexible	87.58	B
Compensatory	85.26	B
Rating 2:		
Non-compensatory	94.11	A
Flexible	88.00	B
Compensatory	87.43	B
Compensatory algorithm:		
Non-compensatory	92.22	A
Compensatory	90.05	A
Flexible	85.07	B
Non-compensatory algorithm:		
Non-compensatory	89.44	A
Flexible	81.30	B
Compensatory	78.76	B

* Means with the same letter are not significantly different.

supported by only the compensatory algorithmic evaluation. Rating 1, Rating 2 and the non-compensatory algorithmic evaluation did not indicate a significant difference in goal attainment levels achieved with either the compensatory or flexible decision aids. Hypothesis 7 dealt with interaction effects between decision aid and complexity level. Since the two-way analysis did not produce significant results, and complexity level was omitted from the analyses, Hypothesis 7

was not supported. A summary of the findings pertaining to goal attainment hypotheses is presented in Table 11.

```
      96
      94                              R2
      92          ·                   R1/A1
A
T     90               A1
T  L                                  A2
G A E 88                                        R1/R2
O I V                  R2
A N E 86
L M L                  R1                       A1
  E S 84
  N
  T   82
                                                A2
      80
                       A2
      78
         |_____
          Compensatory   Non-Compensatory   Flexible

                      DECISION AIDS
```
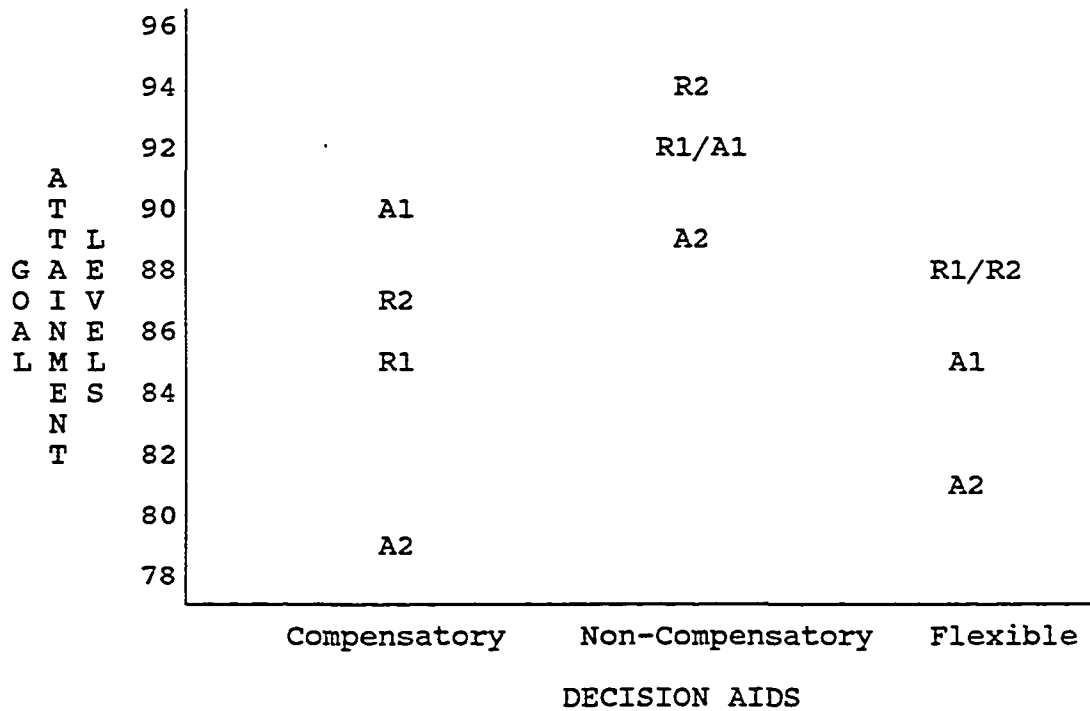
Figure 3. Goal attainment levels for each Decision Aid using the following key for method of evaluation: R1 = Rating 1, R2 = Rating 2, A1 = Compensatory algorithm, and A2 = Non-compensatory algorithm

TABLE 11

SUMMARY OF GOAL ATTAINMENT FINDINGS

Hypothesis:	Rating 1	Rating 2	Compens. Algorithm	Non-Comp. Algorithm
H1: (Comp.>Non-comp.)	no	no	no	no
H3: (Struct.>Flexible)	no	no	yes	no
H7: (Interaction)	no	no	no	no

Time. All of the assumptions for analysis of covariance were valid for time. The observations were independent, normally distributed with common variance (homogeneity). The original two-way ANCOVA was performed, and as expected from the correlation analysis, only the experience covariate was statistically significant. The two-way ANCOVA table produced after omitting the GEFT score as a covariate is shown in Table 12.

TABLE 12

ANCOVA TABLE FOR TIME

Source	DF	Sum of Squares	Mean Square	F value	Prob>F
Model	6	28138346.70	4689724.45	25.03	.0001
Error	174	32601344.23	187364.05		
Total	180	60739690.94			
R-Square	.46				
Experience	1	805218.08	805218.08	4.30	.0396
Dec. Aid	2	24376840.75	12188420.38	65.05	.0001
Complexity	1	737775.40	737775.40	3.94	.0488
Dec. Aid x Complexity	2	1293390.71	646695.35	3.45	.0339

The results of this analysis indicate that a significant interaction effect between decision aid and task complexity was present. A plot of the selection time means by decision aid and complexity is shown in Figure 4. These findings were used to test the hypotheses relating to selection time.

```
  2200 |
       |                                    2109
  2000 |                              _____
T 1800 |                     _____/          Flexible
I      |            _____/
M 1600 |   1731
E      |
  1400 |
       |
  1200 |   1222 _____ 1220   Non-Compensatory
       |
  1000 |   1038 _____ 1073   Compensatory
       |_____
```

"Low"   "High"
     Complexity Level
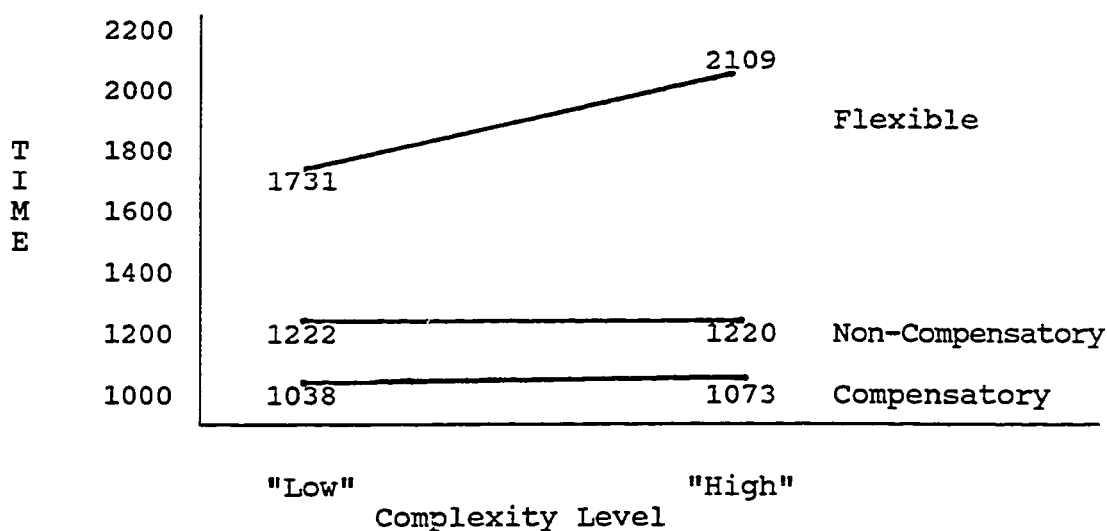
Figure 4.   Interaction Plot of Selection Time Means

Hypothesis 8, which expected the selection time between subjects using the flexible decision aid and subjects using either imposed strategy decision aid to be greater at the higher level of complexity, was supported by these results. The interaction between decision aid and task complexity is a change in magnitude, not a change in direction. At both levels of complexity, selection time with the flexible decision aid was greater than selection time with the non-compensatory decision aid, which was also greater than selection time with the compensatory decision aid. These results do not support Hypothesis 2 which expected no difference in selection time between the compensatory and non-compensatory decision aids. Hypothesis 4, which expected greater selection time for subjects using the flexible

decision aid than for subjects using either of the imposed strategy decision aids, was supported.

Effects on Perceptions

Again, the assumptions of ANCOVA were tested before proceeding with the statistical analysis. First, the assumption of independence was satisfied through random assignment of subjects to experimental cells.

Next, the assumption of normality was tested for each perceptual variable. Plots of residuals against normal scores did not reveal any non-normality, however, a test statistic produced by the SAS analysis indicated some non-normality. Again, this prompted an examination of the plots of raw data. Each of the perceptual measures, like the goal attainment measures, were left skewed. Subjects tended to answer questions in the upper end of the Likert scale provided (lower end for reversed questions). As previously mentioned, however, the F-test is robust to even moderate violations of normality.

Once again, due to non-normality, Levine L tests were performed to check for homogeneity of variance. The assumption of homogeneity of variance was valid for all three perceptual measures. Since only the assumption of normality was violated and the F-test is robust to moderate violations of normality, this analysis could also proceed without problems.

As expected from the correlation table, the ANCOVA models

for each perceptual measure indicated that neither of the covariates was significant and the analyses shifted to ANOVA. Non-significant results, shown in Tables 13 through 15, were obtained for all three ANOVAs. Investigation of statistical results did not appear to show the possibility that the two-way model was concealing real decision aid effects. However, since this result was discovered with the goal attainment variables, a one-way ANOVA was undertaken as a precaution. Again, no significant results were found for any of the three perceptual measures as shown in Tables 16 through 18.

TABLE 13

TWO-WAY ANOVA TABLE FOR CONFIDENCE IN SELECTION

Source	DF	Sum of Squares	Mean Square	F value	Prob>F
Model	5	1.1667	0.2333	.31	.9087
Error	175	133.3740	0.7621		
Total	180	134.5407			
R-Square	.01				

TABLE 14

TWO-WAY ANOVA TABLE FOR SATISFACTION WITH PROCESS

Source	DF	Sum of Squares	Mean Square	F value	Prob>F
Model	5	1.0985	.2197	.43	.8252
Error	175	88.8177	.5075		
Total	180	89.9161			
R-Square	.01				

TABLE 15

TWO-WAY ANOVA TABLE FOR SATISFACTION WITH DECISION AID

Source	DF	Sum of Squares	Mean Square	F value	Prob>F
Model	5	1.8991	.3798	.67	.6440
Error	175	98.6837	.5639		
Total	180	100.5829			

R-Square   .02

TABLE 16

ONE-WAY ANOVA TABLE FOR CONFIDENCE IN SELECTION

Source	DF	Sum of Squares	Mean Square	F value	Prob>F
Model	2	.3499	.1749	.23	.7931
Error	178	134.1908	.7539		
Total	180	134.5407			

R-Square   .003

TABLE 17

ONE-WAY ANOVA TABLE FOR SATISFACTION WITH PROCESS

Source	DF	Sum of Squares	Mean Square	F value	Prob>F
Model	2	.1477	.0739	.16	.8639
Error	178	89.7684	.5043		
Total	180	89.9161			

R-Square   .002

TABLE 18

ONE-WAY ANOVA TABLE FOR SATISFACTION WITH DECISION AID

Source	DF	Sum of Squares	Mean Square	F value	Prob>F
Model	2	.8839	.4420	.79	.4558
Error	178	99.6989	.5601		
Total	180	100.5829			
R-Square	.009				

These results supported Hypothesis 5 which stated that subjects using the compensatory decision aid will have the same levels of confidence in the selection, satisfaction with the process and satisfaction with the decision aid as subjects using the non-compensatory decision aid. Hypothesis 6, however, was not supported. This hypothesis expected higher levels of confidence in the selection, satisfaction with the process and satisfaction with the decision aid for subjects using the flexible decision aid than for those using either one of the imposed strategy decision aids. In an effort to better understand these experimental results, a discussion and interpretation is presented in the following sections.

Interpretations

The interpretation of experimental results will begin with the effects on performance, followed by the effects on perceptions. The tables and figures previously presented will

be discussed more thoroughly in an effort to better understand the implications of these results.

Effects on Performance

As previously stated, performance involves both effectiveness and efficiency. Within these two categories, the interpretation of results will focus on the differences between compensatory and non-compensatory decision aids followed by the differences between flexible and imposed strategy decision aids.

Goal Attainment.

In this study, goal attainment was measured in an attempt to discover how well subjects met their own personal goals and criteria in the apartment selection task. Four measures were used in an effort to provide greater insight and to help overcome the problems associated with any single measure. The subjective measurement of a variable like goal attainment for a task without a correct solution is much more complex than simply obtaining an objective measure of performance in an economic game situation. First, the definition of goal attainment must be clear. Should the evaluators judge only the apartment desired against the apartment chosen, or should the apartment set available (relative goal attainment) be considered. By asking individual raters to perform both ratings, more information is gained.

In addition to the uncertain definition of goal attainment, there is also the risk that the evaluation process

may be biased toward one of the treatments. For instance, the independent raters may consistently be using one of the choice strategies for evaluation. In this case, the results would be biased toward the decision aid based on that same choice strategy. Although using independent raters for this type of evaluation is accepted, without dictating a method of evaluation the individual strategies may not be known. For this reason, two algorithms were developed, one compensatory and one non-compensatory. The natural bias of these algorithms can be taken into account during evaluation. Interpreting results of all four methods provides not only greater understanding of the real differences in performance, but also some insight into the problems of bias associated with selecting methods for performance evaluation.

Using all four measures, the hypothesized relationships were examined. Hypothesis 1 addresses the relationship between compensatory and non-compensatory decision aids. Subjects using the compensatory decision aid were expected to have higher levels of goal attainment than subjects using the non-compensatory decision aid. This result was expected because previous research characterizes compensatory choice strategies as more "accurate" than non-compensatory strategies (Hogarth 1987). This hypothesis was not supported by the data, however. In fact, the opposite was true except for the compensatory algorithmic evaluation. Analysis of this evaluation indicated no significant difference between the

performance levels achieved with the compensatory versus the non-compensatory decision aid. Rating 1, rating 2 and the non-compensatory algorithmic evaluation, however, indicated that subjects using the non-compensatory decision aid outperformed subjects using the compensatory decision aid.

This reversed outcome may have been due to the nature of the task. Assigning numeric values to preferences concerning discrete, often qualitative, levels of apartment attributes may not actually capture true preferences. Subjects selecting an apartment based on these rankings may end up missing more attractive alternatives. Another explanation may be the task size. The large number of alternatives may have caused too much mental effort even with the ranked list. The non-compensatory strategy eliminated much of the list and may have enabled the subjects to evaluate more carefully the remaining alternatives.

The relationship between flexible and imposed strategy decision aids is addressed by Hypothesis 3. Subjects using the flexible decision aid were expected to have lower goal attainment levels than subjects using either of the imposed strategy decision aids, particularly the compensatory decision aid which was expected to have the highest level of goal attainment. This result was hypothesized because subjects tend to perform better with more structured aids as opposed to using less structured aids, even when these subjects are "experts" at the task (Dos Santos & Bariff 1988, Arkes et. al.

1986, Bettman & Park 1980). This hypothesis is only supported by the compensatory algorithmic evaluation which indicates that both imposed strategy decision aids do outperform the flexible decision aid. Rating 1, rating 2 and the non-compensatory algorithmic evaluations indicate that one of the imposed strategy decision aids produces higher levels of performance, but it is the non-compensatory aid instead of the compensatory aid. The possible reasons for this unexpected result were presented previously.

These results show how the evaluation method can impact the understanding of performance. For each of the evaluation methods, the average goal attainment achieved with the non-compensatory decision aid was the highest. The order of the other two systems varies between evaluation methods. (See Table 10.) Rating 1, Rating 2 and the non-compensatory algorithmic evaluation produced the same rankings and significant differences. One thing that these findings may indicate, is that independent raters tended toward non-compensatory models while evaluating goal attainment. This may be true because the non-compensatory strategy is simpler. The use of this strategy by human evaluators has implications for decision support system design which will be discussed in the next chapter.

The only consistent conclusion with respect to goal attainment is that levels achieved with the non-compensatory decision aid are significantly greater than those achieved

with the flexible decision aid (evaluated by 4 different goal attainment measures). Again, this result was unexpected. Instead, subjects using the compensatory system were expected to outperform subjects using both of the other systems. These findings, however, still support the idea that more structure is "better" than less structure with regard to goal attainment. In the context of directed change, the question now becomes, which type of structure or system restrictiveness is best. In this case, the decision aid based on a non-compensatory choice strategy appeared to provided better support for decision makers attempting to make a consumer selection.

With regard to the two covariates, it is important to note that for most of the evaluations they were not significant. Previous experience with the apartment selection task was not a significant covariate in any of the four models of goal attainment. The GEFT score was only a significant covariate in the model of goal attainment as measured by the compensatory algorithm. Use of the GEFT score as a covariate in the goal attainment models was primarily intended to control error and increase precision. Actual treatment (decision aid) effects can be measured more precisely by removing other effects which could not be accounted for in the experimental design, such as GEFT score. This covariate was not intended to be used for interpretation of the data. It is not likely that potential users of a decision aid will be

tested for analytic ability levels prior to system use. Instead, these results point out that a real difference in goal attainment levels is achieved with different decision aids, whereas this difference may not have been recognized without the use of the GEFT covariate in the model. This variable only proved to be useful in the model of goal attainment measured by the compensatory algorithm.

The final hypothesis dealing with goal attainment, Hypothesis 7, expected an interaction effect between decision aid and task complexity level. This hypothesis was obviously not supported since complexity level was excluded from the final analysis. This brings up an important issue of why complexity level was omitted. A pre-test of complexity level resulted in a significant difference in the perceived level of complexity for the task of selecting an apartment from each of these two apartment sets. In the pre-test subjects were not asked to actually complete the task. Requiring task completion may have changed these results. However, the analysis of efficiency (time) did indicate a significant effect for complexity level, as well as, an interaction. One explanation may be that there really is a distinguishable difference in complexity, but not at the levels expected. Due to the large apartment set size, the task complexity levels may not be "low" and "high," but rather "high" and "higher." In this case, time is affected, but decision aid is not. The same decision aids may be most appropriate for tasks beyond a

certain threshold of complexity. This threshold could be an important area for future research.

Time. As a surrogate measure of efficiency, time is much less complicated to measure than goal attainment. The computer recorded time on the decision aid from the beginning of the selection process until the process was complete. Subjects were not constrained by time; they could take as long as necessary to make a selection.

The decision aid/complexity interaction effect on time is addressed in Hypothesis 8. The higher level of task complexity was expected to increase the selection time difference between subjects using the flexible versus either of the imposed decision aids. This hypothesis was supported, suggesting that the flexible decision aid is even less efficient at higher levels of task complexity. The findings also show that the non-compensatory decision aid selection times were significantly greater than the compensatory decision aid, but task complexity did not appear to interact with either of these decision aids as shown in Figure 4. In this case, the task complexity level would not be a factor in deciding between compensatory versus non-compensatory decision aids.

The presence of an interaction effect changes the interpretation of the main effects in the model. Awareness of the interaction effect is necessary for complete understanding of decision aid effects on selection time. In the current

study, the interaction is one of magnitude, not direction. Therefore, decision aid effects will be discussed separately in order to address all hypotheses, however, the interaction detailed above (and displayed in Figure 4) should be recognized throughout the discussion.

Hypothesis 2 addresses the selection time with respect to compensatory versus non-compensatory decision aids. Subjects using the compensatory and non-compensatory decision aids were not expected to have any difference in selection time. The manual use of these strategies would normally lead to greater processing time for the compensatory than for the non-compensatory approach. Since these strategies were computerized, however, the time difference was not expected. This hypothesis was not supported. The selection times for subjects using the compensatory decision aid were actually lower than for subjects using the non-compensatory decision aid.

This result may be due in part to the nature of the decision aid interface. Subjects using the compensatory aid proceeded through a series of preference gathering questions for all eight attributes. At that time, the ranked listing was generated and most subjects chose an apartment without making changes to previous responses. Subjects using the non-compensatory decision aid answered a question about only one attribute and were than able to view the reduced list or continue eliminating for the other attributes without viewing

the reduced list. Most subjects chose to view the reduced
list between each elimination step. The processes followed by
both groups are consistent with the manual use of a linear and
elimination-by-aspects strategy, respectively. It appears
that the computerization of the strategies changes the
efficiency of this process, however. In any case, it is
important to recognize that the system interface may have
contributed to the time difference.

The efficiency of the compensatory decision aid is
important even though the compensatory approach did not
produce the highest levels of goal attainment for this task as
expected. The decision aid designer choosing between a
compensatory and a non-compensatory strategy must weigh the
difference in effectiveness of the non-compensatory against
the efficiency of the compensatory. This is exactly opposite
from evaluating manual strategies.

Additionally, recognizing that compensatory systems were
more efficient than non-compensatory systems in this task
setting is valuable information. The same could be true for
tasks that would benefit from a compensatory strategy (more
quantitative, continuous variables). In those cases, the
cost/benefit model would indicate use of a compensatory
strategy for the decision aid.

Hypothesis 4 addressed flexible versus imposed strategy
decision aids with respect to efficiency. Subjects using the
flexible decision aid were expected to take longer to make a

selection than subjects using either of the imposed strategy decision aids. This result was expected because the flexibility provides more options and the decision maker would spend time exploring these options. The data supported this hypothesis. These findings are important because even though the subjects using the flexible aid spent more time in the selection process, their goal attainment levels did not reflect this effort. In fact, the goal attainment levels achieved with the flexible decision aid were significantly lower than the goal attainment levels achieved with the non-compensatory (imposed) decision aid as measured by all four evaluations of goal attainment. For this particular task, structured aids were more efficient than less structured decision aids, and at the same time more effective. In this case, it would never be appropriate to use flexible decision aids from either a cost or benefit perspective.

The only covariate which was significant in the selection time model was previous experience with the apartment selection task. Use of experience as a covariate in the selection time model was not only intended to control error and increase precision, but also to aid in data interpretation. It is possible that knowledge of previous task experience will be known about the potential system user. If so, it is important to understand how this characteristic affects selection time. For every decision aid, subjects without previous apartment selection experience took longer to

make a selection. Selection times for inexperienced subjects were 9 to 16% higher than selection times for subjects with previous experience. If this time difference was due to task confusion, extra preparation or explanation could be provided for inexperienced system users.

Effects on Perceptions

Three different perceptual variables were studied, but the hypotheses concerning decision aid effects on each were the same. Compensatory versus non-compensatory decision aids were addressed in Hypothesis 5. Confidence in the selection, satisfaction with the process and satisfaction with the decision aid were not expected to be different for subjects using either the compensatory or non-compensatory decision aids. This result was expected because the computerization of calculations necessary for the compensatory model make it less difficult for the user, and therefore should not produce the negative view often associated with manual use of compensatory strategies. For each of the three perceptual measures, the hypothesis was supported. Without any difference in perception levels, either a compensatory or non-compensatory system could be used. Particularly in the case of a discretionary use system, the most appropriate strategy for the task could be employed without fear of negative user perceptions and lack of system use.

User perceptions with respect to flexible versus imposed strategy decision aids were addressed in Hypothesis 6.

Subjects using the flexible decision aid were expected to have higher levels of confidence in the selection, satisfaction with the selection process and satisfaction with the decision aid than subjects using either of the imposed strategy decision aids. This result was expected because subjects tend to prefer less structured decision aids to more structured decision aids regardless of performance levels (Aldag & Power 1986, Goslar et. al. 1986). This hypothesis was not supported by the data. One reason for the unexpected result may be due to the fact that subjects had very high perception levels for each of the imposed strategy decision aids. The difference in the degree of structure may not have been as great as in some previous studies. Although the strategy was imposed, the subject still had some flexibility in the steps of the process, and definitely in the final selection. In any case, it is better that the flexible system was not the preferred system since it was neither more effective nor more efficient than either of the imposed strategy decision aids.

Together, these experimental results and interpretations of performance and perceptions provide guidance to decision support system designers, as well as questions for further study to information systems researchers. A summarization of the entire study, including the implications of these results on DSS design and areas for future research, will be presented in the following chapter.

CHAPTER 6

SUMMARY AND CONCLUSIONS

Introduction

An overall summary of the current research is presented in this chapter. This summary is followed by implications for decision support system design, limitations of the study and potential areas of future research.

Research Overview

The current study focused on the choice phase of the decision making process. Specifically the effects of embedding choice strategies into the design of decision aids on decision maker performance and perceptions were examined. Choice strategies are either compensatory or non-compensatory as described in Chapter 2. The compensatory strategy employed in this study was the linear model, while the non-compensatory strategy employed was the elimination-by-aspects.

In the context of directed versus non-directed change, the decision aids had either one of the choice strategies imposed, or both of the choice strategies available to the user. The system with both of the choice strategies available was flexible in allowing the decision maker to use either

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strategy for alternative selection. In other words, the system was less restrictive by offering both types of choice strategies and therefore did not completely direct the alternative selection process. The "flexible" system, however, would still be considered somewhat restrictive. Although the user was able to follow either a compensatory, non-compensatory or combination approach to alternative selection, only one method of each strategy type was supported. For the compensatory a linear model was available, and for the non-compensatory an elimination-by-aspects model was available. The other two systems, compensatory and non-compensatory, restricted the type of choice strategy, as well as the model (linear, elimination-by-aspects) available to the decision maker, thus directing the alternative selection process to an even greater extent than the flexible system.

The decision aid effects were studied in conjunction with the level of task complexity effects. Specifically the task used in this research was an alternative selection of a consumer nature. Subjects selected an apartment from a pre-defined list of apartments using one of the decision aids. The task was an appropriate match for the upper division undergraduate students used as subjects in the study.

In order to study decision aid and task complexity effects, a laboratory experimental setting was used. The performance variables measured were goal attainment and time, used to represent effectiveness and efficiency, respectively.

The perceptual variables measured were confidence in the selection, satisfaction with the selection process and satisfaction with the decision aid. Hypotheses were stated in Chapter 3 focusing on two sets of relationships. First, how performance and perceptions differ between the compensatory and non-compensatory decision aid users. Second, how performance and perceptions differ between the imposed and flexible decision aid users. The results and interpretation of those results were presented in Chapter 5. A summary of that information is presented in Table 19.

With respect to effectiveness, differences in goal attainment levels were found, however, not the ones which were expected. Subjects using the non-compensatory decision aid achieved the highest levels of goal attainment as measured by all four evaluation methods. This level was significantly higher than the level achieved by subjects using the flexible decision aid in all four cases. Measured by three of the four evaluation methods (Rating 1, Rating 2 and the non-compensatory algorithm), this level was significantly higher than the level achieved by subjects using the compensatory decision aid. However, this level was not significantly higher than the level achieved by subjects using the compensatory decision aid as measured by the compensatory algorithm.

TABLE 19

SUMMARY OF OUTCOMES

Hypothesis:	Outcome:	Actual Effect:
1: Goal Attainment C > N.C.	Not supported	N.C. > C (3 of 4)* N.C. = C (1 of 4)*
2: Selection Time C = N.C.	Not supported	N.C. > C
3: Goal Attainment I (C) > F	Partially supported	I (both) > F (1 of 4)* I (N.C.) > F (3 of 4)*
4: Selection Time I (both) < F	Supported	
5: Perceptions C = N.C.	Supported	
6: Perceptions I (both) < F	Not supported	I (both) = F

7: Interaction:
    Goal Attainment
    > differences
	Not supported	task complexity
		eliminated

8: Interaction:
    Selection Time
    > differences
	Supported	

```
C    = compensatory decision aid
N.C. = non-compensatory decision aid
I    = imposed strategy decision aids (C and N.C)
F    = flexible decision aid
```

* Four different evaluations were used to test goal
attainment differences.

Selection time for subjects using each of the three
decision aids was significantly different with the flexible
aid having the greatest times, as expected. Contrary to
expectations, the subjects using the non-compensatory decision

aid took longer to make a selection than subjects using the compensatory decision aid. The main effects of the decision aid interacted with the levels of complexity causing a change in magnitude of the relationships. At the higher level of task complexity, subjects using the flexible decision aid took even longer to make a selection than subjects using either of the imposed strategy decision aids.

Confidence in the selection, satisfaction with the selection process and satisfaction with the decision aid were not significantly different for subjects using any of the three decision aids. This result was expected for the two imposed strategy decision aids, but unexpected for the flexible versus imposed decision aids.

The integration of these findings can provide insight into the use of decision aid strategies in the choice phase of decision making. This insight can be used for decision support system design, as well as for uncovering future research questions. These topics are the focus of the following sections.

Implications for Decision Support System Design

Greater understanding of decision aids within the choice phase of decision making can provide valuable information for developers of comprehensive decision support systems which incorporate models for alternative selection. The computerization of choice processing strategies provides

insight into how this particular use of choice strategies differs from the manual use of the same strategies. The current research helps to provide this understanding with respect to tasks requiring selection between alternatives with discrete, often qualitative attribute values. Many consumer product selections, as well as selections between business options which are based on qualitative factors represent this type of task.

For effectiveness, an imposed non-compensatory choice strategy embedded in the decision aid produced higher goal attainment levels than a decision aid providing flexibility to the decision maker. As for the compensatory decision aid, significant differences in goal attainment level depended on the method used for evaluation. For the DSS developer, recognizing this bias in evaluation methods is an important matter. The results of this study demonstrate the potential problems involved with a performance evaluation for this type of task. Without a clear objective measure of performance effectiveness, other methods to ascertain the level of performance, such as subjective ratings or algorithms, must be undertaken. These methods, however, run the risk of biasing performance results. Therefore, the use of several competing evaluations are necessary to try and fully understand actual performance effectiveness. It is important to note that individual raters in this study appeared to use non-compensatory models for evaluation. The recognition of

underlying evaluation models is essential if the DSS developer is truly interested in providing competing models to thoroughly investigate system effectiveness.

With respect to efficiency, subjects using all three decision aids had significantly different selection times. The flexible decision aid produced the longest selection times, followed by the non-compensatory and finally the compensatory decision aid. For this task, the flexible decision aid would not be appropriate from either a cost or benefit perspective. Both imposed strategy decision aids were more efficient and the non-compensatory decision aid was more effective than the flexible decision aid.

Performance results indicate that system restrictiveness (directed change) is warranted for this type of task. The type of direction required, limiting decision makers to either a compensatory or a non-compensatory strategy, may vary as a result of the particular attributes stated for the alternatives. In the case of discrete, mainly qualitative attributes, the non-compensatory strategy was consistently better. For attributes measured on continuous quantitative scales, this may not be the case. DSS developers should carefully consider the specific task for which the DSS is being designed.

Understanding cost/benefit tradeoffs with measures of effectiveness and efficiency are not the only area of concern for decision support system design. User perceptions of the

system are important, particularly in the case of discretionary use systems. Again, the findings in this study relate to a specific alternative selection task involving several discrete and/or qualitative attribute values. For these tasks, subjects were equally confident in the selection, satisfied with the selection process and satisfied with the decision aid for all three decision aids. In this case, it would appear that any approach will be accepted by the user, and therefore the decision should revert to a cost/benefit analysis. It is important to remember, however, that this result may be due to the fact that although the strategy was imposed (structured), the decision maker still retained some flexibility in the process, as well as the final selection. If this is the case, the decision support system developer should attempt to provide structure needed to perform the task, and also a certain amount of interface flexibility to accommodate user style.

Limitations of the Research

Every research study involves inevitable trade-offs resulting in certain limitations. A major concern is the balance between precision of measurement, generalizability and realism (McGrath 1982). Since the current study is no exception, limitations of the research design are discussed next.

First, the use of a laboratory experiment provides for

greater measurement precision and control, but consequently reduces generalizability and realism. This trade-off was chosen in order to isolate and investigate the effects of various choice phase decision aids on decision making outcomes. Using knowledge of the significant effects, these decision aids may be incorporated into a comprehensive DSS and tested in a field setting.

Second, the use of student subjects is also a limitation to generalizability and realism. The choice behavior of student subjects might not be similar to that of a manager. However, research would suggest that choice behaviors are less dependent on individuals, and more a function of the task and support tool. Consumers, managers and even children have demonstrated many of the same choice behaviors under similar conditions. In any case, an apartment selection task was chosen to provide a relevant problem for student subjects.

Finally, the focus on just the choice phase of the entire decision making process may be considered a limitation. The findings from this research alone will not provide all of the information necessary to design a comprehensive DSS. This type of research provides detailed information for a few aspects of support tool design. Further research on other aspects is necessary to complete the picture.

This approach is extremely useful, however, for the advancement of knowledge. An attempt to study every possible dimension of the problem would likely lead to unclear results

at this point. After pieces of the puzzle are combined, a larger scale study may be successfully undertaken.

Directions for Future Research

This study compared the computerization of different choice strategies in decision aids which were used for alternative selection by examining performance effectiveness, efficiency and user perceptions. The three decision aids provided the decision maker with either: (1) an imposed compensatory choice strategy, (2) an imposed non-compensatory choice strategy, or (3) the flexibility to use a compensatory choice strategy, a non-compensatory choice strategy or both. The task used in the research is similar to many consumer selections or business choices between alternatives having discrete, sometimes qualitative attribute values. Two distinct levels of task complexity were utilized, although both appear to have been nearer the high end of the complexity scale. The findings from this study raise several issues that should be addressed in future research.

First, the issue of task complexity for computerized alternative selection tasks should be addressed. The threshold levels for high and low complexity have been well studied for manual selection tasks, however, those thresholds have not been established for computerized alternative selection. The unexpected results from this study suggest that this area is important to understand.

Additionally, different alternative selection tasks should be addressed. A better understanding of how the types of attributes (quantitative/qualitative, discrete/continuous) may change the effect of decision aid on goal attainment is needed. The unexpected result of higher goal attainment with the non-compensatory system may be due to the particular attribute values, or it may not. Further study would help answer that question.

The focus of this study is on the choice phase of the decision making process. Future research should examine these strategies incorporated into more comprehensive decision support systems. Information gained from linking controlled experiments of this kind could then be used to undertake a study in more realistic surroundings.

Next, the actual stepwise process of selection for each subject should be studied. Although some subjects were forced to use a compensatory or a non-compensatory strategy, the stepwise processes were unique (as were those of subjects using the flexible decision aid). Possible questions which could be addressed with respect to that process are:

1) How many changes to original specifications were made, and how did that differ between decision aids?

2) Did subjects select the apartments recommended by the decision aid, and how did that differ between decision aids?

3) Which strategy was employed most by subjects using the flexible decision aid?

Gathering more information about the processes surrounding the use of decision aids with computerized choice strategies will add to the understanding of when these strategies are most appropriate. This knowledge could also help guide system development to effectively accomplish directed change.

Finally, the findings of this study indicate that performance evaluation method can bias results of effects on performance. Especially for tasks without a clear, objective solution. Future research should examine these problems more carefully in an effort to find less biased methods of evaluation, or a way of dealing with the bias which remains.

APPENDIX A

PERCEPTUAL MEASURE QUESTIONNAIRE

CODE # _____

THE APARTMENT SELECTION GUIDE
QUESTIONNAIRE

Part I. Read each statement carefully. On the scale below each statement, circle the number which best represents your level of agreement (or disagreement) with the statement.

1. I am pleased with the approach used to select an apartment.

Strongly   Strongly
Disagree   Agree
    1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

2. I felt comfortable while using the decision aid.

Strongly   Strongly
Disagree   Agree
    1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

3. I am not confident about my selection.

Strongly   Strongly
Disagree   Agree
    1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

4. Selecting an apartment using this decision aid was interesting.

Strongly   Strongly
Disagree   Agree
    1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

5. I am not sure my apartment selection was appropriate.

Strongly   Strongly
Disagree   Agree
    1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

6.   I really felt lost trying to select an apartment.

Strongly   Strongly
Disagree   Agree
      1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

7.   Using a computer to make a selection seems like a good
     idea to me.

Strongly   Strongly
Disagree   Agree
      1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

8.   I felt frustrated by the decision aid.

Strongly   Strongly
Disagree   Agree
      1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

9.   The time and effort used to select an apartment were well
     spent.

Strongly   Strongly
Disagree   Agree
      1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

10. My apartment selection was a good one.

Strongly   Strongly
Disagree   Agree
      1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

11. The approach used to select an apartment was not worth
     the effort.

Strongly   Strongly
Disagree   Agree
      1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

12. Using the decision aid was fun.

Strongly   Strongly
Disagree   Agree
    1 ------ 2 ------ 3 ------ 4 ------ 5 ------ 6 ------ 7

13. I am not in favor of computer-aided apartment selection
    because it is just another step toward depersonalization
    of decision making.

Strongly   Strongly
Disagree   Agree
    1 ------ 2 ------ 3 ------ 4 ------ 5 ------ 6 ------ 7

14. It took too much time to make a selection.

Strongly   Strongly
Disagree   Agree
    1 ------ 2 ------ 3 ------ 4 ------ 5 ------ 6 ------ 7

15. I don't like this decision aid.

Strongly   Strongly
Disagree   Agree
    1 ------ 2 ------ 3 ------ 4 ------ 5 ------ 6 ------ 7

16. I am satisfied with the apartment I selected.

Strongly   Strongly
Disagree   Agree
    1 ------ 2 ------ 3 ------ 4 ------ 5 ------ 6 ------ 7

17. I could easily justify my selection to others.

Strongly   Strongly
Disagree   Agree
    1 ------ 2 ------ 3 ------ 4 ------ 5 ------ 6 ------ 7

18. I wish I had approached the apartment selection differently.

Strongly   Strongly
Disagree   Agree
        1 ------ 2 ------ 3 ------ 4 ------ 5 ------ 6 ------ 7

19. Selecting an apartment frustrated me.

Strongly   Strongly
Disagree   Agree
        1 ------ 2 ------ 3 ------ 4 ------ 5 ------ 6 ------ 7

Part II. Read each question carefully. On the scale below the question, circle the number which best represents your answer to that question.

1. How comfortable were you with the process used to select an apartment?

    Very   Very
Uncomfortable   Comfortable
        1 ------ 2 ------ 3 ------ 4 ------ 5 ------ 6 ------ 7

2. How pleased were you with the process?

    Very   Very
Displeased   Pleased
        1 ------ 2 ------ 3 ------ 4 ------ 5 ------ 6 ------ 7

3. How likely is it that you would use the same process again in a similar situation?

    Very   Very
Unlikely   Likely
        1 ------ 2 ------ 3 ------ 4 ------ 5 ------ 6 ------ 7

4. How comfortable were you with the decision aid used to select an apartment?

```
      Very                                                      Very
Uncomfortable                                              Comfortable
       1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7
```

5.. How pleased were you with the decision aid?

```
      Very                                                      Very
Displeased                                                   Pleased
       1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7
```

6. How likely is it that you would use this type of decision aid for selection of an apartment in the future?

```
      Very                                                      Very
Unlikely                                                      Likely
       1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7
```

7. To what extent are you sure you have selected the best apartment for yourself?

```
Very Sure                                                Very Sure
I Did Not                                                    I Did
       1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7
```

8. To what extent are you sure you did not miss an attractive alternative?

```
Very Sure                                                Very Sure
I Did Not                                                    I Did
       1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7
```

9. To what extent are you sure your apartment selection is implementable?

```
Very Sure                                                Very Sure
It Is Not                                                    It Is
       1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7
```

Part III. Carefully read and answer the questions below.

1. Was the apartment you selected on the final reduced listing prepared by The Apartment Selection Guide?

   _____

2. **If you answered no to the previous question,** please explain why you selected an apartment that was not on the final reduced listing.

   _____

   _____

   _____

   _____

   _____

   _____

   _____

3. Do you have any comments regarding The Apartment Selection Guide?

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

Part III. Carefully read and answer the questions below.

1. Was the apartment you selected in the top three on the final ranked listing prepared by The Apartment Selection Guide?

   _____

2. **If you answered no to the previous question,** please explain why you selected an apartment that was not in the top three on the final ranked listing.

   _____

   _____

   _____

   _____

   _____

   _____

   _____

3. Do you have any comments regarding The Apartment Selection Guide?

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

ANSWER THE NEXT TWO PAGES IF YOU USED THE APARTMENT SELECTION GUIDE TO RANK AND REDUCE THE APARTMENT LISTING:

Part III. Carefully read and answer the questions below.

1. Was the apartment you selected on the final listing prepared by The Apartment Selection Guide?

   _____

2. **If you answered no to question #1,** please explain why you selected an apartment that was not on the final listing.

   _____

   _____

   _____

   _____

   _____

   _____

3. **If you answered yes to question #1:**

   A. Was the apartment you selected in the top three on the final listing?

   _____

   B. **If you answered no to question #3A,** please explain why you selected an apartment that was not in the top three on the final listing?

   _____

   _____

   _____

   _____

   _____

4. Do you have any comments regarding The Apartment Selection Guide?

  _____

  _____

  _____

  _____

  _____

  _____

  _____

  _____

  _____

ANSWER THIS PAGE IF YOU USED THE APARTMENT SELECTION GUIDE TO RANK BUT NOT REDUCE THE APARTMENT LISTING:

Part III. Carefully read and answer the questions below.

1. Was the apartment you selected in the top three on the final ranked listing prepared by The Apartment Selection Guide?

   _____

2. **If you answered no to the previous question,** please explain why you selected an apartment that was not in the top three on the final ranked listing.

   _____

   _____

   _____

   _____

   _____

   _____

   _____

3. Do you have any comments regarding The Apartment Selection Guide?

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

ANSWER THIS PAGE IF YOU USED THE APARTMENT SELECTION GUIDE TO REDUCE BUT NOT RANK THE APARTMENT LISTING:

Part III. Carefully read and answer the questions below.

1. Was the apartment you selected on the final reduced listing prepared by The Apartment Selection Guide?

    _____

2. **If you answered no to the previous question,** please explain why you selected an apartment that was not on the final reduced listing.

    _____

    _____

    _____

    _____

    _____

    _____

3. Do you have any comments regarding The Apartment Selection Guide?

    _____

    _____

    _____

    _____

    _____

    _____

    _____

    _____

APPENDIX B

TASK EXPERIENCE QUESTIONNAIRE

CODE # _____

APARTMENT DATA

1. Which statement best describes your current residence.

    A. I own my current residence.
    B. I rent my current residence.
    C. I live with my parents.
    D. other:_____

2. Prior to where you currently live, have you ever rented a house, townhouse, condominium, duplex, or apartment? Circle all answers which apply.

    A. house
    B. townhouse
    C. condominium
    D. duplex
    E. apartment
    F. other: _____
    G. I have not previously rented.

3. Approximately how many times have you rented any type of residence? (Count each residence only once, even if you signed more than one lease agreement at the same location.)

_____

If you are currently renting, answer the following 3 questions:

4. How involved were you in the process of renting your current residence? Circle your answer on the scale below.

  Very   Not
Involved   Involved

    1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

5. Which statement best describes your participation in the process of finding your current residence?

    A.   I searched for my current residence alone.

    B.   I searched for my current residence with the help of another person.

    C.   I searched for my current residence with the help of more than one other person.

    D.   Someone else searched for my current residence.

6. Which statement best describes your participation in the decision to rent your current residence?

    A.   The decision to rent my current residence was completely my own.

    B.   The decision to rent my current residence involved myself and one other person.

    C.   The decision to rent my current residence involved myself and more than one other person.

    D.   I did not make the decision to rent my current residence.

APPENDIX C

PREFERENCE/PRIORITY QUESTIONNAIRES

Code # _____

APARTMENT SURVEY #1

Carefully read and answer the following questions. These questions pertain to your personal search for an apartment to pre-lease for the Fall Semester 1991.

1. What length lease agreement (in months) do you need?

   _____

2. Circle the lowest level of cleanliness which is acceptable to you on the scale below:

   Exceptionally
      Clean   Dirty
         1 ---------- 2 ---------- 3 ---------- 4 --------- 5

3. What is the minimum square footage which is acceptable?

   _____

4. Are you looking for an apartment with a washer/dryer?

   _____

5. All things being equal, would you prefer to live closer to campus of farther from campus?

   _____

   A. If you answered closer, what is the maximum distance (measured in approximate driving time) which is acceptable?

   _____

   B. If you answered farther, what is the minimum distance (measured in approximate driving time) which is acceptable?

   _____

6. What is the maximum price (monthly rent) you are willing to pay? (Please state the total rent, not just the portion you intend to pay if you have roommates.)

_____

7. How many bedrooms do you need?

_____

8. How many bathrooms do you need?

_____

Rate the importance of the following apartment features in your personal apartment search. On the line to the right of the feature place check marks to indicate relative importance. You have 30 total check marks which may be assigned. If a single apartment feature is the only one that matters to you, place all 30 checks on that line. If two features are equally important and no others matter, place 15 check marks on each of those two lines. If six of the features are equally important, place 5 check marks on those lines, and so on. You may assign the 30 check marks in any way you choose. (The check marks do not need to be evenly divided as in the examples above.)

Length of the Lease   _____

Cleanliness   _____

Square footage   _____

Washer/dryer in the apartment _____

Distance from campus   _____

Price   _____

Number of bedrooms   _____

Number of bathrooms   _____

Please go back and count your check marks to make sure you have assigned exactly 30.

Code # _____

APARTMENT SURVEY #2

Carefully read and answer the following questions. These questions pertain to your personal search for an apartment to pre-lease for the Fall Semester 1991. Circle the answer which best applies to your situation. Circle only one answer unless otherwise indicated.

1. What is the lowest level of cleanliness you are willing to accept?

    A. Exceptionally clean - looks brand new
    B. Very clean - almost spotless
    C. Fairly clean - needs a little cleaning
    D. Slightly dirty - needs moderate cleaning
    E. Dirty - needs extensive cleaning

2. What is the maximum amount of rent you are willing to pay (total rent, not just your portion)?

    A. under $ 250
    B. $ 251 - 350
    C. $ 351 - 450
    D. $ 451 - 550
    E. $ 551 - 650
    F. $ 651 - 750
    G. $ 751 - 850
    H. $ 851 - 950
    I. over $ 950

3. How many bedrooms do you need?

    A. 1 bedroom
    B. 2 bedrooms
    C. 3 bedrooms
    D. 4 bedrooms
    E. over 4 bedrooms

4. How many bathrooms do you need?

    A. 1 bathroom
    B. 2 bathrooms
    C. 3 bathrooms
    D. over 3 bathrooms

5. Which distance ranges from campus (measured in approximate driving time) are acceptable? Circle **all** ranges that are acceptable.

    A. less than 5 minutes
    B. 5 to 10 minutes
    C. 10 to 15 minutes
    D. 15 to 20 minutes
    E. 20 to 25 minutes
    F. 25 to 30 minutes
    G. 30 to 35 minutes
    H. 35 to 40 minutes
    I. over 40 minutes

6. Which lease agreements are acceptable? Circle **all** lease agreements which are acceptable.

    A. month to month lease
    B. three month lease
    C. six month lease
    D. nine month lease
    E. twelve month lease

7. Which statement best describes your opinion about a washer/dryer in the apartment?

    A. A necessity which must be included.
    B. Desired, but not a necessity.
    C. Does not matter either way.
    D. Would prefer not to have them.

8. What is the minimum square footage you are willing to accept?

    A. less than 450 sq. ft.
    B. 450 - 600 sq. ft.
    C. 601 - 750 sq. ft.
    D. 751 - 900 sq. ft.
    E. 901 - 1050 sq. ft.
    F. 1051 - 1300 sq. ft.
    G. 1301 - 1450 sq. ft.
    H. over 1450 sq. ft.

Circle the level of importance for each apartment feature.

	Not important at all						Extremely Important

Cleanliness   1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7

Price   1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7

Number of
bedrooms   1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7

Number of
bathrooms   1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7

Distance   1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7

Length of
lease   1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7

Washer/dryer
in apt.   1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7

Square
footage   1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7

Code # _____

APARTMENT SURVEY #3

Carefully read and answer the following questions. These questions pertain to your personal search for an apartment to pre-lease for the Fall Semester 1991.

1. All things being equal, would you prefer to live closer to campus of farther from campus?

_____

A. **If you answered closer,** what is the maximum distance (measured in approximate driving time) which is acceptable?

_____

B. **If you answered farther,** what is the minimum distance (measured in approximate driving time) which is acceptable?

_____

2. Circle the lowest level of cleanliness which is acceptable to you on the scale below:

Exceptionally Clean	Very Clean	Fairly Clean	Slightly Dirty	Dirty	Extremely Dirty

1 --------- 2 --------- 3 --------- 4 --------- 5 --------- 6

3. What is the maximum price (monthly rent) you are willing to pay? (Please state the total rent, not just the portion you intend to pay if you have roommates.)

_____

4. What is the minimum square footage which is acceptable?

_____

5. How many bedrooms do you need?

_____

6. How many bathrooms do you need?

_____

7. What length lease agreement (in months) do you need?

_____

8. Are you looking for an apartment with a washer/dryer?

_____

Circle the level of importance for each apartment feature.

	Not important at all						Extremely Important
Distance	1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7
Cleanliness	1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7
Price	1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7
Square footage	1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7
Number of bedrooms	1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7
Number of bathrooms	1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7
Length of lease	1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7
Washer/dryer in apt.	1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7

Code # _____

APARTMENT SURVEY #4

Carefully read and answer the following questions. These questions pertain to your personal search for an apartment to pre-lease for the Fall Semester 1991. Circle the answer which best applies to your situation. Circle only one answer unless otherwise indicated.

1. Which statement best describes your opinion about a washer/dryer in the apartment?

   A. A necessity which must be included.
   B. Desired, but not a necessity.
   C. Does not matter either way.
   D. Would prefer not to have them.

2. How many bedrooms do you need?

   A. 1 bedroom
   B. 2 bedrooms
   C. 3 bedrooms
   D. 4 bedrooms
   E. over 4 bedrooms

3. How many bathrooms do you need?

   A. 1 bathroom
   B. 2 bathrooms
   C. 3 bathrooms
   D. over 3 bathrooms

4. Which lease agreements are acceptable? Circle all lease agreements which are acceptable.

   A. month to month lease
   B. three month lease
   C. six month lease
   D. nine month lease
   E. twelve month lease

5. What is the lowest level of cleanliness you are willing to accept?

    A. Exceptionally clean - looks brand new
    B. Very clean - almost spotless
    C. Fairly clean - needs a little cleaning
    D. Slightly dirty - needs moderate cleaning
    E. Dirty - needs extensive cleaning

6. What is the maximum amount of rent you are willing to pay (total rent, not just your portion)?

    A. under $ 250
    B. $ 250 - 350
    C. $ 351 - 450
    D. $ 451 - 550
    E. $ 551 - 650
    F. $ 651 - 750
    G. $ 751 - 850
    H. $ 851 - 950
    I. over $ 950

7. Which ranges of distance from campus (measured in approximate driving time) are acceptable? Circle **all** ranges that are acceptable.

    A. less than 5 minutes
    B. 5 to 10 minutes
    C. 10 to 15 minutes
    D. 15 to 20 minutes
    E. 20 to 25 minutes
    F. 25 to 30 minutes
    G. 30 to 35 minutes
    H. 35 to 40 minutes
    I. over 40 minutes

8. What is the minimum square footage you are willing to accept?

    A. less than 450 sq. ft.
    B. 450 - 600 sq. ft.
    C. 601 - 750 sq. ft.
    D. 751 - 900 sq. ft.
    E. 901 - 1050 sq. ft.
    F. 1051 - 1300 sq. ft.
    G. 1301 - 1450 sq. ft.
    H. over 1450 sq. ft.

Rate the importance of the following apartment features in your personal apartment search. On the line to the right of the feature place check marks to indicate relative importance. You have 30 total check marks which may be assigned. If a single apartment feature is the only one that matters to you, place all 30 checks on that line. If two features are equally important and no others matter, place 15 check marks on each of those two lines. If six of the features are equally important, place 5 check marks on those lines, and so on. You may assign the 30 check marks in any way you choose. (The check marks do _not_ need to be evenly divided as in the examples above.)

Washer/dryer in the apartment _____

Number of bedrooms _____

Number of bathrooms _____

Length of the Lease _____

Cleanliness _____

Price _____

Distance from campus _____

Square footage _____

Please go back and count your check marks to make sure you have assigned exactly 30.

APPENDIX D

POWER ANALYSIS

Introduction:

A sample of 180 subjects gives 30 subjects to each of the six different experimental cells. The denominator degrees of freedom equals 174 which is 180 total subjects minus 6 experimental cells. A moderate effect size (ES) of .25 and an alpha level of .05 are chosen. Using formulas and tables from Cohen (1988) produces the following power levels:

Task:

$\mu = 2-1 = 1$

$n' = 174/(1+1)+1 = 88$

Power = .92 (from Table 8.3.12, p. 311)

Decision Aid:

$\mu = 3-1 = 2$

$n' = 174/(2+1)+1 = 59$

Power = .855 (from Table 8.3.13, p. 313)

Task x Decision Aid:

$\mu = (2-1)(3-1) = 2$

$n' = 174/(2+1)+1 = 59$

Power = .855 (from Table 8.3.13, p. 313)

Working from the other direction, the smallest sample size required for at least .80 power on all tests is 162 subjects. Using 180 subjects allows for a loss of 10% of the subjects while still maintaining an adequate level of power.

APPENDIX E

APARTMENT SETS

APT #	CLEANLINESS	DISTANCE FROM CAMPUS	LEASE LENGTH	# OF BEDS	# OF BATHS	PRICE	SQ. FEET	LAUNDRY
1	Dirty	6 min	12 mos	1	1	$ 400	650	Yes
2	Slightly dirty	30 min	1 mos	4	2	$ 850	1350	Yes
3	Fairly clean	5 min	12 mos	2	1	$ 475	900	Yes
4	Slightly dirty	16 min	4 mos	2	2	$ 425	800	No
5	Exceptional	36 min	9 mos	2	1	$ 625	850	Yes
6	Very clean	6 min	12 mos	2	2	$ 575	900	Yes
7	Exceptional	10 min	12 mos	1	1	$ 375	550	No
8	Fairly clean	2 min	6 mos	3	1	$ 600	1050	No
9	Exceptional	10 min	1 mos	3	2	$ 650	950	Yes
10	Dirty	23 min	1 mos	1	1	$ 250	600	No
11	Dirty	21 min	6 mos	2	1	$ 400	1000	Yes
12	Slightly dirty	27 min	12 mos	2	1	$ 450	800	No
13	Dirty	21 min	9 mos	4	3	$ 925	1450	No
14	Very clean	9 min	1 mos	4	2	$ 875	1300	Yes
15	Very clean	14 min	6 mos	3	3	$ 700	1200	No

Press any key to continue...

APT #	CLEANLINESS	DISTANCE FROM CAMPUS	LEASE LENGTH	# OF BEDS	# OF BATHS	PRICE	SQ. FEET	LAUNDRY
16	Slightly dirty	5 min	1 mos	1	1	$ 325	550	Yes
17	Exceptional	37 min	6 mos	1	1	$ 375	600	Yes
18	Very clean	7 min	6 mos	3	2	$ 675	1150	No
19	Fairly clean	6 min	1 mos	2	2	$ 550	850	No
20	Exceptional	30 min	4 mos	4	3	$ 975	1550	No
21	Slightly dirty	15 min	6 mos	3	3	$ 650	1250	Yes
22	Slightly dirty	2 min	9 mos	2	1	$ 575	1000	No
23	Very clean	5 min	9 mos	1	1	$ 450	750	Yes
24	Dirty	25 min	12 mos	2	2	$ 450	1000	Yes
25	Fairly clean	5 min	12 mos	3	1	$ 575	1000	No
26	Fairly clean	30 min	4 mos	2	1	$ 475	800	No
27	Very clean	15 min	4 mos	4	3	$ 825	1400	Yes
28	Very clean	7 min	1 mos	2	2	$ 650	1050	Yes
29	Slightly dirty	16 min	12 mos	1	1	$ 350	650	Yes
30	Exceptional	10 min	4 mos	4	2	$ 900	1450	No

Press any key to continue...

APT #	CLEANLINESS	DISTANCE FROM CAMPUS	LEASE LENGTH	# OF BEDS	# OF BATHS	PRICE	SQ. FEET	LAUNDRY
1	Dirty	6 min	12 mos	1	1	$ 400	650	Yes
2	Slightly dirty	30 min	1 mos	4	2	$ 850	1350	Yes
3	Fairly clean	5 min	12 mos	2	1	$ 475	900	Yes
4	Slightly dirty	16 min	4 mos	2	2	$ 425	800	No
5	Exceptional	36 min	9 mos	2	1	$ 625	850	Yes
6	Very clean	6 min	12 mos	2	2	$ 575	900	Yes
7	Exceptional	10 min	12 mos	1	1	$ 375	550	No
8	Fairly clean	2 min	6 mos	3	1	$ 600	1050	No
9	Exceptional	10 min	1 mos	3	2	$ 650	950	Yes
10	Dirty	23 min	1 mos	1	1	$ 250	600	No
11	Dirty	21 min	6 mos	2	1	$ 400	1000	Yes
12	Slightly dirty	27 min	12 mos	2	1	$ 450	800	No
13	Dirty	21 min	9 mos	4	3	$ 925	1450	No
14	Very clean	9 min	1 mos	4	2	$ 875	1300	Yes
15	Very clean	14 min	6 mos	3	3	$ 700	1200	No

Press any key to continue...

APT #	CLEANLINESS	DISTANCE FROM CAMPUS	LEASE LENGTH	# OF BEDS	# OF BATHS	PRICE	SQ. FEET	LAUNDRY
16	Slightly dirty	5 min	1 mos	1	1	$ 325	550	Yes
17	Exceptional	37 min	6 mos	1	1	$ 375	600	Yes
18	Very clean	7 min	6 mos	3	2	$ 675	1150	No
19	Fairly clean	6 min	1 mos	2	2	$ 550	850	No
20	Exceptional	30 min	4 mos	4	3	$ 975	1550	No
21	Slightly dirty	15 min	6 mos	3	3	$ 650	1250	Yes
22	Slightly dirty	2 min	9 mos	2	1	$ 575	1000	No
23	Very clean	5 min	9 mos	1	1	$ 450	750	Yes
24	Dirty	25 min	12 mos	2	2	$ 450	1000	Yes
25	Fairly clean	5 min	12 mos	3	1	$ 575	1000	No
26	Fairly clean	30 min	4 mos	2	1	$ 475	800	No
27	Very clean	15 min	4 mos	4	3	$ 825	1400	Yes
28	Very clean	7 min	1 mos	2	2	$ 650	1050	Yes
29	Slightly dirty	16 min	12 mos	1	1	$ 350	650	Yes
30	Exceptional	10 min	4 mos	4	2	$ 900	1450	No

Press any key to continue...

APT #	CLEANLINESS	DISTANCE FROM CAMPUS	LEASE LENGTH	# OF BEDS	# OF BATHS	PRICE	SQ. FEET	LAUNDRY
31	Very clean	15 min	6 mos	1	1	$ 450	800	Yes
32	Dirty	7 min	9 mos	2	2	$ 600	850	Yes
33	Exceptional	32 min	6 mos	1	1	$ 425	650	No
34	Dirty	21 min	9 mos	3	2	$ 550	1100	No
35	Exceptional	11 min	6 mos	2	2	$ 575	900	No
36	Slightly dirty	37 min	12 mos	4	2	$ 775	1450	No
37	Fairly clean	10 min	12 mos	2	1	$ 550	850	Yes
38	Very clean	7 min	1 mos	3	1	$ 600	900	Yes
39	Fairly clean	24 min	4 mos	1	1	$ 300	550	Yes
40	Exceptional	17 min	6 mos	3	2	$ 700	1200	Yes
41	Dirty	7 min	4 mos	2	1	$ 500	750	Yes
42	Fairly clean	11 min	12 mos	1	1	$ 325	600	Yes
43	Very clean	6 min	9 mos	4	2	$ 925	1350	Yes
44	Slightly dirty	2 min	6 mos	2	2	$ 550	800	Yes
45	Very clean	15 min	9 mos	4	3	$ 950	1450	Yes

Press any key to continue...

APT #	CLEANLINESS	DISTANCE FROM CAMPUS	LEASE LENGTH	# OF BEDS	# OF BATHS	PRICE	SQ. FEET	LAUNDRY
46	Exceptional	4 min	4 mos	2	2	$ 650	850	Yes
47	Very clean	35 min	12 mos	2	1	$ 575	900	Yes
48	Dirty	26 min	9 mos	1	1	$ 275	550	Yes
49	Fairly clean	25 min	12 mos	1	1	$ 300	600	No
50	Very clean	10 min	1 mos	4	2	$ 825	1300	No
51	Dirty	11 min	9 mos	3	3	$ 725	1300	Yes
52	Very clean	17 min	9 mos	2	1	$ 425	950	Yes
53	Very clean	30 min	4 mos	1	1	$ 350	750	No
54	Fairly clean	11 min	9 mos	2	2	$ 475	850	No
55	Fairly clean	12 min	12 mos	3	2	$ 600	1050	No
56	Slightly dirty	6 min	1 mos	2	1	$ 500	800	Yes
57	Fairly clean	11 min	6 mos	4	3	$ 900	1500	No
58	Slightly dirty	2 min	9 mos	1	1	$ 375	700	No
59	Slightly dirty	19 min	12 mos	4	3	$ 875	1550	No
60	Fairly clean	20 min	6 mos	3	2	$ 575	1000	No

Press any key to continue...

APPENDIX F

COMPENSATORY DECISION AID CODE

```
*************************** LMAIN ***************************
This is the main program for the compensatory (linear)
decision aid.
************************************************************

set bell off
set talk off
set echo off
set status off
clear

********  Designates the database to be used.
USE db1

********  Prevents program from ending if user presses escape.
ON ESCAPE dummy=1


********  Makes variables to be transferred public, and non-
transferred variables private.

PUBLIC time_lmain,time_intro,time_view,time_prior,time_lexpl
PUBLIC time_reslt,time_calc,time_lopt,time_scrn,time_ch

PUBLIC pclean,pdist,please,pbaths,pbeds,pprice,psqft,pwd
PUBLIC clean1,clean2,clean3,clean4,clean5,time_lclen
PUBLIC month,four,six,nine,twelve,time_llese
PUBLIC onebed,twobed,threebed,fourbed,time_lbed
PUBLIC onebath,twobath,threebath,time_lbath
PUBLIC wd,time_lwd
PUBLIC dist,time_ldist

PUBLIC start1,kount,number,what,apt1,apt2

PRIVATE finish


********  Initializes incremental variables.
kount=0
number=0


********  Executes module to introduce the system.
DO intro

********  Executes module to gather priority weightings.
DO priority

********  Executes module to explain how to use system.
DO lexplain
```

```
********  Executes each of the preference gathering modules.
DO lclean
DO ldist
DO llease
DO lbeds
DO lbaths
DO llaundry


********  Executes module to produce the ranked listing.
DO results

********  Executes module to provide process options.
DO loptions


********  Calculates total time on the system.
finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_lmain=finish-start1


********  Creates the database with the user selection.
USE choose
REPLACE selection WITH apt1 FOR apartment="APT_ONE"
REPLACE selection WITH apt2 FOR apartment="APT_TWO"


********  Adds "total time" to the time variable database.
kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "LMAIN"
REPLACE time WITH time_lmain
REPLACE iterate WITH kount


********  Concludes the program.
clear
@6,5 to 14,70 double
@9,12 say "Thank you for using The Apartment Selection Guide."
@11,12 say "Please take your disk to the Project Coordinator."


RETURN
```

```
************************ INTRO.PRG ************************
This module introduces the user to the Apartment Selection
Guide and explains the purpose of the system.
*************************************************************


set bell off
set talk off
set echo off
set status off
clear

PUBLIC start1,time_intro,kount

PRIVATE finish,again

again=" "

DO WHILE again<>"N"
again=" "

@1,1 to 22,78 double
@2,20 say "WELCOME TO THE APARTMENT SELECTION GUIDE"
@3,20 say "===================================="
@5,3 say "This decision support system is designed to help you
choose an apartment"
@6,3 say "to meet your needs.  Remember, you are to assume
that this is an apartment"
@7,3 say "you plan to pre-lease for the Fall Semester."

@9,3 say "Each apartment in the listing will include the
following information:"

@11,10 say "(1)  A rating of the apartment cleanliness into
one of the"
@12,10 say "     following five levels:"
@13,20 say "Exceptionally clean, looks brand new."
@14,20 say "Very clean, almost spotless."
@15,20 say "Fairly clean, needs a little cleaning."
@16,20 say "Slightly dirty, needs moderate cleaning."
@17,20 say "Dirty, needs extensive cleaning."
@19,10 say "(2)  The distance the complex is located from
campus measured"
@20,10 say "     in approximate driving time."

@23,1 say " "
WAIT
CLEAR


start1=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))
```

```
@1,1 to 22,78 double
@2,10 say "(3)  The required length of the lease in months."
@4,10 say "(4)  The number of bedrooms available."
@6,10 say "(5)  The number of bathrooms available."
@8,10 say "(6)  The total price of the apartment. (If you plan
to have"
@9,10 say "      roommates, you may pay only a portion of that
amount.)"
@11,10 say "(7)  The size of the apartment measured in square
feet."
@13,10 say "(8)  The availability of laundry facilities.  (A
washer and"
@14,10 say "      dryer located in the apartment.)"
@16,3 say "The Apartment Selection Guide will lead you through
a series of questions"
@17,3 say "in an effort to help you locate the most
appropriate apartment to meet"
@18,3 say "your needs.  Each question screen will allow you
the opportunity to make"
@19,3 say "changes before continuing on to the next screen.
Before the questions"
@20,3 say "begin, you may first view the information for the
set of apartments from"
@21,3 say "which you will choose."

@24,3 say "Would you like to go back and read this
introduction again (Y or N)? " get again
read
again=upper(again)

CLEAR
ENDDO

CLEAR

DO view

finish=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

time_intro=finish-start1

kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "INTRO"
REPLACE time WITH time_intro
REPLACE iterate WITH kount

RETURN
```

```
************************* VIEW.PRG *************************
This module allows the user to view the apartment set or
continue without viewing the apartment set.
**********************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_view,kount

PRIVATE start,finish,review,other,form,correct,noview

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


store " " to review,other,form
correct=.f.
noview=.f.

DO WHILE .not.correct
correct=.f.
store " " to review,other

@5,4 to 15,73 double
@7,8 say "The apartment set may be viewed, or you may choose
to move on"
@8,8 say "without viewing the information.  What would you
like to do at"
@9,8 say "this time (A or B)? "

@11,19 say "A - View the apartment set."
@13,19 say "B - Move on without viewing the apartment set."

@9,30 say " " get form
read
form=upper(form)

DO CASE
   CASE form="A"
        correct=.t.
        DO CONDENSE
        clear
   CASE form="B"
        correct=.t.
        noview=.t.
        review="N"
        clear
```

```
        OTHERWISE
                @17,19 say "The response must be A or B only."

ENDCASE

ENDDO


finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_view=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "VIEW"
REPLACE time WITH time_view
REPLACE iterate WITH kount


RETURN
```

```
*********************** CONDENSE.PRG ***********************
This module contains the format for viewing the apartment
sets.
***********************************************************

set bell off
set talk off
set echo off
set status off
clear

PRIVATE review,linecount,twopage,start,finish,full
                                  ¢

store " " to review,twopage

DO WHILE review<>"N"

? "APT                    DISTANCE      LEASE     # OF    # OF
     SQ."
? " #    CLEANLINESS     FROM CAMPUS    LENGTH    BEDS    BATHS
PRICE FEET   LAUNDRY"
? "=== ===========      ===========    ======    ====    =====
===== ====  ======="
? "   "


linecount=3
go top

DO WHILE .NOT. EOF()
full=.f.
linecount=linecount+1

?apt_no+"    "+clean+"      "+transform(distance,"99")+" min
"+lease+" mos     "+ltrim(str(bedrooms))+"        ";
+ltrim(str(bathrooms))+"     $"+;
transform(price,"9999")+"    "+transform(sqfootage,"9999")+"
 "+laundry

SKIP

IF linecount>=18
    ? " "
    ? " "
    WAIT
    CLEAR


IF EOF()
    full=.t.
ELSE
```

```
?  "APT                         DISTANCE       LEASE      # OF     # OF
      SQ."
?  " #    CLEANLINESS      FROM CAMPUS     LENGTH     BEDS     BATHS
PRICE    FEET    LAUNDRY"
?  "===  ============     ============    ======    ====    =====
=====    ====  ======="
?  "    "

ENDIF



linecount=3
twopage="yes"

ENDIF

ENDDO

IF .not. full
   @23,4 say " "
   WAIT
ENDIF

review=" "
clear
@6,8 to 14,68 double
@10,14 say "Would you like to review this list (Y or N)? " get
review
READ
review=upper(review)
clear

IF review<>"N"
store " " to review
ENDIF


ENDDO


RETURN
```

```
*********************** PRIORITY.PRG ***********************
This module gathers user priorities with respect to the eight
apartment features.
**************************************************************

set bell off
set talk off
set echo off
set status off
clear


PUBLIC time_prior,pclean,pdist,please,pbaths,pbeds,pprice,
       psqft,pwd
PUBLIC kount,number

PRIVATE changes,start,finish,ptotal


start=val(left(time(),3))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


@1,1 to 23,78 double
@3,5 say "Rate the importance of the following apartment
features in your"
@4,5 say "personal apartment search.  The percentage weights
assigned to each"
@5,5 say "feature should total 100%.  The computer will total
the weights"
@6,5 say "automatically as you complete the list."

@10,15 say "Cleanliness .........................           %"
@11,15 say "Distance from campus .................          %"
@12,15 say "Length of the lease .................           %"
@13,15 say "Number of bathrooms .................           %"
@14,15 say "Number of bedrooms ..................           %"
@15,15 say "Price ...............................           %"
@16,15 say "Square footage ......................           %"
@17,15 say "Washer/dryer in the apartment .......           %"
@19,15 say "                            Total              %"


store 0 to
pclean,pdist,please,pbeds,pbaths,pprice,psqft,pwd,ptotal
store " " to changes


DO WHILE changes<>"N"
store " " to changes
```

```
@10,52 say " " get pclean picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@11,52 say " " get pdist picture "99"          .
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@12,52 say " " get please picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@13,52 say " " get pbaths picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@14,52 say " " get pbeds picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@15,52 say " " get pprice picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@16,52 say " " get psqft picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@17,52 say " " get pwd picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"
```

```
IF ptotal<>100
    @21,5 say "The total must equal 100%.   Make changes as
necessary to reach 100%."
    @24,3 say "                                            "
loop
ENDIF

@21,5 say "                                                      "
@24,4 say " Do you want to make any changes before continuing
(Y or N)?" get changes
read
changes=upper(changes)
enddo

finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_prior=finish-start

kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "PRIORITY"
REPLACE time WITH time_prior
REPLACE iterate WITH kount

number=number+1

USE prefvar
APPEND BLANK
REPLACE clean WITH pclean
REPLACE distance WITH pdist
REPLACE lease WITH please
REPLACE bedrooms WITH pbeds
REPLACE bathrooms WITH pbaths
REPLACE price WITH pprice
REPLACE sqfootage WITH psqft
REPLACE laundry WITH pwd
REPLACE iterate WITH number

pclean=pclean/100
pdist=pdist/100
please=please/100
pbaths=pbaths/100
pbeds=pbeds/100
pprice=pprice/100
psqft=psqft/100
pwd=pwd/100

RETURN
```

```
*********************** LEXPLAIN.PRG ***********************
This module explains how to answer the apartment feature
preference questions which will follow.
*****************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_lexpl,kount

PRIVATE start,finish,goback


start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


store " " to goback

DO WHILE goback<>"N"
goback=" "

clear
@5,1 to 18,75 double

@7,4 say "The next series of questions uses a category system
to rank your"
@8,4 say "preferences with respect to different features of an
apartment.  For"
@9,4 say "each feature (i.e. number of bedrooms, length of
lease), you will"
@10,4 say "be asked to categorize several options pertaining
to these features."
@11,4 say "The categories are as follows:"

@13,20 say "A - PREFERRED"
@14,20 say "B - ACCEPTABLE"
@15,20 say "C - ACCEPTABLE ONLY IN LIMITED SITUATIONS"
@16,20 say "D - UNACCEPTABLE"


@20,4 say " "
WAIT

clear
@1,1 to 20,77 double
```

```
@3,4 say "Categorizing an option as 'A - PREFERRED' means this
is the ideal"
@4,4 say "situation, and the option will be ranked at the
highest level.  You may"
@5,4 say "wish to place more than one option in this category
if the options are"
@6,4 say "equally ideal for your needs."

@8,4 say "Categorizing an option as 'B - ACCEPTABLE' means
this option is good,"
@9,4 say "but others are better.  These options will be ranked
slightly lower than"
@10,4 say "options categorized as 'A.'"

@12,4 say "Categorizing an option as 'C - ACCEPTABLE ONLY IN
LIMITED SITUATIONS' "
@13,4 say "means this is not a good situation, however, it may
be acceptable if all"
@14,4 say "other features of the apartment are appropriate for
your needs.  These"
@15,4 say "options will be ranked lower than both 'A' and
'B.'"

@17,4 say "Categorizing an option as 'D - UNACCEPTABLE' means
this is not an"
@18,4 say "acceptable situation, and these options will have
the lowest ranking."

@22,2 say "Would you like to go back and look at these
instructions again (Y or N)? "  get goback
read
goback=upper(goback)

ENDDO

finish=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

time_lexpl=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "LEXPLAIN"
REPLACE time WITH time_lexpl
REPLACE iterate WITH kount


RETURN
```

```
************************* LCLEAN.PRG *************************
This   module   gathers   preferences   concerning   apartment
cleanliness.
****************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_lclen,clean1,clean2,clean3,clean4,clean5,kount

PRIVATE changes,start,finish,part1,part2,correct

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


@1,1 to 23,78 double
@3,10 say "Classify the apartment cleanliness levels presented
below"
@4,10 say "using the following categories:"
@6,20 say "A - PREFERRED"
@7,20 say "B - ACCEPTABLE"
@8,20 say "C - ACCEPTABLE ONLY IN LIMITED SITUATIONS"
@9,20 say "D - UNACCEPTABLE"

@12,4 to 22,75 double
@13,54 say "Category"
@14,53 say "A,B,C or D"

@16,10 say "Exceptionally clean - looks brand new"
@17,10 say "Very clean - almost spotless"
@18,10 say "Fairly clean - needs a little cleaning"
@19,10 say "Slightly dirty - needs moderate cleaning"
@20,10 say "Dirty - needs extensive cleaning"

store " " to clean1,clean2,clean3,clean4,clean5,changes
correct=.f.

DO WHILE changes<>"N".or..not.correct
correct=.f.
part1=.f.
part2=.f.

@16,55 say " " get clean1
@17,55 say " " get clean2
@18,55 say " " get clean3
@19,55 say " " get clean4
@20,55 say " " get clean5
```

```
READ

clean1=upper(clean1)
clean2=upper(clean2)
clean3=upper(clean3)
clean4=upper(clean4)
clean5=upper(clean5)


IF  (clean1="A"  .or.  clean1="B"  .or.  clean1="C"  .or.
clean1="D") .and. (clean2="A" .or. clean2="B" .or. clean2="C"
.or.  clean2="D")  .and.  (clean3="A"  .or.  clean3="B"  .or.
clean3="C" .or. clean3="D")
        part1=.t.
ENDIF


IF  (clean4="A"  .or.  clean4="B"  .or.  clean4="C"  .or.
clean4="D") .and. (clean5="A" .or. clean5="B" .or. clean5="C"
.or. clean5="D")
        part2=.t. .
ENDIF


IF part1.and.part2
    correct=.t.
    @24,4 say "Do you want to make any changes before
continuing (Y or N)? " get changes
    READ
    changes=upper(changes)

ELSE
    @24,4 say "                 Categories must be A, B, C or D
only.     "
    store " " to changes

ENDIF

ENDDO


clean1=upper(clean1)
DO CASE
    CASE clean1="A"
        clean1=val("10")
    CASE clean1="B"
        clean1=val("6.67")
    CASE clean1="C"
        clean1=val("3.33")
    CASE clean1="D"
        clean1=val("0")
ENDCASE
```

```
clean2=upper(clean2)
DO CASE
    CASE clean2="A"
        clean2=val("10")
    CASE clean2="B"
        clean2=val("6.67")
    CASE clean2="C"
        clean2=val("3.33")
    CASE clean2="D"
        clean2=val("0")
ENDCASE

clean3=upper(clean3)
DO CASE
    CASE clean3="A"
        clean3=val("10")
    CASE clean3="B"
        clean3=val("6.67")
    CASE clean3="C"
        clean3=val("3.33")
    CASE clean3="D"
        clean3=val("0")
ENDCASE

clean4=upper(clean4)
DO CASE
    CASE clean4="A"
        clean4=val("10")
    CASE clean4="B"
        clean4=val("6.67")
    CASE clean4="C"
        clean4=val("3.33")
    CASE clean4="D"
        clean4=val("0")
ENDCASE

clean5=upper(clean5)
DO CASE
    CASE clean5="A"
        clean5=val("10")
    CASE clean5="B"
        clean5=val("6.67")
    CASE clean5="C"
        clean5=val("3.33")
    CASE clean5="D"
        clean5=val("0")
ENDCASE


finish=val(left(time(),2))*3600+;
       val(subst(time(),4,2))*60+;
       val(right(time(),2))
```

```
time_lclen=finish-start

kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "LCLEAN"
REPLACE time WITH time_lclen
REPLACE iterate WITH kount


RETURN   ·
```

```
*********************** LDIST.PRG ************************
This module gathers preferences concerning apartment distance
from campus.
**************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_ldist,dist,kount
PRIVATE changes,start,finish,correct

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


@4,1 to 15,78 double
@6,10 say "All things being equal, would you prefer to live
closer"
@8,10 say "to campus or farther from campus?"
@11,20 say "A - Closer to campus."
@12,20 say "B - Farther from campus."

store " " to dist,changes
correct=.f.


DO WHILE changes<>"N".or..not.correct
store " " to changes
correct=.f.

@8,45 say " " get dist
READ
dist=upper(dist)


IF dist="A".or.dist="B"
      correct=.t.
      @17,4 say "Do you want to make any changes before
continuing (Y or N)? " get changes
      READ
      changes=upper(changes)

ELSE
      @17,4 say "                   Response must be A or B only."
      store " " to changes
ENDIF

ENDDO
```

```
finish=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

time_ldist=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "LDIST"
REPLACE time WITH time_ldist
REPLACE iterate WITH kount


RETURN
```

```
************************ LLEASE.PRG ************************
This module gathers preferences concerning the apartment lease
length.
*************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_llese,month,four,six,nine,twelve,kount

PRIVATE changes,start,finish,part1,part2,correct

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))

@1,1 to 23,78 double
@3,10 say "Classify the acceptability of lease lengths
presented below"
@4,10 say "using the following categories:"
@6,20 say "A - PREFERRED"
@7,20 say "B - ACCEPTABLE"
@8,20 say "C - ACCEPTABLE ONLY IN LIMITED SITUATIONS"
@9,20 say "D - UNACCEPTABLE"

@12,14 to 22,65 double
@13,49 say "Category"
@14,48 say "A,B,C or D"

@16,20 say "Month to month lease"
@17,20 say "Four month lease"
@18,20 say "Six month lease"
@19,20 say "Nine month lease"
@20,20 say "Twelve month lease"

store " " to month,four,six,nine,twelve,changes
correct=.f.

DO WHILE changes<>"N".or..not.correct
store " " to changes
correct=.f.
part1=.f.
part2=.f.

@16,50 say " " get month
@17,50 say " " get four
@18,50 say " " get six
@19,50 say " " get nine
@20,50 say " " get twelve
```

```
READ

month=upper(month)
four=upper(four)
six=upper(six)
nine=upper(nine)
twelve=upper(twelve)


IF  (month="A".or.month="B".or.month="C".or.month="D")  .and.
(four="A".or.four="B".or.four="C".or.four="D")      .and.
(six="A".or.six="B".or.six="C".or.six="D")
     part1=.t.
ENDIF


IF    (nine="A".or.nine="B".or.nine="C".or.nine="D")     .and.
(twelve="A".or.twelve="B".or.twelve="C".or.twelve="D")
     part2=.t.
ENDIF


IF part1.and.part2
     correct=.t.
     @24,4  say  "Do  you  want  to  make  any  changes  before
continuing (Y or N)? " get changes
     READ
     changes=upper(changes)

ELSE
     @24,4 say "                  Categories must be A, B, C or D
only.       "
     store " " to changes
ENDIF

ENDDO


month=upper(month)
DO CASE
    CASE month="A"
         month=val("10")
    CASE month="B"
         month=val("6.67")
    CASE month="C"
         month=val("3.33")
    CASE month="D"
         month=val("0")
ENDCASE
```

```
four=upper(four)
DO CASE
    CASE four="A"
          four=val("10")
    CASE four="B"
          four=val("6.67")
    CASE four="C"
          four=val("3.33")
    CASE four="D"
          four=val("0")
ENDCASE


six=upper(six)
DO CASE
    CASE six="A"
          six=val("10")
    CASE six="B"
          six=val("6.67")
    CASE six="C"
          six=val("3.33")
    CASE six="D"
          six=val("0")
ENDCASE


nine=upper(nine)
DO CASE
    CASE nine="A"
          nine=val("10")
    CASE nine="B"
          nine=val("6.67")
    CASE nine="C"
          nine=val("3.33")
    CASE nine="D"
          nine=val("0")
ENDCASE


twelve=upper(twelve)
DO CASE
    CASE twelve="A"
          twelve=val("10")
    CASE twelve="B"
          twelve=val("6.67")
    CASE twelve="C"
          twelve=val("3.33")
    CASE twelve="D"
          twelve=val("0")
ENDCASE
```

```
finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_llese=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "LLEASE"
REPLACE time WITH time_llese
REPLACE iterate WITH kount


RETURN
```

```
************************ LBEDS.PRG ************************
This module gathers preferences concerning the number of
bedrooms in the apartment.
***********************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_1bed,onebed,twobed,threebed,fourbed,kount

PRIVATE changes,start,finish,part1,part2,correct

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


@1,1 to 23,78 double
@3,10 say "State your preferences with respect to the number
of bedrooms"
@4,10 say "using the following categories:"
@6,20 say "A - PREFERRED"
@7,20 say "B - ACCEPTABLE"
@8,20 say "C - ACCEPTABLE ONLY IN LIMITED SITUATIONS"
@9,20 say "D - UNACCEPTABLE"

@12,14 to 21,65 double
@13,49 say "Category"
@14,48 say "A,B,C or D"

@16,20 say "One bedroom"
@17,20 say "Two bedrooms"
@18,20 say "Three bedrooms"
@19,20 say "Four bedrooms"

store " " to onebed,twobed,threebed,fourbed,changes
correct=.f.


DO WHILE changes<>"N".or..not.correct
store " " to changes
correct=.f.
part1=.f.
part2=.f.

@16,50 say " " get onebed
@17,50 say " " get twobed
@18,50 say " " get threebed
@19,50 say " " get fourbed
```

```
READ

onebed=upper(onebed)
twobed=upper(twobed)
threebed=upper(threebed)
fourbed=upper(fourbed)


IF     (onebed="A".or.onebed="B".or.onebed="C".or.onebed="D")
.and.  (twobed="A".or.twobed="B".or.twobed="C".or.twobed="D")
     part1=.t.
ENDIF


I                                                              F
(threebed="A".or.threebed="B".or.threebed="C".or.threebed="D")
.and.(fourbed="A".or.fourbed="B".or.fourbed="C".or.
fourbed="D")
     part2=.t.
ENDIF


IF part1.and.part2
     correct=.t.
     @24,4  say  "Do  you  want  to  make  any  changes  before
continuing  (Y or N)? " get changes
     READ
     changes=upper(changes)

ELSE
     @24,4 say "                    Categories must be A, B, C or
D only. "
     store " " to changes
ENDIF


ENDDO


onebed=upper(onebed)
DO CASE
   CASE onebed="A"
        onebed=val("10")
   CASE onebed="B"
        onebed=val("6.67")
   CASE onebed="C"
        onebed=val("3.33")
   CASE onebed="D"
        onebed=val("0")
ENDCASE
```

```
twobed=upper(twobed)
DO CASE
    CASE twobed="A"
          twobed=val("10")
    CASE twobed="B"
          twobed=val("6.67")
    CASE twobed="C"
          twobed=val("3.33")
    CASE twobed="D"
          twobed=val("0")
ENDCASE

threebed=upper(threebed)
DO CASE
    CASE threebed="A"
          threebed=val("10")
    CASE threebed="B"
          threebed=val("6.67")
    CASE threebed="C"
          threebed=val("3.33")
    CASE threebed="D"
          threebed=val("0")
ENDCASE

fourbed=upper(fourbed)
DO CASE
    CASE fourbed="A"
          fourbed=val("10")
    CASE fourbed="B"
          fourbed=val("6.67")
    CASE fourbed="C"
          fourbed=val("3.33")
    CASE fourbed="D"
          fourbed=val("0")
ENDCASE

finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_lbed=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "LBEDS"
REPLACE time WITH time_lbed
REPLACE iterate WITH kount

RETURN
```

```
*********************** LBATHS.PRG ***********************
This module gathers preferences concerning the number of
bathrooms in the apartment.
*****************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_lbath,onebath,twobath,threebath,kount

PRIVATE changes,start,finish,correct

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


@1,1 to 23,78 double
@3,10 say "State your preferences with respect to the number
of bathrooms"
@4,10 say "using the following categories:"
@6,20 say "A - PREFERRED"
@7,20 say "B - ACCEPTABLE"
@8,20 say "C - ACCEPTABLE ONLY IN LIMITED SITUATIONS"
@9,20 say "D - UNACCEPTABLE"

@12,14 to 21,65 double
@13,49 say "Category"
@14,48 say "A,B,C or D"

@16,20 say "One bathroom"
@17,20 say "Two bathrooms"
@18,20 say "Three bathrooms"

store " " to onebath,twobath,threebath,changes
correct=.f.

DO WHILE changes<>"N".or..not.correct
store " " to changes
correct=.f.

@16,50 say " " get onebath
@17,50 say " " get twobath
@18,50 say " " get threebath
READ

onebath=upper(onebath)
twobath=upper(twobath)
threebath=upper(threebath)
```

```
IF(onebath="A".or.onebath="B".or.onebath="C".or.onebath="D")
.and.(twobath="A".or.twobath="B".or.twobath="C".or.
twobath="D")      .and.(threebath="A".or.threebath="B".or.
threebath="C".or.threebath="D")
     correct=.t.
     @24,4 say "Do you want to make any changes before
continuing (Y or N)? " get changes
     READ
     changes=upper(changes)
ELSE
     @24,4 say "                    Categories must be A, B, C or D
only "      .
     store " " to changes
ENDIF

ENDDO

onebath=upper(onebath)
DO CASE
    CASE onebath="A"
         onebath=val("10")
    CASE onebath="B"
         onebath=val("6.67")
    CASE onebath="C"
         onebath=val("3.33")
    CASE onebath="D"
         onebath=val("0")
ENDCASE

twobath=upper(twobath)
DO CASE
    CASE twobath="A"
         twobath=val("10")
    CASE twobath="B"
         twobath=val("6.67")
    CASE twobath="C"
         twobath=val("3.33")
    CASE twobath="D"
         twobath=val("0")
ENDCASE

threebath=upper(threebath)
DO CASE
    CASE threebath="A"
         threebath=val("10")
    CASE threebath="B"
         threebath=val("6.67")
    CASE threebath="C"
         threebath=val("3.33")
    CASE threebath="D"
         threebath=val("0")
ENDCASE
```

```
finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_lbath=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "LBATHS"
REPLACE time WITH time_lbath
REPLACE iterate WITH kount


RETURN
```

```
*********************** LLAUNDRY.PRG ***********************
This module gathers preferences concerning a washer/dryer in
the apartment.
***************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_lwd,wd,kount

PRIVATE changes,start,finish,correct

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


@2,5 to 13,71 double
@4,12 say "Which statement best describes your opinion about
a"
@5,12 say "washer/dryer in the apartment?"
@8,20 say "A - A necessity which must be included."
@9,20 say "B - Desired, but not a necessity."
@10,20 say "C - Does not matter either way."
@11,20 say "D - Would prefer not to have them."

store " " to wd,changes
correct=.f.


DO WHILE changes<>"N".or..not.correct
store " " to changes
correct=.f.

@5,42 say " " get wd
READ
wd=upper(wd)


IF wd="A".or.wd="B".or.wd="C".or.wd="D"
     correct=.t.
     @15,7 say "Do you want to make any changes before
continuing (Y or N)? " get changes
     READ
     changes=upper(changes)

ELSE
     @15,7 say "                    Response must be A, B, C or D
only. "
```

```
        store " " to changes
ENDIF


ENDDO


wd=upper(wd)
DO CASE
    CASE wd="A"
         wd=val("10")
    CASE wd="B"
         wd=val("6.67")
    CASE wd="C"
         wd=val("3.33")
    CASE wd="D"
         wd=val("0")
ENDCASE


finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_lwd=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "LLAUNDRY"
REPLACE time WITH time_lwd
REPLACE iterate WITH kount


RETURN
```

.

```
*********************** RESULTS.PRG ***********************
This module calls the linear module to calculate the ranking
for each apartment and then explains the rank ordered listing
to the user.
*******************************************************************

set bell off
set talk off
set echo off
set status off
clear

USE db1

PUBLIC time_reslt,tally,kount,apts

PRIVATE start,finish

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))

tally=0

DO calcs

clear
@6,4 to 15,71 double

@8,8 say "Using the information you have entered concerning
your"
@9,8 say "personal preferences and priorities, the following
apartment"
@10,8 say "listing has been generated.  The apartments are
rank ordered"
@11,8 say "by appropriateness for your individual needs.  (The
first"
@12,8 say "apartment in the list is most appropriate, followed
by the"
@13,8 say "second most appropriate, etc.)"


@20,5 say " "
WAIT


DO view


finish=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))
```

```
time_reslt=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "RESULTS"
REPLACE time WITH time_reslt
REPLACE iterate WITH kount
apts=LTRIM(STR(tally))
USE ranked&apts


RETURN
```

```
*********************** CALCS.PRG *************************
This module performs the linear calculations required to rank
order the apartments.
****************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_calc,clean1,clean2,clean3,clean4,clean5
PUBLIC month,four,six,nine,twelve
PUBLIC onebed,twobed,threebed,fourbed
PUBLIC onebath,twobath,threebath
PUBLIC wd,dist,tally,kount
PUBLIC pclean,pdist,please,pbeds,pbaths,pprice,psqft,pwd

PRIVATE start,finish,apts
PRIVATE xclean,xlease,xbeds,xbaths,xwd
PRIVATE xdist,idist,xprice,iprice,xsqft,weight


start=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))


@8,12 to 13,62 double
@10,16 say "Please wait while your apartment listing is"
@11,16 say "being prepared."


STORE 0 to xclean,xlease,xwd,xbeds,xbaths,xdist,xprice,xsqft
STORE 0 to iprice,idist

GO TOP

DO WHILE .not. EOF()

DO CASE
    CASE clean="Exceptional"
        xclean=clean1
    CASE clean="Very clean"
        xclean=clean2
    CASE clean="Fairly clean"
        xclean=clean3
    CASE clean="Slightly dirty"
        xclean=clean4
    CASE clean="Dirty"
        xclean=clean5
ENDCASE
```

```
DO CASE
    CASE lease=" 1"
         xlease=month
    CASE lease=" 4"
         xlease=four
    CASE lease=" 6"
         xlease=six
    CASE lease=" 9"
         xlease=nine
    CASE lease="12"
         xlease=twelve
ENDCASE

DO CASE
    CASE bedrooms=1
         xbeds=onebed
    CASE bedrooms=2
         xbeds=twobed
    CASE bedrooms=3
         xbeds=threebed
    CASE bedrooms=4
         xbeds=fourbed
ENDCASE

DO CASE
    CASE bathrooms=1
         xbaths=onebath
    CASE bathrooms=2
         xbaths=twobath
    CASE bathrooms=3
         xbaths=threebath
ENDCASE

DO CASE
    CASE laundry="Yes"
         xwd=wd
    CASE laundry="No"
         xwd=(wd-10)*(-1)
ENDCASE

dist=upper(dist)
DO CASE
    CASE dist="A"
         idist=(distance-2)/3.5
         xdist=(idist-10)*(-1)
    CASE dist="B"
         xdist=(distance-2)/3.5
ENDCASE

iprice=(price-250)/72.5
xprice=(iprice-10)*(-1)
xsqft=(sqfootage-550)/100
```

```
WEIGHT = (xclean*pclean) + (xlease*please) + (xbeds*pbeds) +
(xbaths*pbaths) + (xwd*pwd) + (xdist*pdist) + (xprice*pprice)
+ (xsqft*psqft)

REPLACE rank with weight
SKIP
ENDDO

tally=tally+1
apts=LTRIM(STR(tally))

SORT on rank/d to ranked&apts


finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_calc=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "CALCS"
REPLACE time WITH time_calc
REPLACE iterate WITH kount
USE ranked&apts


RETURN
```

```
*********************** LOPTIONS.PRG ***********************
This module provides options for the user to choose the next
course of action.
***********************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_lopt,what,kount
PRIVATE start,finish,correct,duplicate


start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


store " " to what
correct=.f.

DO WHILE what<>"A".or..not.correct
store " " to what
duplicate=.f.
correct=.f.

@3,3 to 20,74 double

@5,7 say "At this time you may make a selection, view the
ranked apartment"
@6,7 say "listing again, or return to a previous screen to
make changes to"
@7,7 say "some or all of your prior responses.  What would you
like to do"
@8,7 say "at this time (A, B or C)? " get what

@11,14 say "A - Make final apartment selection.  (You must
know"
@12,14 say "    the apartment number to make a selection.)"

@14,14 say "B - Review ranked apartment listing.  (This will
be"
@15,14 say "      an updated listing if you have made any
changes.)"

@17,14 say "C - Return to a previous screen to make changes
to"
@18,14 say "    your responses."

read
```

```
what=upper(what)


DO CASE
    CASE what="A"
        correct=.t.
        DO choice
    CASE what="B"
        correct=.t.
        what=" "
        DO view
        clear
    CASE what="C"
        correct=.t.
        duplicate=.t.
        what=" "
        DO screens
        clear
ENDCASE


IF .not.correct
    @21,18 say "The response must be A, B or C only."
ENDIF

apts=LTRIM(STR(tally))
USE ranked&apts


ENDDO


finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_lopt=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "LOPTIONS"
REPLACE time WITH time_lopt
REPLACE iterate WITH kount


RETURN
```

```
************************ SCREENS.PRG ************************
This module allows the user to return to one of the previous
screens to change a response.
**************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_scrn,kount,tally,apts
PRIVATE start,finish,changes,more


store " " to changes,more
correct=.f.

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


DO WHILE more<>"N"
store " " to more

@4,5 to 21,74 double

@6,12 say "For which one of the previous set of questions
would"
@7,12 say "you like to change your responses.  (After making
changes"
@8,12 say "to one screen, you will have the opportunity to
change"
@9,12 say "others before continuing.)"

@11,19 say "A - Importance ratings (percentage weights)."
@12,19 say "B - Cleanliness levels."
@13,19 say "C - Distance from campus."
@14,19 say "D - Length of lease."
@15,19 say "E - Number of bedrooms."
@16,19 say "F - Number of bathrooms."
@17,19 say "G - Washer/dryer availability."


IF correct
    @2,10 say "Would you like to make any further changes (Y or
N)?  " get more
    read
    more=upper(more)
ENDIF
```

```
IF more<>"N"
    correct=.f.
    @2,10 say "                                                    "
    @23,6 say "                                                    "
    @19,12 say "Which screen would you like to see (A through
G)?    " get changes
    read
    changes=upper(changes)

DO CASE
    CASE changes="A"
        correct=.t.
        changes=" "
        DO priority
        clear
    CASE changes="B"
        correct=.t.
        changes=" "
        DO lclean
        clear
    CASE changes="C"
        correct=.t.
        changes=" "
        DO ldist
        clear
    CASE changes="D"
        correct=.t.
        changes=" "
        DO llease
        clear
    CASE changes="E"
        correct=.t.
        changes=" "
        DO lbeds
        clear
    CASE changes="F"
        correct=.t.
        changes=" "
        DO lbaths
        clear
    CASE changes="G"
        correct=.t.
        changes=" "
        DO llaundry
        clear
    OTHERWISE
        @22,20 say "Response must be A through G only."
ENDCASE

ENDIF

ENDDO
```

```
USE ranked&apts


DO calcs


finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_scrn=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "SCREENS"
REPLACE time WITH time_scrn
REPLACE iterate WITH kount


RETURN
```

```
************************ CHOICE.PRG ************************
This module records the user's final apartment selection.
***********************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_ch,what,apt1,apt2,feature,chosen,kount
PRIVATE start,finish,ready,correct

store " " to ready
store 0 to apt1,apt2
correct=.f.

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


DO WHILE ready<>"Y".and.ready<>"N"

@6,3 to 14,73 double

@9,6 say "Are you ready to make your final apartment selection
(Y or N)? " get ready
@11,11 say "YOU MUST KNOW THE APARTMENT NUMBER TO MAKE A
SELECTION"
read
ready=upper(ready)

     IF ready<>"N".and.ready<>"Y"
        @15,20 say "The response must be Y or N only."
     ENDIF
ENDDO

clear

IF ready="Y"
     chosen=.t.

   DO WHILE .not.correct
        store 0 to apt1,apt2
        @4,5 to 16,72 double
        @6,13 say "Enter the number of the apartment you would
like"
        @7,13 say "to select.   " get apt1 PICTURE "99"
        read
        @12,13 say "                              "
        @13,13 say "                              "
```

```
        IF apt1<>0
                @9,13 say "Re-enter the apartment number to confirm.
   " get apt2 PICTURE "99"
                read

        IF apt1>=1.and.apt1<=30.and.apt2>=1.and.apt2<=30


        IF apt1=apt2
            correct=.t.
            clear
        ELSE
                @12,13 say "You did not enter the same apartment
    number."
                @13,13 say "Please try again."
        ENDIF


        ELSE
                @12,13 say "Apartment number must be between 1 and
    30."
                @13,13 say "Please try again."
        ENDIF

        ENDIF

     ENDDO


ELSE
    what=" "
    feature=" "

ENDIF


finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_ch=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "CHOICE"
REPLACE time WITH time_ch
REPLACE iterate WITH kount


RETURN
```

APPENDIX G

NON-COMPENSATORY DECISION AID CODE

```
************************** EMAIN ***************************
This   is   the   main   program   for   the   non-compensatory
(elimination-by-aspects) decision aid.
*************************************************************

set bell off
set talk off
set echo off
set status off
clear

******** Designates the database to be used
USE db1

******** Prevents program from ending if user presses escape.
ON ESCAPE dummy=1


******** Makes variables to be transferred public, and non-
transferred variables private.

PUBLIC time_emain,time_intro,time_view,time_eview
PUBLIC time_prior,time_expl,time_first,time_elim,time_eopt
PUBLIC time_next,time_altvu,time_ch,time_eclen,time_edist
PUBLICtime_elese,time_ebed,time_ebath,time_erent,time_esqft,
        time_ewd

PUBLIC pclean,pdist,please,pbaths,pbeds,pprice,psqft,pwd
PUBLIC feature,kount,number,tally,kounto,begin,numero
PUBLIC repeat1,repeat2,repeat3,repeat4,repeat5,repeat6,
        repeat7,repeat8
PUBLIC condition,dist1,dist2,lease1,lease2,lease3,
        lease4,lease5
PUBLIC bed1,bed2,bed3,bed4,bath1,bath2,bath3
PUBLIC money,size,wd
PUBLIC start1,what,apt1,apt2

PRIVATE finish

******** Initializes incremental variables.
kount=0
number=0
tally=0

******** Executes the module to introduce the system.
DO intro

******** Executes the module to gather priority weightings.
DO priority

******** Executes the module to explain how to use the system.
DO explain
```

```
******** Executes the module which allows the user to choose
the most important apartment feature to begin eliminating.

DO first

******** Executes the module to provide process options.
DO eoptions


******** Calculates total time on the system.
finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_emain=finish-start1


******** Creates the database with the user selection.
USE choose
REPLACE selection WITH apt1 FOR apartment="APT_ONE"
REPLACE selection WITH apt2 FOR apartment="APT_TWO"

        .

******** Adds "total time" to the time variable database.
kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "EMAIN"
REPLACE time WITH time_emain
REPLACE iterate WITH kount


******** Concludes the program.
clear
@6,5 to 14,70 double
@9,12 say "Thank you for using The Apartment Selection Guide."
@11,12 say "Please take your disk to the Project Coordinator."


RETURN
```

```
************************ INTRO.PRG ************************
This module introduces the user to the Apartment Selection
Guide and explains the purpose of the system.
*********************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC start1,time_intro,kount

PRIVATE finish,again

again=" "

DO WHILE again<>"N"
again=" "

@1,1 to 22,78 double
@2,20 say "WELCOME TO THE APARTMENT SELECTION GUIDE"
@3,20 say "======================================="
@5,3 say "This decision support system is designed to help you
choose an apartment"
@6,3 say "to meet your needs.  Remember, you are to assume
that this is an apartment"
@7,3 say "you plan to pre-lease for the Fall Semester."

@9,3 say "Each apartment in the listing will include the
following information:"

@11,10 say "(1)  A rating of the apartment cleanliness into
one of the"
@12,10 say "      following five levels:"
@13,20 say "Exceptionally clean, looks brand new."
@14,20 say "Very clean, almost spotless."
@15,20 say "Fairly clean, needs a little cleaning."
@16,20 say "Slightly dirty, needs moderate cleaning."
@17,20 say "Dirty, needs extensive cleaning."
@19,10 say "(2)  The distance the complex is located from
campus measured"
@20,10 say "      in approximate driving time."

@23,1 say " "
WAIT
CLEAR


start1=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))
```

```
@1,1 to 22,78 double
@2,10 say "(3)  The required length of the lease in months."
@4,10 say "(4)  The number of bedrooms available."
@6,10 say "(5)  The number of bathrooms available."
@8,10 say "(6)  The total price of the apartment. (If you plan
to have"
@9,10 say "     roommates, you may pay only a portion of that
amount.)"
@11,10 say "(7)  The size of the apartment measured in square
feet."
@13,10 say "(8)  The availability of laundry facilities.  (A
washer and"
@14,10 say "     dryer located in the apartment.)"
@16,3 say "The Apartment Selection Guide will lead you through
a series of questions"
@17,3  say  "in  an  effort  to  help  you  locate  the  most
appropriate apartment to meet"
@18,3 say "your needs.  Each question screen will allow you
the opportunity to make"
@19,3 say "changes before continuing on to the next screen.
Before the questions"
@20,3 say "begin, you may first view the information for the
set of apartments from"
@21,3 say "which you will choose."

@24,3  say  "Would  you  like  to  go  back  and  read  this
introduction again (Y or N)? " get again
read
again=upper(again)

CLEAR
ENDDO

CLEAR

DO view

finish=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

time_intro=finish-start1

kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "INTRO"
REPLACE time WITH time_intro
REPLACE iterate WITH kount

RETURN
```

```
*************************** VIEW.PRG ***************************
This module allows the user to view the apartment set or
continue without viewing the apartment set.
**************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_view,kount

PRIVATE start,finish,review,other,form,correct,noview

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


store " " to review,other,form
correct=.f.
noview=.f.

DO WHILE .not.correct
correct=.f.
store " " to review,other

@5,4 to 15,73 double
@7,8 say "The apartment set may be viewed, or you may choose
to move on"
@8,8 say "without viewing the information.  What would you
like to do at"
@9,8 say "this time (A or B)? "

@11,19 say "A - View the apartment set."
@13,19 say "B - Move on without viewing the apartment set."

@9,30 say " " get form
read
form=upper(form)

DO CASE
   CASE form="A"
        correct=.t.
        DO CONDENSE
        clear
   CASE form="B"
        correct=.t.
        noview=.t.
        review="N"
        clear
```

```
        OTHERWISE
                @17,19 say "The response must be A or B only."

ENDCASE

ENDDO


finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_view=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "VIEW"
REPLACE time WITH time_view
REPLACE iterate WITH kount


RETURN
```

```
********************* CONDENSE.PRG *********************
This module contains the format for viewing the apartment
sets.
*******************************************************************

set bell off
set talk off
set echo off
set status off
clear

PRIVATE review,linecount,twopage,start,finish,full


store " " to review,twopage

DO WHILE review<>"N"

? "APT                  DISTANCE      LEASE     # OF   # OF
     SQ."
? "  #    CLEANLINESS   FROM CAMPUS   LENGTH    BEDS   BATHS
PRICE FEET   LAUNDRY"
? "===   ============   ===========   ======    ====   =====
=====  ====   ======="
? "   "


linecount=3
go top

DO WHILE .NOT. EOF()
full=.f.
linecount=linecount+1

?apt_no+"    "+clean+"        "+transform(distance,"99")+" min
"+lease+" mos       "+ltrim(str(bedrooms))+"       ";
+ltrim(str(bathrooms))+"      $"+;
transform(price,"9999")+"    "+transform(sqfootage,"9999")+"
"+laundry

SKIP

IF linecount>=18
    ? " "
    ? " "
    WAIT
    CLEAR


IF EOF()
    full=.t.
ELSE
```

```
?  "APT                    DISTANCE      LEASE     # OF   # OF
    SQ."
?  "  #    CLEANLINESS     FROM CAMPUS   LENGTH    BEDS   BATHS
PRICE    FEET   LAUNDRY"
?  "===  ===========      ===========   ======    ====   =====
=====    ====   ======="
?  "       "

ENDIF



linecount=3
twopage="yes"

ENDIF

ENDDO

IF .not. full
    @23,4 say "  "
    WAIT
ENDIF

review="  "
clear
@6,8 to 14,68 double
@10,14 say "Would you like to review this list (Y or N)? " get
review
READ
review=upper(review)
clear

IF review<>"N"
store "  " to review
ENDIF


ENDDO


RETURN
```

```
*********************** PRIORITY.PRG ***********************
This module gathers user priorities with respect to the eight
apartment features.
***********************************************************

set bell off
set talk off
set echo off
set status off
clear


PUBLIC time_prior,pclean,pdist,please,pbaths,pbeds,pprice,
       psqft,pwd
PUBLIC kount,number

PRIVATE changes,start,finish,ptotal


start=val(left(time(),3))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


@1,1 to 23,78 double
@3,5 say "Rate the importance of the following apartment
features in your"
@4,5 say "personal apartment search.  The percentage weights
assigned to each"
@5,5 say "feature should total 100%.  The computer will total
the weights"
@6,5 say "automatically as you complete the list."

@10,15 say "Cleanliness ...........................     %"
@11,15 say "Distance from campus .................     %"
@12,15 say "Length of the lease .................     %"
@13,15 say "Number of bathrooms .................     %"
@14,15 say "Number of bedrooms ..................     %"
@15,15 say "Price ...............................     %"
@16,15 say "Square footage ......................     %"
@17,15 say "Washer/dryer in the apartment .......     %"
@19,15 say "                            Total     %"


store 0 to
pclean,pdist,please,pbeds,pbaths,pprice,psqft,pwd,ptotal
store " " to changes


DO WHILE changes<>"N"
store " " to changes
```

```
@10,52 say " " get pclean picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@11,52 say " " get pdist picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@12,52 say " " get please picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@13,52 say " " get pbaths picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@14,52 say " " get pbeds picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@15,52 say " " get pprice picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@16,52 say " " get psqft picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"

@17,52 say " " get pwd picture "99"
read
ptotal = pclean + pdist + please + pbaths + pbeds + pprice +
psqft + pwd
@19,53 say ptotal picture "999"
```

```
IF ptotal<>100
    @21,5 say "The total must equal 100%.   Make changes as
necessary to reach 100%."
    @24,3 say "                                              "
loop
ENDIF

@21,5 say "                                                  "
@24,4 say " Do you want to make any changes before continuing
(Y or N)?" get changes
read
changes=upper(changes)
enddo

finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_prior=finish-start

kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "PRIORITY"
REPLACE time WITH time_prior
REPLACE iterate WITH kount

number=number+1

USE prefvar
APPEND BLANK
REPLACE clean WITH pclean
REPLACE distance WITH pdist
REPLACE lease WITH please
REPLACE bedrooms WITH pbeds
REPLACE bathrooms WITH pbaths
REPLACE price WITH pprice
REPLACE sqfootage WITH psqft
REPLACE laundry WITH pwd
REPLACE iterate WITH number

pclean=pclean/100
pdist=pdist/100
please=please/100
pbaths=pbaths/100
pbeds=pbeds/100
pprice=pprice/100
psqft=psqft/100
pwd=pwd/100

RETURN
```

```
*********************** EXPLAIN.PRG ***********************
This module explains how to answer the apartment feature
preference questions which will follow.
**********************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_expl,kount
PRIVATE start,finish,goback


start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


store " " to goback

DO WHILE goback<>"N"
goback=" "

clear
@6,1 to 15,78 double


@8,5 say "The following screens will lead you through a
process to eliminate"
@9,5 say "undesirable apartments based on your own personal
criteria.  You will"
@10,5 say "evaluate apartment features individually beginning
with the feature"
@11,5 say "which is most important to you.  After specifying
your personal"
@12,5 say "criteria on any one feature, the decision support
system will generate"
@13,5 say "a list of apartments (usually a reduced set) which
meet this criteria."


@18,4 say " "
WAIT                    .
clear                         .

@2,1 to 22,77 double

@4,6 say "After this listing has been generated, you will have
the following"
@5,6 say "options:"
```

```
@7,9 say "(1)  View the apartment listing which has just been
generated."

@9,9 say "(2)  View the original apartment listing."

@11,9 say "(3)  Continue the elimination process by moving on
to the feature"
@12,9 say "      which is next in importance."

@14,9 say "(4)  Go back to the original set of apartments and
begin the"
@15,9 say "      process again.  (This option allows you to
change one of"
@16,9 say "      your previously stated criteria.)"

@18,9 say "(5)  Make a final apartment selection.  You will
always have the"
@19,9 say "          opportunity to select from the entire
(original) apartment"
@20,9 say "          listing, not just the current reduced
listing."


@24,2 say "Would you like to go back and look at these
instructions again (Y or N)? " get goback
read
goback=upper(goback)

ENDDO

finish=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

time_expl=finish-start

kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "EXPLAIN"
REPLACE time WITH time_expl
REPLACE iterate WITH kount


RETURN
```

```
*********************** FIRST.PRG *************************
This module allows the user to choose the most important
apartment attribute in order to begin eliminating.
***********************************************************

set bell off
set talk off
set echo off
set status off
clear


PUBLIC feature,time_first,kount,tally,force,stuck
PUBLIC repeat1,repeat2,repeat3,repeat4,repeat5,repeat6,
       repeat7,repeat8

PRIVATE changes,start,finish,correct

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


@2,2 to 16,77 double

@4,5 say "Which feature is most important to you when
searching for an apartment"
@5,5 say "to lease (A through H)?  "

@7,20 say "A - Cleanliness Level"
@8,20 say "B - Distance from Campus"
@9,20 say "C - Length of Lease"
@10,20 say "D - Number of Bedrooms"
@11,20 say "E - Number of Bathrooms"
@12,20 say "F - Price"
@13,20 say "G - Square footage"
@14,20 say "H - Washer/dryer in the apartment"


store " " to changes,feature,stuck
correct=.f.
force=.f.


DO WHILE changes<>"N".or..not.correct
store " " to changes
correct=.f.

@5,30 say " " get feature
read
feature=upper(feature)
```

```
IF   feature="A"   .or.   feature="B"   .or.   feature="C"   .or.
feature="D" .or. feature="E" .or. feature="F" .or. feature="G"
.or. feature="H"
      correct=.t.
      @18,5 say "Would you like to change your response before
continuing (Y or N)? " get changes
      READ
      changes=upper(changes)

ELSE
      @18,5 say "                        Response must be A through G
only.                           "
ENDIF


ENDDO



DO CASE
     CASE feature="A"
          DO eclean
     CASE feature="B"
          DO edist
     CASE feature="C"
          DO elease
     CASE feature="D"
          DO ebeds
     CASE feature="E"
          DO ebaths
     CASE feature="F"
          DO eprice
     CASE feature="G"
          DO esqft
     CASE feature="H"
          DO elaundry
ENDCASE


kounto=0
store " " to
repeat1,repeat2,repeat3,repeat4,repeat5,repeat6,repeat7,repe
at8                                          .
tally=tally+1


USE db1

DO elim
```

```
finish=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

time_first=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "FIRST"
REPLACE time WITH time_first
REPLACE iterate WITH kount
begin=LTRIM(STR(tally))
numero=LTRIM(STR(kounto))
USE reduce&begin&numero


RETURN
```

```
*********************** ECLEAN.PRG ************************
This module gathers preferences concerning the apartment
cleanliness.
**************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_eclen,condition,kount

PRIVATE start,finish,correct,changes,lowclean

start=val(left(time(),3))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


@5,2 to 15,76 double
@7,8 say "What is the lowest level of cleanliness which is
acceptable?"

@9,15 say "A - Exceptionally clean, looks brand new"
@10,15 say "B - Very clean, almost spotless"
@11,15 say "C - Fairly clean, needs a little cleaning"
@12,15 say "D - Slightly dirty, needs moderate cleaning"
@13,15 say "E - Dirty, needs extensive cleaning"

store " " to lowclean,changes
correct=.f.


DO WHILE changes<>"N".or..not.correct
store " " to changes
correct=.f.

@7,68 say " " get lowclean
READ
lowclean=upper(lowclean)


IF   lowclean="A".or.lowclean="B".or.lowclean="C".or.
lowclean="D".or.lowclean="E"

   correct=.t.
   @17,8 say "Do you want to make any changes before
continuing (Y or N)?" get changes
   READ
   changes=upper(changes)
```

```
ELSE
    @17,8 say "              Response must be A through E only.
                "
ENDIF


ENDDO


DO CASE
    CASE lowclean="A"
        condition='clean="Exceptional"'
    CASE lowclean="B"
        condition='clean="Exceptional".or.clean="Veryclean"'
    CASE lowclean="C"
         condition='clean="Exceptional".or.clean="Very
clean".or.clean="Fairly clean"'
    CASE lowclean="D"
        condition='clean<>"Dirty"'
    CASE lowclean="E"
        condition="price>100"
ENDCASE


finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_eclen=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "ECLEAN"
REPLACE time WITH time_eclen
REPLACE iterate WITH kount


RETURN
```

```
*********************** EDIST.PRG ************************
This module gather preferences concerning apartment distance
from campus.
**************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_edist,dist1,dist2,kount

PRIVATE start,finish,correct,changes,minmax,tofrom,ok

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))

@2,1 to 17,74 double
@4,10 say "All things being equal, would you prefer to live
closer"
@5,10 say "to campus or farther from campus?"
@7,20 say "A - Closer to campus."
@8,20 say "B - Farther from campus."

store " " to dist1,changes,minmax,tofrom
ok=.f.
correct=.f.
dist2=0

DO WHILE changes<>"N".or..not.correct
dist2=0
store " " to changes
ok=.f.
correct=.f.

@5,45 say " " get dist1
read
dist1=upper(dist1)

IF dist1="A".or.dist1="B"
   @19,2 say "                                    "
   correct=.t.

IF dist1="A"
   minmax="maximum"
   tofrom="closer to"
ELSE
   minmax="minimum"
   tofrom="farther from"
ENDIF
```

```
DO WHILE .not. ok
ok=.f.

@10,4 to 16,71 double

@12,10 say "Given that you want to live "+tofrom+" campus,
what is"
@13,10 say "the "+minmax+" distance (measured by approximate
driving"
@14,10 say "time) which is still acceptable?        minutes"

@14,45 say " " get dist2 PICTURE "99"
READ


    IF dist1="A".and.dist2<2
        @19,2 say "The minimum distance from campus in this
apartment listing is 2 minutes."
    ENDIF


    IF dist1="B".and.dist2>37
        @19,2 say "The maximum distance from campus in this
apartment listing is 37 minutes."
    ENDIF


    IF (dist1="A".and.dist2>=2).or.(dist1="B".and.dist2<=37)
        ok=.t.
        @19,2 say "    Do you want to change your response
before continuing (Y or N)? " get changes
        @19,71 say "        "
        READ
        changes=upper(changes)
    ENDIF

ENDDO


ELSE
    @19,2 say "                    Response must be A or B only.
                    "

ENDIF

ENDDO


finish=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))
```

```
time_edist=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "EDIST"
REPLACE time WITH time_edist
REPLACE iterate WITH kount


RETURN
```

```
*********************** ELEASE.PRG ***********************
This module gather preferences concerning the apartment lease
length.
*************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC lease1,lease2,lease3,lease4,lease5,time_elese,kount

PRIVATE start,finish,correct,changes,month,four,six,
        nine,twelve

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


@5,5 to 18,70 double
@7,10 say "Classify the following lease agreements as
acceptable [A]"
@8,10 say "or unacceptable [U]?"

@10,46 say "A or U"

@12,20 say "Month to month lease"
@13,20 say "Four month lease"
@14,20 say "Six month lease"
@15,20 say "Nine month lease"
@16,20 say "Twelve month lease"

store " " to month,four,six,nine,twelve,changes
correct=.f.

DO WHILE changes<>"N".or..not.correct
correct=.f.
store " " to changes

@12,46 say " " get month
@13,46 say " " get four
@14,46 say " " get six
@15,46 say " " get nine
@16,46 say " " get twelve
READ
month=upper(month)
four=upper(four)
six=upper(six)
nine=upper(nine)
twelve=upper(twelve)
```

```
IF    (month="A".or.month="U").and.(four="A".or.
four="U").and.(six="A".or.six="U").and.(nine="A".or.
nine="U").and.(twelve="A".or.twelve="U")
    correct=.t.
    @20,7 say "Do you want to make any changes before
continuing (Y or N)? " get changes
    READ
    changes=upper(changes)

ELSE
    @20,7 say "              Response must be A or U only.
                 "
ENDIF


ENDDO


lease1="price<100"
lease2="price<100"
lease3="price<100"
lease4="price<100"
lease5="price<100"


IF month="A"
    lease1='lease=" 1"'
ENDIF

IF four="A"
    lease2='lease=" 4"'
ENDIF

IF six="A"
    lease3='lease=" 6"'
ENDIF

IF nine="A"
    lease4='lease=" 9"'
ENDIF

IF twelve="A"
    lease5='lease="12"'
ENDIF


finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_elese=finish-start
```

```
kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "ELEASE"
REPLACE time WITH time_elese
REPLACE iterate WITH kount


RETURN
```

```
************************* EBEDS.PRG *************************
This  module  gathers  preferences  concerning  the  number  of
bedrooms  in  the  apartment.
***********************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC bed1,bed2,bed3,bed4,time_ebed,kount

PRIVATE start,finish,correct,changes,onebed,twobed,
        threebed,fourbed


start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


@5,5 to 17,70 double
@7,10 say "Classify the number of bedrooms as acceptable [A]
or"
@8,10 say "unacceptable [U]?"

@10,46 say "A or U"

@12,20 say "One bedroom"
@13,20 say "Two bedrooms"
@14,20 say "Three bedrooms"
@15,20 say "Four bedrooms"

store " " to onebed,twobed,threebed,fourbed,changes
correct=.f.


DO WHILE changes<>"N".or..not.correct
correct=.f.
store " " to changes


@12,46 say " " get onebed
@13,46 say " " get twobed
@14,46 say " " get threebed
@15,46 say " " get fourbed
READ
onebed=upper(onebed)
twobed=upper(twobed)
threebed=upper(threebed)
fourbed=upper(fourbed)
```

```
IF     (onebed="A".or.onebed="U").and.(twobed="A".or.
twobed="U").and.(threebed="A".or.threebed="U").and.
(fourbed="A".or.fourbed="U")
    correct=.t.
    @19,7 say "Do you want to make any changes before
continuing (Y or N)? " get changes
    READ
    changes=upper(changes)

ELSE
    @19,7 say "                    Response must be A or U only.
         "
ENDIF

ENDDO

bed1="price<100"
bed2="price<100"
bed3="price<100"
bed4="price<100"

IF onebed="A"
    bed1='bedrooms=1'
ENDIF

IF twobed="A"
    bed2='bedrooms=2'
ENDIF

IF threebed="A"
    bed3='bedrooms=3'
ENDIF

IF fourbed="A"
    bed4='bedrooms=4'
ENDIF

finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_ebed=finish-start

kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "EBEDS"
REPLACE time WITH time_ebed
REPLACE iterate WITH kount

RETURN
```

```
************************* EBATHS.PRG *************************
This module gathers preferences concerning the number of
bathrooms in the apartment.
*************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC bath1,bath2,bath3,time_ebath,kount

PRIVATE start,finish,correct,changes,onebath,twobath,threebath


start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


@5,5 to 16,70 double
@7,10 say "Classify the number of bathrooms as acceptable [A]
or"
@8,10 say "unacceptable [U]?"

@10,46 say "A or U"

@12,20 say "One bathroom"
@13,20 say "Two bathrooms"
@14,20 say "Three bathrooms"

store " " to onebath,twobath,threebath,changes
correct=.f.


DO WHILE changes<>"N".or..not.correct
correct=.f.
store " " to changes


@12,46 say " " get onebath
@13,46 say " " get twobath
@14,46 say " " get threebath
READ
onebath=upper(onebath)
twobath=upper(twobath)
threebath=upper(threebath)
```

```
IF    (onebath="A".or.onebath="U").and.(twobath="A".or.
twobath="U").and.(threebath="A".or.threebath="U")
    correct=.t.
    @18,7 say "Do you want to make any changes before
continuing (Y or N)? " get changes
    READ
    changes=upper(changes)

ELSE
    @18,7 say "               Response must be A or U only.
              "
ENDIF                    .

ENDDO


bath1="price<100"
bath2="price<100"
bath3="price<100"
bath4="price<100"


IF onebath="A"
    bath1='bathrooms=1'
ENDIF

IF twobath="A"
    bath2='bathrooms=2'
ENDIF

IF threebath="A"
    bath3='bathrooms=3'
ENDIF


finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_ebath=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "EBATHS"
REPLACE time WITH time_ebath
REPLACE iterate WITH kount


RETURN
```

```
*********************** EPRICE.PRG ***********************
This module gathers preferences concerning the price of the
apartment.
*************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_erent,money,kount

PRIVATE start,finish,correct,changes

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


@5,9 to 11,69 double
@7,15 say "What is the highest price you would be willing to"
@9,15 say "pay for the apartment you are seeking?"

store " " to changes
correct=.f.
money=0


DO WHILE changes<>"N".or..not.correct
store " " to changes
correct=.f.

@9,57 say "$" get money picture "9999"
READ

IF money<250
   @13,9 say "    The minimum price in this apartment listing
is $250.       "
   @14,9 say "      Please adjust your response to $250 or
greater."


ELSE
   correct=.t.
   @14,9 say "                                              "
   @13,9 say "Do you want to make any changes before
continuing (Y i
or N)?" get changes
   READ
   changes=upper(changes)
```

```
ENDIF

ENDDO


finish=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))

time_erent=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "EPRICE"
REPLACE time WITH time_erent
REPLACE iterate WITH kount


RETURN
```

```
************************ ESQFT.PRG ************************
This module gathers preferences concerning the square footage
of the apartment.
*****************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_esqft,size,kount

PRIVATE start,finish,correct,changes

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


@5,6 to 11,72 double

@7,10 say "What is the minimum square footage you would be
willing to"
@9,10 say "accept in the apartment you are seeking?
sq. ft."

store " " to changes
correct=.f.
size=0


DO WHILE changes<>"N".or..not.correct
store " " to changes
correct=.f.

@9,53 say " " get size picture "9999"
READ

IF size>1550
    @13,8 say "   The maximum square footage available for the
apartments          "
    @14,8 say "   in this listing is 1550 sq. ft.    Please
adjust your"
    @15,8 say "   response to 1550 sq. ft. or less."

ELSE
    correct=.t.
    @13,8 say " Do you want to make any changes before
continuing (Y i
or N)? " get changes
    @14,8 say "                                          "
```

```
    @15,8 say "                                    "
    READ
    changes=upper(changes)

ENDIF

ENDDO


finish=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

time_esqft=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "ESQFT"
REPLACE time WITH time_esqft
REPLACE iterate WITH kount


RETURN
```

```
********************** ELAUNDRY.PRG **********************
This module gathers preferences concerning a washer/dryer in
the apartment.
********************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_ewd,wd,kount

PRIVATE start,finish,correct,changes

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


@5,7 to 11,70 double

@7,12 say "Is the availability of a washer/dryer in the
apartment"
@9,12 say "a necessity (Y or N)? "
store " " to changes,wd
correct=.f.


DO WHILE changes<>"N".or..not.correct
store " " to changes
correct=.f.

@9,36 say " " get wd
READ
wd=upper(wd)

IF wd="Y".or.wd="N"
    correct=.t.
    @13,8 say "Do you want to make any changes before
continuing (Y or N)? " get changes
    READ
    changes=upper(changes)

ELSE
    @13,8 say "                    Response must be Y or N only.
                        "
ENDIF


ENDDO
```

```
finish=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))

time_ewd=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "ELAUNDRY"
REPLACE time WITH time_ewd
REPLACE iterate WITH kount


RETURN
```

```
************************* ELIM.PRG **************************
This module eliminates apartments which do not meet the most
recently stated criteria.
***********************************************************


set bell off
set talk off
set echo off
set status off
clear


PUBLIC  kount,tally,begin,kounto,numero,feature,time_elim,
        onlyone
PUBLIC  condition,dist1,dist2
PUBLIC  lease1,lease2,lease3,lease4,lease5
PUBLIC  bed1,bed2,bed3,bed4,bath1,bath2,bath3
PUBLIC  money,size,wd,force,stuck
PUBLIC  repeat1,repeat2,repeat3,repeat4,repeat5,repeat6,
        repeat7,repeat8

PRIVATE

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


IF stuck<>"stop"

@8,12 to 13,62 double
@10,16 say "Please wait while your apartment listing is"
@11,16 say "being prepared."

onlyone=0


GO TOP
DO WHILE .not. EOF()
   onlyone=onlyone+1
   SKIP
ENDDO


IF onlyone>1
   onlyone=0
   kounto=kounto+1
   numero=LTRIM(STR(kounto))
   begin=LTRIM(STR(tally))
```

```
DO CASE
    CASE feature="A"
        SORT TO reduce&begin&numero ON apt_no FOR &condition
    CASE feature="B"
        IF dist1="A"
            SORT    TO    reduce&begin&numero    ON    apt_no    FOR
distance<=dist2
        ELSE
            SORT    TO    reduce&begin&numero    ON    apt_no    FOR
distance>=dist2
        ENDIF
    CASE feature="C"
        SORT    TO    reduce&begin&numero    ON    apt_no    FOR
&lease1..or.&lease2..or.&lease3..or.&lease4..or.&lease5
    CASE feature="D"
        SORT    TO    reduce&begin&numero    ON    apt_no    FOR
&bed1..or.&bed2..or.&bed3..or.&bed4
    CASE feature="E"
        SORT    TO    reduce&begin&numero    ON    apt_no    FOR
&bath1..or.&bath2..or.&bath3
    CASE feature="F"
        SORT TO reduce&begin&numero ON apt_no FOR price<=money
    CASE feature="G"
        SORT    TO    reduce&begin&numero    ON    apt_no    FOR
sqfootage>=size
    CASE feature="H"
        IF wd="Y"
            SORT    TO    reduce&begin&numero    ON    apt_no    FOR
laundry="Yes"
        ELSE
            SORT TO reduce&begin&numero ON apt_no
        ENDIF
ENDCASE

    repeat&numero=feature
    feature=" "



ELSE
    clear
.   @7,10 to 12,66 double
    @9,14 say "Not enough apartments are remaining.  You must"
    @10,14 say "begin the elimination process again."
    @15,14 say " "
    WAIT
    force=.t.
ENDIF

ENDIF
```

```
finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_elim=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "ELIM"
REPLACE time WITH time_elim
REPLACE iterate WITH kount
USE reduce&begin&numero


RETURN
```

```
*********************** EOPTIONS.PRG ***********************
This module provides options for the user to choose the next
course of action.
*************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_eopt,kount,what,kounto,numero,force,stuck

PRIVATE start,finish,correct


start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

store " " to what,changes,stuck
correct=.f.
force=.f.

DO WHILE changes<>"N".or..not.correct.or.what<>"E"
store " " to what,changes
correct=.f.

@1,1 to 23,78 double

@3,4 say "The following options are available to you.  What
would you like to do"
@4,4 say "at this time (A through E)? " get what

@6,10 say "A - View the current apartment listing.  This list
has been"
@7,10 say "    reduced from the original list based on the
criteria"
@8,10 say "    stated up to this time."

@10,10 say "B - Review the entire (original) apartment
listing."

@12,10 say "C - Continue the current elimination process by
moving on"
@13,10 say "    to the feature which is next in importance."

@15,10 say "D - Begin the elimination process again.  This
will allow"
@16,10 say "    you to make changes to criteria previously
stated."
```

```
@18,10 say "E - Make your final apartment selection.  You must
know"
@19,10 say "     the apartment number to choose this option.
Remember,"
@20,10 say "        any apartment in the original list is
available for"
@21,10 say "    selection."

READ
what=upper(what)


IF what="A".or.what="B".or.what="C".or.what="D".or.what="E"
    correct=.t.
    @24,4 say "Would you like to change your response before
continuing (Y or N)? " get changes
    READ
    changes=upper(changes)

IF changes="N"

    IF what="C".and.force
        what="D"
        clear
        @8,5 to 12,70 double
        @10,15 say "You must begin the elimination process
again."
        @14,14 say " "
        WAIT
    ENDIF

    IF stuck="stop"
        what="D"
    ENDIF


DO CASE
    CASE what="A"
        DO altview
        clear
    CASE what="B"
        DO eview
        clear
    CASE what="C"
        DO next
        clear
    CASE what="D"
        DO first
        clear
    CASE what="E"
        DO choice
ENDCASE
```

```
ENDIF


ELSE
    @24,4 say "                        The response must be A through
E only.                         "
ENDIF


begin=LTRIM(STR(tally))
numero=LTRIM(STR(kounto))
USE reduce&begin&numero


ENDDO


finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_eopt=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "EOPTIONS"
REPLACE time WITH time_eopt
REPLACE iterate WITH kount


RETURN
```

```
*********************** ALTVIEW.PRG ***********************
This module allows the user to view the current (reduced)
apartment set.
***********************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_altvu,force,kount

PRIVATE start,finish,review,other,form,correct,noview,
        nomore,empty


start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


STORE " " to review,other,form
STORE "   " to nomore
correct=.f.
noview=.f.
empty=0


GO TOP
DO WHILE .not. EOF()
   empty=empty+1
   SKIP
ENDDO


IF empty=0
   force=.t.
   nomore="Yes"
   @7,10 to 14,66 double
   @9,14 say "All of the apartments have been eliminated.
You"
   @10,14 say "will need to begin the elimination process
again"
   @11,14 say "in order to make changes to previous criteria,
or"
   @12,14 say "stop before all apartments have been
eliminated."
   @17,14 say " "
   WAIT
ENDIF
```

```
DO WHILE .not.correct.and.nomore<>"Yes"
correct=.f.
store " " to review,other

@5,4 to 15,73 double
@7,8 say "The apartment set may be viewed, or you may choose
to move on"
@8,8 say "without viewing the information.  What would you
like to do at"
@9,8 say "this time (A or B)? "

@11,19 say "A - View the apartment set."
@13,19 say "B - Move on without viewing the apartment set."

@9,28 say " " get form
read
form=upper(form)


DO CASE
    CASE form="A"
        correct=.t.
        DO CONDENSE
        clear
    CASE form="B"
        correct=.t.
        noview=.t.
        review="N"
        clear
    OTHERWISE
        @17,19 say "The response must be A or B only."
ENDCASE

ENDDO


finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_altvu=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "ALTVIEW"
REPLACE time WITH time_altvu
REPLACE iterate WITH kount

RETURN
```

```
*********************** EVIEW.PRG ************************
This module allows the user to view the original (complete)
apartment set.
*************************************************************

set bell off
set talk off
set echo off
set status off
clear

USE db1

PUBLIC time_eview,begin,number,onlyone,kount

PRIVATE start,finish,review,other,form,correct,noview


start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


store " " to review,other,form
correct=.f.
noview=.f.


DO WHILE .not.correct
correct=.f.
store " " to review,other

@5,4 to 15,73 double
@7,8 say "The apartment set may be viewed, or you may choose
to move on"
@8,8 say "without viewing the information.  What would you
like to do at"
@9,8 say "this time (A or B)? "

@11,19 say "A - View the apartment set."
@13,19 say "B - Move on without viewing the apartment set."

@9,28 say " " get form
read
form=upper(form)
```

```
DO CASE
    CASE form="A"
        correct=.t.
        DO CONDENSE
        clear
    CASE form="B"
        correct=.t.
        noview=.t.
        review="N"
        clear
    OTHERWISE
        @17,19 say "The response must be A or B only."
ENDCASE


ENDDO


finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_eview=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "EVIEW"
REPLACE time WITH time_eview
REPLACE iterate WITH kount


RETURN
```

```
************************** NEXT.PRG **************************
This module allow the user to go on to another apartment
feature to continue eliminating.
************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_next,feature,kount,stuck
PUBLIC repeat1,repeat2,repeat3,repeat4,repeat5,repeat6,
       repeat7,repeat8

PRIVATE changes,start,finish,correct

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


IF repeat1<>" " .and. repeat2<>" " .and. repeat3<>" " .and.
repeat4<>" " .and. repeat5<>" " .and. repeat6<>" " .and.
repeat7<>" " .and. repeat8<>" "
       stuck="stop"
       clear
       @7,10 to 13,66 double
       @9,14 say "You have already chosen all features.  You
must"
       @10,14 say "make a selection, or begin the elimination"
       @11,14 say "process again."
       @15,14 say " "
       WAIT
ENDIF


IF stuck<>"stop"

@2,2 to 16,77 double
@4,5 say "Which feature is next in importance to you when
searching for an"
@5,5 say "apartment to lease (A through H)?  "

@7,20 say "A - Cleanliness Level"
@8,20 say "B - Distance from Campus"
@9,20 say "C - Length of Lease"
@10,20 say "D - Number of Bedrooms"
@11,20 say "E - Number of Bathrooms"
@12,20 say "F - Price"
@13,20 say "G - Square footage"
@14,20 say "H - Washer/dryer in the apartment"
```

```
store " " to changes,feature,stuck
correct=.f.


DO WHILE (changes<>"N".or..not.correct).and.stuck<>"stop"
store " " to changes
correct=.f.
stuck=" "

@5,40 say " " get feature
read
feature=upper(feature)


IF feature=repeat1 .or. feature=repeat2 .or. feature=repeat3
.or. feature=repeat4 .or. feature=repeat5 .or. feature=repeat6
.or. feature=repeat7 .or. feature=repeat8
    @18,5 say "  This feature has already been chosen.  Please
select another.         "

ELSE

   IF  feature="A"  .or.  feature="B"  .or.  feature="C"  .or.
feature="D" .or. feature="E" .or. feature="F" .or. feature="G"
.or. feature="H"
      correct=.t.
      @18,5 say "Would you like to change your response before
continuing (Y or N)? " get changes
      READ
      changes=upper(changes)

   ELSE
      @18,5 say "                     Response must be A through H
only.                 "
   ENDIF

ENDIF

ENDDO


DO CASE
     CASE feature="A"
          DO eclean
     CASE feature="B"
          DO edist
     CASE feature="C"
          DO elease
     CASE feature="D"
          DO ebeds
     CASE feature="E"
          DO ebaths
```

```
        CASE feature="F"
             DO eprice
        CASE feature="G"
             DO esqft
        CASE feature="H"
             DO elaundry
ENDCASE
ENDIF


begin=LTRIM(STR(tally))
numero=LTRIM(STR(kounto))
USE reduce&begin&numero


DO elim


finish=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

time_next=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "NEXT"
REPLACE time WITH time_next
REPLACE iterate WITH kount


RETURN
```

```
************************* CHOICE.PRG *************************
This module records the user's final apartment selection.
*************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_ch,what,apt1,apt2,feature,chosen,kount
PRIVATE start,finish,ready,correct

store " " to ready
store 0 to apt1,apt2
correct=.f.

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))


DO WHILE ready<>"Y".and.ready<>"N"

@6,3 to 14,73 double

@9,6 say "Are you ready to make your final apartment selection
(Y or N)? " get ready
@11,11 say "YOU MUST KNOW THE APARTMENT NUMBER TO MAKE A
SELECTION"
read
ready=upper(ready)

      IF ready<>"N".and.ready<>"Y"
          @15,20 say "The response must be Y or N only."
      ENDIF
ENDDO

clear

IF ready="Y"
      chosen=.t.

   DO WHILE .not.correct
      store 0 to apt1,apt2
      @4,5 to 16,72 double
      @6,13 say "Enter the number of the apartment you would
like"
      @7,13 say "to select.   " get apt1 PICTURE "99"
      read
      @12,13 say "                                        "
      @13,13 say "                                        "
```

```
      IF apt1<>0
          @9,13 say "Re-enter the apartment number to confirm.
" get apt2 PICTURE "99"
          read

      IF apt1>=1.and.apt1<=30.and.apt2>=1.and.apt2<=30


      IF apt1=apt2
          correct=.t.
          clear
      ELSE
          @12,13 say "You did not enter the same apartment
number."
          @13,13 say "Please try again."
      ENDIF

      ELSE
          @12,13 say "Apartment number must be between 1 and
30."
          @13,13 say "Please try again."
      ENDIF

      ENDIF

   ENDDO


ELSE
    what=" "
    feature=" "

ENDIF


finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_ch=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "CHOICE"
REPLACE time WITH time_ch
REPLACE iterate WITH kount


RETURN
```

APPENDIX H

FLEXIBLE DECISION AID CODE

.

```
*********************** FMAIN.PRG ************************
This is the main program for the flexible decision aid.
************************************************************

set bell off
set talk off
set echo off
set status off
clear

******** Designates the database to be used.
USE db1

******** Prevents program from ending if user presses escape.
ON ESCAPE dummy=1


******** Makes variables to be transferred public, and non-
transferred variables private

PUBLIC time_fmain,time_intro,time_view,time_prior
PUBLIC time_fexpl,time_frslt,time_fcalc,time_fopt,time_fscrn,
       time_ch
PUBLIC time_lmod,time_emod,time_linop,time_ebaop,time_bthop
PUBLICtime_ffrst,time_felim,time_altvu,time_fview,time_fnext
PUBLIC time_expl,time_lexpl

PUBLIC pclean,pdist,please,pbaths,pbeds,pprice,psqft,pwd
PUBLIC clean1,clean2,clean3,clean4,clean5,time_lclen
PUBLIC month,four,six,nine,twelve,time_llese
PUBLIC onebed,twobed,threebed,fourbed,time_lbed
PUBLIC onebath,twobath,threebath,time_lbath
PUBLIC lwd,time_lwd
PUBLIC dist,time_ldist

PUBLIC condition,dist1,dist2,time_eclen,time_edist
PUBLIC lease1,lease2,lease3,lease4,lease5,time_elese
PUBLIC bed1,bed2,bed3,bed4,time_ebed,bath1,bath2,bath3,
       time_ebath
PUBLIC money,size,ewd,time_erent,time_esqft,time_ewd

PUBLIC repeat1,repeat2,repeat3,repeat4,repeat5,repeat6,
       repeat7,repeat8
PUBLIC tally,database,kount,number,fcount,fnumber
PUBLIC feature,what,apt1,apt2,start1

PRIVATE finish


******** Initializes incremental variables.
kount=0
number=0
```

```
******** Executes module to introduce the system.
DO intro

******** Executes module to gather priority weightings.
DO priority

******** Executes module to explain how to use system.
DO fexplain


STORE " " to repeat1,repeat2,repeat3,repeat4,repeat5,repeat6,
repeat7,repeat8


******** Executes module which allows user to choose one of
the two choice strategies.

DO foptions


******** Calculates total time in the system.
finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_fmain=finish-start1


******** Creates the database with the user selection.
USE choose
REPLACE selection WITH apt1 FOR apartment="APT_ONE"
REPLACE selection WITH apt2 FOR apartment="APT_TWO"


******** Adds "total time" to the time variable database.
kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "FMAIN"
REPLACE time WITH time_fmain
REPLACE iterate WITH kount


******** Concludes the program.
clear
@6,5 to 14,70 double
@9,12 say "Thank you for using The Apartment Selection Guide."
@11,12 say "Please take your disk to the Project Coordinator."


RETURN
```

The following modules are the same, and are presented in the same order, as in both of the previous program codes (compensatory and non-compensatory):

        INTRO.PRG
        VIEW.PRG
        CONDENSE.PRG
        PRIORITY.PRG

```
*********************** FEXPLAIN.PRG ***********************
This module explains the two separate approaches to apartment
selection which can be followed.
***********************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_fexpl,kount
PRIVATE start,finish

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

clear
@6,3 to 16,73 double
@8,8 say "This decision support system provides two separate
approaches"
@9,8 say "to prepare your personal apartment listing from the
original"
@10,8 say "set based on your individual needs.  You may use
either one or"
@11,8 say "a combination of both of these approaches.  One
approach uses"
@12,8 say "your personal preferences and priorities to
generate a rank"
@13,8 say "ordered apartment listing.  The other eliminates
unsuitable"
@14,8 say "apartments from the listing based on your
criteria."
@18,4 say " "
WAIT

finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_fexpl=finish-start

kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "FEXPLAIN"
REPLACE time WITH time_fexpl
REPLACE iterate WITH kount

RETURN
```

```
*********************** FOPTIONS.PRG ***********************
This module allows the user to choose which approach he/she
will use to begin the selection process.
*****************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_fopt,oncelin,onceeba,lin,eba,chosen,again
PUBLIC kount,tally,number,database,force

PRIVATE start,finish,correct,changes,module

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

tally=0
fcount=0
chosen=.f.
force=.f.


DO WHILE .not. chosen
    chosen=.f.
    again=.f.
    USE db1

store " " to changes
correct=.f.


DO WHILE .not. correct .or. changes<>"N"
store " " to changes,module
correct=.f.
lin="No"
eba="No"

@3,7 to 12,66 double

@5,12 say "Which approach would you like to use to begin the"
@6,12 say "apartment selection process? " get modulei

@8,20 say "A - The rank ordered approach."
@10,20 say "B - The elimination approach."
read
module=upper(module)
```

```
IF module="A".or.module="B"
    correct=.t.
    @14,3 say "Would you like to change your response before
continuing (Y or N)? " get changes
    READ
    changes=upper(changes)
ELSE
    @14,3 say "                              Response must be A or B only.
                        "
ENDIF


IF changes="N"

DO CASE
    CASE module="A"
        DO linmod
    CASE module="B"
        DO ebamod
ENDCASE

ENDIF

ENDDO

database=LTRIM(STR(tally))
USE this&database

DO WHILE .not. chosen .and..not. again

DO CASE
    CASE lin="Yes".and.eba="No"
        DO linopt
    CASE lin="No".and.eba="Yes"
        DO ebaopt
    CASE lin="Yes".and.eba="Yes"
        DO bothopt
ENDCASE


database=LTRIM(STR(tally))
USE this&database


ENDDO

database=LTRIM(STR(tally))
USE this&database


ENDDO
```

```
finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_fopt=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "FOPTIONS"
REPLACE time WITH time_fopt
REPLACE iterate WITH kount


RETURN
```

```
************************ LINMOD.PRG ************************
This module is used if the user begins the process with the
compensatory (linear) approach.    The explanations and
preference gathering screens are the same as those used in the
compensatory decision aid.
*************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_lmod,oncelin,lin,kount
PRIVATE start,finish

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


IF .not. oncelin
    DO lexplain
    oncelin=.t.

ELSE
    @7,10 to 12,64 double
    @9,14 say "You will need to restate your preferences with"
    @10,14 say "respect to apartment features."
    @14,14 say " "
    WAIT
    clear
ENDIF


DO lclean
DO ldist
DO llease
DO lbeds
DO lbaths
DO llaundry

DO fresults


lin="Yes"

finish=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))

time_lmod=finish-start
```

```
kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "LINMOD"
REPLACE time WITH time_lmod
REPLACE iterate WITH kount


RETURN
```

```
************************ EBAMOD.PRG ************************
This module is used if the user begins the process with the
non-compensatory (elimination-by-aspects) approach.     The
explanations and preference gathering screens are the same as
those used in the non-compensatory decision aid.
**************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_emod,onceeba,eba,kount

PRIVATE start,finish

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))


IF .not. onceeba
    DO explain
    onceeba=.t.
ENDIF


DO ffirst


eba="Yes"


finish=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

time_emod=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "EBAMOD"
REPLACE time WITH time_emod
REPLACE iterate WITH kount


RETURN
```

```
*********************** LINOPT.PRG ************************
This module is executed if the compensatory approach was
chosen first (LINMOD). It allows the user to re-rank or begin
eliminating.
***********************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_linop,what,kount
PRIVATE start,finish,correct,duplicate

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

store " " to what
correct=.f.

DO WHILE (what<>"A".and.what<>"D").or..not.correct
store " " to what
duplicate=.f.
correct=.f.

@3,3 to 22,74 double
@5,7 say "At this time you may make a selection, view the
ranked apartment"
@6,7 say "listing again, return to a previous screen to make
changes to"
@7,7 say "some or all of your prior responses, or begin
eliminating"
@8,7 say "unsuitable apartments.  What would you like to do at
this"
@9,7 say "time (A, B, C or D)? " get what

@11,14 say "A - Make final apartment selection.   (You must
know"
@12,14 say "    the apartment number to make a selection.)"

@14,14 say "B - Review ranked apartment listing.   (This will
be"
@15,14 say "    an updated listing if you have made any
changes.)"

@17,14 say "C - Return to a previous screen to make changes
to"
@18,14 say "    your responses."

@20,14 say "D - Begin eliminating unsuitable apartments."
```

```
read
what=upper(what)


DO CASE
    CASE what="A"
        correct=.t.
        DO choice
    CASE what="B"
        correct=.t.
        what=" "
        DO view
        clear
    CASE what="C"
        correct=.t.
        duplicate=.t.
        what=" "
        DO fscreens
        clear
    CASE what="D"
        correct=.t.
        DO ebamod
    OTHERWISE
        @24,18 say "The response must be A through D only."

ENDCASE


database=LTRIM(STR(tally))
USE this&database


ENDDO


finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_linop=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "LINOPT"
REPLACE time WITH time_linop
REPLACE iterate WITH kount


RETURN
```

```
************************* EBAOPT.PRG *************************
This module is executed if the non-compensatory approach was
chosen first (EBAMOD).   It allows the user to continue
eliminating or to rank the reduced list.
****************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_ebaop,what,kount,tally,stuck
PRIVATE start,finish,correct

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))

store " " to what,changes
correct=.f.


DO WHILE
changes<>"N".or..not.correct.or.(what<>"E".and.what<>"F")
store " " to what,changes
correct=.f.

@1,1 to 23,78 double
@2,4 say "The following options are available to you.   What
would you like to do"
@3,4 say "at this time (A through F)? " get what

@5,10 say "A - View the current apartment listing.  This list
has been"
@6,10 say "    reduced from the original list based on the
criteria"
@7,10 say "    stated up to this time."

@9,10 say "B  -  Review  the  entire  (original)  apartment
listing."

@11,10 say "C - Continue the current elimination process by
moving on"
@12,10 say "    to the feature which is next in importance."

@14,10 say "D - Begin the elimination process again.   This
will allow"
@15,10 say "    you to make changes to criteria previously
stated."

@17,10 say "E - Rank order the current apartment listing."
```

```
@19,10 say "F - Make your final apartment selection.  You must
know"
@20,10 say "    the apartment number to choose this option.
Remember,"
@21,10 say "    any apartment in the original list is
available for"
@22,10 say "    selection."

READ
what=upper(what)

IF
what="A".or.what="B".or.what="C".or.what="D".or.what="E".or.
what="F"
    correct=.t.
    @24,4 say "Would you like to change your response before
continuing (Y or N)? " get changes
    READ
    changes=upper(changes)

IF changes="N"

    IF (what="C".or.what="E").and.(force.or.stuck="stop")
        what="D"
        clear
        @8,5 to 12,70 double
        @10,15 say "You must begin the elimination process
again."
        @14,14 say " "
        WAIT
    ENDIF

DO CASE
    CASE what="A"
        DO altview
        clear
    CASE what="B"
        DO flexview
        clear
    CASE what="C"
        DO fnext
        clear
    CASE what="D"
        DO ffirst
        clear
    CASE what="E"
        DO linmod
        clear
    CASE what="F"
        DO choice

ENDCASE
```

```
ENDIF

ELSE
    @24,4 say "                        The response must be A through
F only.                    "
ENDIF


database=LTRIM(STR(tally))
USE this&database

ENDDO


finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_ebaop=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "EBAOPT"
REPLACE time WITH time_ebaop
REPLACE iterate WITH kount


RETURN
```

```
*********************** BOTHOPT.PRG ***********************
This module allows process options and is executed after both
the ranking and reducing have been employed by the user.
****************************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_bthop,kount,number,what,again,force,stuck
PRIVATE start,finish,correct

start=val(left(time(),2))*3600+;
     val(substr(time(),4,2))*60+;
     val(right(time(),2))

store " " to what,changes
correct=.f.


DO WHILE
changes<>"N".or..not.correct.or.(what<>"F".and.what<>"E")
store " " to what,changes
correct=.f.

@1,1 to 23,78 double

@2,4 say "The following options are available to you.  What
would you like to do"
@3,4 say "at this time (A through F)? " get what

@5,10 say "A - View the current apartment listing.  This list
reflects"
@6,10 say "    any changes made up to the present time."

@8,10  say  "B  -  Review  the  entire  (original)  apartment
listing."

@10,10 say "C - Continue the current elimination process by
moving on"
@11,10 say "    to the feature which is next in importance."

@13,10 say "D - Change the rank order of the current listing
by return-"
@14,10 say "    ing to a previous screen and changing your
responses."

@16,10 say "E - Go back to the original apartment set and
begin the"
@17,10 say "    selection process again."
```

```
@19,10 say "F - Make your final apartment selection.  You must
know"
@20,10 say "    the apartment number to choose this option.
Remember,"
@21,10 say "    any apartment in the original list is
available for"
@22,10 say "   selection."

READ
what=upper(what)

IF
what="A".or.what="B".or.what="C".or.what="D".or.what="E".or.
what="F"
    correct=.t.
    @24,4 say "Would you like to change your response before
continuing (Y or N)? " get changes
    READ
    changes=upper(changes)

IF changes="N"

    IF (what="C".or.what="D").and.(force.or.stuck="stop")
       what="E"
       clear
       @8,5 to 12,70 double
       @10,15 say "You must begin the selection process again."
       @14,14 say " "
       WAIT
    ENDIF


DO CASE
    CASE what="A"
         DO altview
         clear
    CASE what="B"
         DO flexview
         clear
    CASE what="C"
         DO fnext
         clear
    CASE what="D"
         DO fscreens
         clear
    CASE what="E"
         again=.t.
         force=.f.
         clear
    CASE what="F"
         DO choice
ENDCASE
```

```
ENDIF

ELSE
    @24,4 say "                    The response must be A through
F only.                    "
ENDIF


database=LTRIM(STR(tally))
USE this&database


ENDDO


finish=val(left(time(),2))*3600+;
       val(substr(time(),4,2))*60+;
       val(right(time(),2))

time_bthop=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "BOTHOPT"
REPLACE time WITH time_bthop
REPLACE iterate WITH kount


RETURN
```

The calculations, manipulations and viewing are the same as
presented in the previous two decision aid codes. When the
user is ready to make a selection, the following module is
executed.

```
************************ CHOICE.PRG *********)*****************
This module records the user's final apartment selection.
***********************************************************

set bell off
set talk off
set echo off
set status off
clear

PUBLIC time_ch,what,apt1,apt2,feature,chosen,kount
PRIVATE start,finish,ready,correct

store " " to ready
store 0 to apt1,apt2
correct=.f.

start=val(left(time(),2))*3600+;
      val(substr(time(),4,2))*60+;
      val(right(time(),2))

DO WHILE ready<>"Y".and.ready<>"N"

@6,3 to 14,73 double
@9,6 say "Are you ready to make your final apartment selection
(Y or N)? " get ready
@11,11 say "YOU MUST KNOW THE APARTMENT NUMBER TO MAKE A
SELECTION"
read
ready=upper(ready)

      IF ready<>"N".and.ready<>"Y"
         @15,20 say "The response must be Y or N only."
      ENDIF
ENDDO

clear
IF ready="Y"
      chosen=.t.

   DO WHILE .not.correct
      store 0 to apt1,apt2
      @4,5 to 16,72 double
      @6,13 say "Enter the number of the apartment you would
like"
      @7,13 say "to select.   " get apt1 PICTURE "99"
      read
```

```
        @12,13 say "                                          "
        @13,13 say "                                          "

        IF apt1<>0
            @9,13 say "Re-enter the apartment number to confirm.
" get apt2 PICTURE "99"
            read

        IF apt1>=1.and.apt1<=30.and.apt2>=1.and.apt2<=30

        IF apt1=apt2
            correct=.t.
            clear
        ELSE
            @12,13 say "You did not enter the same apartment
number."
            @13,13 say "Please try again."
        ENDIF

        ELSE
            @12,13 say "Apartment number must be between 1 and
30."
            @13,13 say "Please try again."
        ENDIF

        ENDIF

    ENDDO


ELSE
    what=" "
    feature=" "

ENDIF

finish=val(left(time(),2))*3600+;
        val(substr(time(),4,2))*60+;
        val(right(time(),2))

time_ch=finish-start


kount=kount+1

USE timevar
APPEND BLANK
REPLACE screen WITH "CHOICE"
REPLACE time WITH time_ch
REPLACE iterate WITH kount

RETURN
```

APPENDIX I

COMPENSATORY DECISION AID INTERFACE

```
╔════════════════════════════════════════════════╗
║         WELCOME TO THE APARTMENT SELECTION GUIDE          ║
║         ==========================================        ║
║                                                           ║
║ This decision support system is designed to help you choose an apartment
║ to meet your needs.  Remember, you are to assume that this is an apartment
║ you plan to pre-lease for the Fall Semester.
║
║ Each apartment in the listing will include the following information:
║
║      (1)  A rating of the apartment cleanliness into one of the
║           following five levels:
║                Exceptionally clean, looks brand new.
║                Very clean, almost spotless.
║                Fairly clean, needs a little cleaning.
║                Slightly dirty, needs moderate cleaning.
║                Dirty, needs extensive cleaning.
║
║      (2)  The distance the complex is located from campus measured
║           in approximate driving time.
║
╚═══════════════════════════════════════════════════════════╝

Press any key to continue...
```

(3) The required length of the lease in months.

(4) The number of bedrooms available.

(5) The number of bathrooms available.

(6) The total price of the apartment. (If you plan to have roommates, you may pay only a portion of that amount.)

(7) The size of the apartment measured in square feet.

(8) The availability of laundry facilities. (A washer and dryer located in the apartment.)

The Apartment Selection Guide will lead you through a series of questions in an effort to help you locate the most appropriate apartment to meet your needs. Each question screen will allow you the opportunity to make changes before continuing on to the next screen. Before the questions begin, you may first view the information for the set of apartments from which you will choose.

Would you like to go back and read this introduction again (Y or N)?

The apartment set may be viewed, or you may choose to move on without viewing the information. What would you like to do at this time (A or B)?

    A - View the apartment set.

    B - Move on without viewing the apartment set.

Rate the importance of the following apartment features in your personal apartment search. The percentage weights assigned to each feature should total 100%. The computer will total the weights automatically as you complete the list.

```
        Cleanliness ...........................   0 %
        Distance from campus ................       %
        Length of the lease .................       %
        Number of bathrooms .................       %
        Number of bedrooms ..................       %
        Price ...............................       %
        Square footage ......................       %
        Washer/dryer in the apartment .......       %

                                    Total           %
```

The next series of questions uses a category system to rank your preferences with respect to different features of an apartment. For each feature (i.e. number of bedrooms, length of lease), you will be asked to categorize several options pertaining to these features. The categories are as follows:

A - PREFERRED
B - ACCEPTABLE
C - ACCEPTABLE ONLY IN LIMITED SITUATIONS
D - UNACCEPTABLE

Categorizing an option as 'A - PREFERRED' means this is the ideal situation, and the option will be ranked at the highest level. You may wish to place more than one option in this category if the options are equally ideal for your needs.

Categorizing an option as 'B - ACCEPTABLE' means this option is good, but others are better. These options will be ranked slightly lower than options categorized as 'A.'

Categorizing an option as 'C - ACCEPTABLE ONLY IN LIMITED SITUATIONS' means this is not a good situation, however, it may be acceptable if all other features of the apartment are appropriate for your needs. These options will be ranked lower than both 'A' and 'B.'

Categorizing an option as 'D - UNACCEPTABLE' means this is not an acceptable situation, and these options will have the lowest ranking.

Would you like to go back and look at these instructions again (Y or N)?

Classify the apartment cleanliness levels presented below
using the following categories:

A - PREFERRED
B - ACCEPTABLE
C - ACCEPTABLE ONLY IN LIMITED SITUATIONS
D - UNACCEPTABLE

	Category A,B,C or D
Exceptionally clean - looks brand new	
Very clean - almost spotless	
Fairly clean - needs a little cleaning	
Slightly dirty - needs moderate cleaning	
Dirty - needs extensive cleaning	

Classify the acceptability of lease lengths presented below
using the following categories:

    A - PREFERRED
    B - ACCEPTABLE
    C - ACCEPTABLE ONLY IN LIMITED SITUATIONS
    D - UNACCEPTABLE

                                        Category
                                        A,B,C or D

    Month to month lease
    Four month lease
    Six month lease
    Nine month lease
    Twelve month lease

State your preferences with respect to the number of bedrooms
using the following categories:

```
A - PREFERRED
B - ACCEPTABLE
C - ACCEPTABLE ONLY IN LIMITED SITUATIONS
D - UNACCEPTABLE
```

	Category A,B,C or D
One bedroom	
Two bedrooms	
Three bedrooms	
Four bedrooms	

State your preferences with respect to the number of bathrooms
using the following categories:

```
A - PREFERRED
B - ACCEPTABLE
C - ACCEPTABLE ONLY IN LIMITED SITUATIONS
D - UNACCEPTABLE
```

	Category A,B,C or D
One bathroom	
Two bathrooms	
Three bathrooms	

All things being equal, would you prefer to live closer

to campus or farther from campus?

        A - Closer to campus.
        B - Farther from campus.

Which statement best describes your opinion about a
washer/dryer in the apartment?

        A - A necessity which must be included.
        B - Desired, but not a necessity.
        C - Does not matter either way.
        D - Would prefer not to have them.

Please wait while your apartment listing is
being prepared.

Using the information you have entered concerning your
personal preferences and priorities, the following apartment
listing has been generated. The apartments are rank ordered
by appropriateness for your individual needs. (The first
apartment in the list is most appropriate, followed by the
second most appropriate, etc.)

Press any key to continue...

At this time you may make a selection, view the ranked apartment
listing again, or return to a previous screen to make changes to
some or all of your prior responses. What would you like to do
at this time (A, B or C)?

        A - Make final apartment selection. (You must know
            the apartment number to make a selection.)

        B - Review ranked apartment listing. (This will be
            an updated listing if you have made any changes.)

        C - Return to a previous screen to make changes to
            your responses.

If the user chooses to make changes to previous responses, this screen will appear.

For which one of the previous set of questions would
you like to change your responses. (After making changes
to one screen, you will have the opportunity to change
others before continuing.)

            A - Importance ratings (percentage weights).
            B - Cleanliness levels.   !
            C - Distance from campus.
            D - Length of lease.
            E - Number of bedrooms.
            F - Number of bathrooms.
            G - Washer/dryer availability.

Which screen would you like to see (A through G)?

If the user chooses to make a final selection, this set of screens appears.

```
Are you ready to make your final apartment selection (Y or N)?

    YOU MUST KNOW THE APARTMENT NUMBER TO MAKE A SELECTION
```

```
Enter the number of the apartment you would like
to select.     11

Re-enter the apartment number to confirm.       0
```

```
Thank you for using The Apartment Selection Guide.

Please take your disk to the Project Coordinator.
```

APPENDIX J

NON-COMPENSATORY DECISION AID INTERFACE

```
┌──────────────────────────────────────────────────────────────────────┐
│              WELCOME TO THE APARTMENT SELECTION GUIDE                  │
│        ================================================               │
│                                                                        │
│ This decision support system is designed to help you choose an apartment │
│ to meet your needs.  Remember, you are to assume that this is an apartment │
│ you plan to pre-lease for the Fall Semester.                           │
│                                                                        │
│ Each apartment in the listing will include the following information:  │
│                                                                        │
│     (1)   A rating of the apartment cleanliness into one of the        │
│           following five levels:                                       │
│                 Exceptionally clean, looks brand new.                  │
│                 Very clean, almost spotless.                           │
│                 Fairly clean, needs a little cleaning.                 │
│                 Slightly dirty, needs moderate cleaning.               │
│                 Dirty, needs extensive cleaning.                       │
│                                                                        │
│     (2)   The distance the complex is located from campus measured     │
│           in approximate driving time.                                 │
│                                                                        │
└──────────────────────────────────────────────────────────────────────┘
```

Press any key to continue...

(3)   The required length of the lease in months.

(4)   The number of bedrooms available.

(5)   The number of bathrooms available.

(6)   The total price of the apartment. (If you plan to have roommates, you may pay only a portion of that amount.)

(7)   The size of the apartment measured in square feet.

(8)   The availability of laundry facilities.   (A washer and dryer located in the apartment.)

The Apartment Selection Guide will lead you through a series of questions in an effort to help you locate the most appropriate apartment to meet your needs.   Each question screen will allow you the opportunity to make changes before continuing on to the next screen.   Before the questions begin, you may first view the information for the set of apartments from which you will choose.

Would you like to go back and read this introduction again (Y or N)?

The apartment set may be viewed, or you may choose to move on without viewing the information. What would you like to do at this time (A or B)?

        A - View the apartment set.

        B - Move on without viewing the apartment set.

Rate the importance of the following apartment features in your personal apartment search. The percentage weights assigned to each feature should total 100%. The computer will total the weights automatically as you complete the list.

Cleanliness	0 %
Distance from campus	%
Length of the lease	%
Number of bathrooms	%
Number of bedrooms	%
Price	%
Square footage	%
Washer/dryer in the apartment	%
Total	%

The following screens will lead you through a process to eliminate
undesirable apartments based on your own personal criteria. You will
evaluate apartment features individually beginning with the feature
which is most important to you. After specifying your personal
criteria on any one feature, the decision support system will generate
a list of apartments (usually a reduced set) which meet this criteria.

After this listing has been generated, you will have the following
options:

(1) View the apartment listing which has just been generated.

(2) View the original apartment listing.

(3) Continue the elimination process by moving on to the feature
     which is next in importance.

(4) Go back to the original set of apartments and begin the
     process again. (This option allows you to change one of
     your previously stated criteria.)

(5) Make a final apartment selection. You will always have the
     opportunity to select from the entire (original) apartment
     listing, not just the current reduced listing.

Would you like to go back and look at these instructions again (Y or N)?

Which feature is most important to you when searching for an apartment
to lease (A through H)?

                    A - Cleanliness Level
                    B - Distance from Campus
                    C - Length of Lease
                    D - Number of Bedrooms
                    E - Number of Bathrooms
                    F - Price
                    G - Square footage
                    H - Washer/dryer in the apartment

Depending on the selection made here, the user will see one of the
following preference gathering screens.

What is the lowest level of cleanliness which is acceptable?

    A - Exceptionally clean, looks brand new
    B - Very clean, almost spotless
    C - Fairly clean, needs a little cleaning
    D - Slightly dirty, needs moderate cleaning
    E - Dirty, needs extensive cleaning

All things being equal, would you prefer to live closer
to campus or farther from campus?   a

    A - Closer to campus.
    B - Farther from campus.

Given that you want to live closer to campus, what is
the maximum distance (measured by approximate driving
time) which is still acceptable?   0 minutes

Classify the following lease agreements as acceptable [A]
or unacceptable [U]?

A or U

Month to month lease
Four month lease
Six month lease
Nine month lease
Twelve month lease

What is the highest price you would be willing to

pay for the apartment you are seeking? $ 0

What is the minimum square footage you would be willing to

accept in the apartment you are seeking?   0   sq. ft.

```
Classify the number of bedrooms as acceptable [A] or
unacceptable [U]?

                                      A or U

        One bedroom
        Two bedrooms
        Three bedrooms
        Four bedrooms
```

```
Classify the number of bathrooms as acceptable [A] or
unacceptable [U]?

                                      A or U

        One bathroom
        Two bathrooms
        Three bathrooms
```

```
Is the availability of a washer/dryer in the apartment

a necessity (Y or N)?
```

```
  Please wait while your apartment listing is
  being prepared.
```

```
The following options are available to you.  What would you like to do
at this time (A through E)?

    A - View the current apartment listing.  This list has been
        reduced from the original list based on the criteria
        stated up to this time.

    B - Review the entire (original) apartment listing.

    C - Continue the current elimination process by moving on
        to the feature which is next in importance.

    D - Begin the elimination process again.  This will allow
        you to make changes to criteria previously stated.

    E - Make your final apartment selection.  You must know
        the apartment number to choose this option.  Remember,
        any apartment in the original list is available for
        selection.
```

If the user chooses to continue eliminating, this screen will appear.

```
Which feature is next in importance to you when searching for an
apartment to lease (A through H)?

                    A - Cleanliness Level
                    B - Distance from Campus
                    C - Length of Lease
                    D - Number of Bedrooms
                    E - Number of Bathrooms
                    F - Price
                    G - Square footage
                    H - Washer/dryer in the apartment
```

If the user chooses to make a final selection, this set of screens appears.

Are you ready to make your final apartment selection (Y or N)?

YOU MUST KNOW THE APARTMENT NUMBER TO MAKE A SELECTION

Enter the number of the apartment you would like
to select.   11

Re-enter the apartment number to confirm.   0

Thank you for using The Apartment Selection Guide.

Please take your disk to the Project Coordinator.

APPENDIX K

FLEXIBLE DECISION AID INTERFACE

.

```
WELCOME TO THE APARTMENT SELECTION GUIDE
========================================

This decision support system is designed to help you choose an apartment
to meet your needs.  Remember, you are to assume that this is an apartment
you plan to pre-lease for the Fall Semester.

Each apartment in the listing will include the following information:

        (1)   A rating of the apartment cleanliness into one of the
              following five levels:
                    Exceptionally clean, looks brand new.
                    Very clean, almost spotless.
                    Fairly clean, needs a little cleaning.
                    Slightly dirty, needs moderate cleaning.
                    Dirty, needs extensive cleaning.

        (2)   The distance the complex is located from campus measured
              in approximate driving time.
```

Press any key to continue...

(3)   The required length of the lease in months.

(4)   The number of bedrooms available.

(5)   The number of bathrooms available.

(6)   The total price of the apartment. (If you plan to have roommates, you may pay only a portion of that amount.)

(7)   The size of the apartment measured in square feet.

(8)   The availability of laundry facilities.   (A washer and dryer located in the apartment.)

The Apartment Selection Guide will lead you through a series of questions in an effort to help you locate the most appropriate apartment to meet your needs.   Each question screen will allow you the opportunity to make changes before continuing on to the next screen.   Before the questions begin, you may first view the information for the set of apartments from which you will choose.

Would you like to go back and read this introduction again (Y or N)?

The apartment set may be viewed, or you may choose to move on without viewing the information. What would you like to do at this time (A or B)?

       A - View the apartment set.

       B - Move on without viewing the apartment set.

Rate the importance of the following apartment features in your personal apartment search. The percentage weights assigned to each feature should total 100%. The computer will total the weights automatically as you complete the list.

```
        Cleanliness ..........................   0 %
        Distance from campus .................     %
        Length of the lease ..................     %
        Number of bathrooms ..................     %
        Number of bedrooms ...................     %
        Price ................................     %
        Square footage .......................     %
        Washer/dryer in the apartment .......      %

                                 Total         %
```

This decision support system provides two separate approaches
to prepare your personal apartment listing from the original
set based on your individual needs. You may use either one or
a combination of both of these approaches. One approach uses
your personal preferences and priorities to generate a rank
ordered apartment listing. The other eliminates unsuitable
apartments from the listing based on your criteria.

Press any key to continue...

Which approach would you like to use to begin the
apartment selection process?

     A - The rank ordered approach.

     B - The elimination approach.

If the rank ordered approach is chosen first, the processing will be the same as the with the compensatory decision aid and then this set of options will appear.

At this time you may make a selection, view the ranked apartment listing again, return to a previous screen to make changes to some or all of your prior responses, or begin eliminating unsuitable apartments.   What would you like to do at this time (A, B, C or D)?

      A - Make final apartment selection.   (You must know the apartment number to make a selection.)

      B - Review ranked apartment listing.   (This will be an updated listing if you have made any changes.)

      C - Return to a previous screen to make changes to your responses.

      D - Begin eliminating unsuitable apartments.

If the elimination approach is chosen first, the processing will be the same as the with the non-compensatory decision aid and then this set of options will appear.

```
The following options are available to you.  What would you like to do
at this time (A through F)?

    A - View the current apartment listing.  This list has been
        reduced from the original list based on the criteria
        stated up to this time.

    B - Review the entire (original) apartment listing.

    C - Continue the current elimination process by moving on
        to the feature which is next in importance.

    D - Begin the elimination process again.  This will allow
        you to make changes to criteria previously stated.

    E - Rank order the current apartment listing.

    F - Make your final apartment selection.  You must know
        the apartment number to choose this option.  Remember,
        any apartment in the original list is available for
        selection.
```

After the list has been both ranked and reduced, this set of options will appear.

```
The following options are available to you.  What would you like to do
at this time (A through F)?

    A - View the current apartment listing.  This list reflects
        any changes made up to the present time.

    B - Review the entire (original) apartment listing.

    C - Continue the current elimination process by moving on
        to the feature which is next in importance.  ·

    D - Change the rank order of the current listing by return-
        ing to a previous screen and changing your responses.

    E - Go back to the original apartment set and begin the
        selection process again.

    F - Make your final apartment selection.  You must know
        the apartment number to choose this option.  Remember,
        any apartment in the original list is available for
        selection.
```

If the user chooses to make a final selection, this set of screens appears.

Are you ready to make your final apartment selection (Y or N)?

YOU MUST KNOW THE APARTMENT NUMBER TO MAKE A SELECTION

Thank you for using The Apartment Selection Guide.

Please take your disk to the Project Coordinator.

Enter the number of the apartment you would like
to select.   11

Re-enter the apartment number to confirm.   0

APPENDIX L

RATER INSTRUCTIONS

INSTRUCTIONS FOR
RATER PERFORMANCE EVALUATIONS

Purpose

Subjects participating in the experiment used different Decision Support Systems to select an apartment (from a set of either 30 or 60 apartments) which would best meet their personal requirements. Using individual subject's preferences and priorities with respect to apartment features, raters will evaluate the selection in order to determine how well the subject met his/her personal requirements.

Background Information

The following eight features were specified for each apartment in the listing:

Apartment feature	Possible values
1) Cleanliness level	Exceptionally clean Very clean Fairly clean Slightly dirty Dirty
2) Distance from campus	Between 2 and 37 minutes
3) Length of lease	Month to month Four months Six months Nine months Twelve months
4) Number of bedrooms	1, 2, 3 or 4
5) Number of bathrooms	1, 2 or 3
6) Price (monthly rent)	$250-$975
7) Square footage	550-1550 sq. ft.
8) Laundry (washer/dryer located in the apartment)	Yes or No

Rater Instructions

Between July 3rd and July 18th, each rater will be asked to evaluate 40 subjects.

For each subject, the following information will be provided:

1)   The subject's preferences; which values are acceptable for each of the eight apartment features. The acceptable values for each feature will be checked on the Evaluation Form. The 'Distance from campus' feature required the subject to specify whether he/she prefers to live closer to campus or farther from campus.

2)   The subject's priorities; how much weight (importance) is placed on each of the eight apartment features.

3)   A description of the selected apartment.

4)   An ordered listing of the entire apartment set available to the subject. The subject made the selection from either Set A (30 apartments) or Set B (60 apartments). The listing is sorted by number of bedrooms and number of bathrooms. Within each combination of bedrooms and bathrooms, the list is sorted by price.

This information will be used to rate the performance level of the subject with two separate evaluations:

1)   Overall, rate how well the subject met his/her personal requirements for an apartment on a scale of 0-100%.

2)   Given the available apartments, rate how well the subject met his/her personal requirements for an apartment on a scale of 0-100%.

The next few pages discuss the process and possible scenarios which will impact performance ratings.

POSSIBLE SCENARIOS

1) If a subject selects an apartment with an acceptable value for every feature, the performance rating for Evaluation #1 would be 100%. However, another apartment may exist in the available set which also has acceptable values for all features, but this other apartment has more square footage, is less expensive and is the same distance from campus. In that case, the performance rating for Evaluation #2 should be less than 100%.

If, however, the other apartment has acceptable values for all features, but the square footage is greater and the rent is higher (still within acceptable limits), it may or may not be a "better" apartment for the subject. Under these circumstances, judgement calls must be made to determine which apartment is "best" for this subject. From this point on, the use of "better" or "best" will refer to your opinion.

A subject would receive less than 100% on Evaluation #2 if a better apartment exists in the available set, even if he/she met all requirements and received 100% on Evaluation #1.

2) If a subject selects an apartment that does not have an acceptable value for every feature, the performance rating for Evaluation #1 should be less than 100%. However, if the apartment set does not contain an apartment which meets all requirements for this subject, or an apartment which would be "better," the performance rating for Evaluation #2 should be 100%.

A subject would receive 100% on Evaluation #2 for selecting the best possible apartment, even if he/she receives less than 100% on Evaluation #1 for not meeting all requirements.

3) Subject A meets 6 of 8 feature requirements, and the 2 which are missed account for 15% of the importance weight. Subject B meets 7 of 8 feature requirements, and the 1 which is missed accounts for 30% of the importance weight. Even though Subject A matched fewer requirements than subject B, Subject A met 85% while subject B only met 70%. At this point it appears that Subject A should receive a higher performance rating than Subject B.

However, it is still necessary to consider how close the subjects were to the acceptable limits on the features which they did not match. For instance, Subject C meets 7 of 8 features, with the 1 missed accounting for 10% of the importance weight. Subject D also meets 7 of 8 features, with the 1 missed accounting for only 5% of the importance weight. It would appear that Subject D should receive a higher

performance rating. By adding more information to the picture, this may not necessarily be true. The feature Subject C missed is price, he wanted an apartment for under $750 and selected an apartment for $775. The feature Subject D missed is square footage, she wanted an apartment with over 1000 sq. ft. and selected an apartment with 550 sq. ft. Judgements must be made to determine performance ratings.

Any number of possible scenarios will occur. To make Evaluation #1, the rater must combine information for each subject concerning the number of feature requirements met, the importance weight of the features, as well as, the actual values involved (how close or far from the required value). This same type of process will carry over to the second evaluation. Additionally, Evaluation #2 requires the rater to consider the apartments available in the apartment set from which the subject selected, in order to judge performance relative to the possibilities.

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Kathy L. McCommon was born on April 9, 1961 in Laurel, Mississippi. She holds both a Bachelor of Business Administration in Accounting and a Master of Business Administration specializing in Statistics from The University of Texas at Austin. At the time of completion of this dissertation, she is employed as an Assistant Professor of Management Information Systems at The University of Houston. Eleven days after the dissertation defense, she will be married and her new name will be Kathy L. Cossick.