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Job Duties and Qualifications for Computer Programmers in Selected Organizations of the Richmond, Virginia, Area and Implications for an Electronic Data Processing Curriculum at the Richmond Professional Institute

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JOB DUTIES AND QUALIFICATIONS FOR COMPUTER PROGRAMMERS IN
SELECTED ORGANIZATIONS OF THE RICHMOND, VIRGINIA, AREA AND
IMPLICATIONS FOR AN ELECTRONIC DATA PROCESSING CURRICULUM
AT THE RICHMOND PROFESSIONAL INSTITUTE

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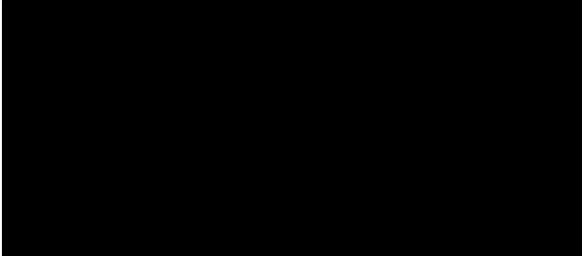
TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (continued)

CHAPTER I

FORMULATION AND DEFINITION OF THE PROBLEM

Introduction

The tremendous impact of electronic data processing on the lives

of the American people is being felt in every segment of our economy.

Regardless of the area of activity, be it business, education, government,

industry, or the service areas, electronic data processing is performing

an increasingly important function. The volume of paper work, the magni-

tude of government reports, and the demands of management for information,

have created mammoth challenges for electronic data processing. These

challenges are complex. However, electronic data processing equipment and

personnel are making favorable gains on the problems posed by these chal-

lenges.

The invention and manufacture of machines and equipment of rapid

speed and accuracy for the production and reproduction of business reports

and records is the newest step forward in business organization and manage-

ment.[1] Undoubtedly the best known machine developed for this purpose is

the computer. The invention of the computer commenced the revolution of

electronic data processing. The first machine to use electronic tubes for

calculating was the ENIAC, Electronic Numerical Integrator and Computer,

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[1]Clarence B. Randall, Sally W. Weimer, and Maynard S. Greenfield,
Systems and Procedures for Automated Accounting, (Cincinnati: South-Western
Publishing Company, 1962), p. 95.

developed between 1942 and 1946 at the University of Pennsylvania by Dr. John W. Mauchly, J. Presper Eckert, and their associates.[2]

General Statement

The primary purpose of this study was to determine the specific job duties and qualifications of a computer programmer in the Richmond Metropolitan area. This information should offer some criteria for establishing an electronic data processing curriculum at the Richmond Professional Institute.

Sub-Problems

To accomplish the explicit objectives of this study, answers were needed for the following questions:

1. What job duties are required of a computer programmer? How frequent are the different job duties performed?

2. What qualifications are required of a computer programmer? What age is preferred for programming personnel? How much previous experience is required? What educational requirements are necessary?

3. What job title is associated with the person performing the job duties of a computer programmer?

4. Is there a demand for graduates of a two-year program in electronic data processing?

5. How many business and other establishments have an educational program to prepare personnel for work in electronic data processing departments?

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[2]Robert R. Arnold, Harold C. Hill, and Aylmer V. Nichols, Introduction To Data Processing, (New York: John Wiley and Sons, Inc., 1966), p. 28.

6. What types of computers are currently being used in data processing installations? What types of new computers are on order?

7. How many persons are working in electronic data processing departments? Is it difficult to locate computer programmers?

8. What testing devices are being used in selecting computer programmers?

9. What types of organizations are using electronic data processing equipment?

10. How many hours per day do data processing installations operate their equipment?

Need for the Study

More than 100,000 Americans are pursuing a career that did not exist 15 years ago.[3] That career is computer programming.[4] The persons who are members of this profession are most commonly known as programmers.

Programmers are a hybrid group. The rapid expansion of the electronic data processing field has afforded little opportunity for the current programmers to have received any formal college or university training for their professional careers. Their educational backgrounds vary from engineering and physics to literature and psychology. Accounting and commerce majors have also made their way into the programming profession with great success. Since the majority of programmers received no formal training in programming during their collegiate years, the computer manufacturers provided the necessary training.

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[3] "Twentieth Century's Newest Career," Data Processor, Volume VIII, Number IV, (October 1965), p. 11.

[4] Ibid., p. 11.

Additional employees will be needed to operate electronic data processing equipment in the years ahead. There are approximately 300 electronic data processing installations in the Richmond Metropolitan area. They employ about 3,000 persons.[5] These figures represent installations utilizing computers and unit record equipment to process data. The need for trained data processing personnel is expected to increase by 15 percent in the Richmond Metropolitan area each year in the coming decade.[6] This suggests that 450 additional, qualified persons will be needed by organizations in the Richmond area next year.

Electronic data processing equipment manufacturers now find it almost impossible to train the required data processing personnel because of the rapid acceptance and expansion of electronic data processing. The need for training a significant number of competent analysts and specialists cannot be overlooked by educational institutions. Unique demands are being placed on many educational institutions to provide facilities for developing the knowledge and skills of those persons who will use sophisticated computers in the future.

What content material should be emphasized in courses designed to prepare computer programmers? What content material should be emphasized in courses designed to prepare unit record technicians? A study to determine the job duties and qualifications of programmers in the field of electronic data processing would be desirable in answering the first question. A similar study should be conducted to determine the job duties and qualifications of unit record technicians in the field of electronic data processing

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[5]Interview with William K. Parsons, Jr., Sales Representative, International Business Machines Corporation, March 10, 1966.

[6]Ibid.

to help in answering the second question. The latter study was conducted by Mr. David P. Jones. Since the two studies were initiated at approximately the same time with a congruent purpose, the two investigators worked jointly throughout the data gathering phase of the study.

Definition of Terms

Block Diagram

A "block diagram" is a graphical representation of the equipment in a computer system. The primary purpose of a block is to indicate the paths along which information and/or control flows between the various parts of a computer system. It should not be confused with the term flow chart.[7]

Coding

"Coding" is a term representing the ordered list in computer code of the successive computer instructions representing successive computer operations for solving a specific problem.[8]

Computer

A "computer" is a device capable of accepting information, applying prescribed processes to the information, and supplying the results of these processes. It usually consists of input and output devices, storage, arithmetic, and logical units, and a control unit.[9]

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[7]Automatic Data Processing Glossary, (Washington, D. C., Executive Office of the President, Bureau of the Budget, December 1962), p. 18.

[8]Ibid., p. 11.

[9]Ibid., p. 12.

Console

The "console" is a portion of the computer that may be used to
control the machine manually; correct errors; determine the status of
machine circuits, registers, and counters; determine the contents of
storage; and manually revise the contents of storage.[10]

Data Processing Courses

The term "Data Processing Courses" refers to a succession of courses
designed to provide an understanding of the concepts, principles and tech-
niques involved in processing data. The courses are arranged in a workable
sequence, with an appropriate balance between technical and general courses.
Laboratory exercises are included.

Debug

The word "debug" is used to mean the tracking down and correcting
of any mistakes found in the computer program.

DPMA

This abbreviation refers to the organization known as the Data
Processing Management Association. It is "an international organization
of management personnel dedicated to the advancement of the data processing
profession."[11]

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[10]Ibid., p. 14.

[11]Certificate in Professional Data Processing, (Park Ridge, Illinois:
Data Processing Management Association, n.d.), p. 1.

Electronic Data Processing

"Electronic Data Processing" is the preparation of data by electronic devices that contain basic elements of information, and the handling of such data according to precise rules of procedure to accomplish such operations as classifying, sorting, calculating, summarizing, and recording.[12]

Flow Chart

A "flow chart" is a graphic representation of the major steps of work in process. The illustrative symbols may represent documents, machines, or actions taken during the process. The emphasis is on where or who does what rather than how it is done.[13]

Hardware

"Hardware" is the physical equipment or devices forming a computer and peripheral equipment.[14]

High-Speed Printer

A "high-speed printer" is an electromechanical line printer using engraved type. Up to 132 print positions may be printed on one line at speeds up to 1200 lines per minute. The high-speed printer is capable of printing alphabetic, numeric, and special characters.[15]

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[12]Automatic Data Processing Glossary, op. cit., p. 40.

[13]Automatic Data Processing Glossary, op. cit., p. 8.

[14]Automatic Data Processing Glossary, op. cit., p. 25.

[15]General Information Manual, Introduction to IBM Data Processing Systems, (New York: IBM Corporation, 1960), p. 54.

Input-Output Devices

"Input-output devices" is a general term signifying the pieces of
equipment used to communicate with a computer.[16]

Installation

An "installation" refers to any combination of a computer and unit
record equipment that is normally auxiliary to a computer.

Job Duties

The term "job duties" refers to the specific tasks performed by a
programmer in a data processing installation.

Key Punch

The "key punch" is a special device used to record information in
cards or tape by punching holes in the cards or tape to represent letters,
digits, and special characters.[17]

Machine Language

"Machine language" is a system for representing and communicating
information between people or between people and machines. Such a system
consists of a carefully defined set of characters and rules for combining
them into larger units, such as words or expressions, and rules for word
arrangement or usage to achieve specific meanings.[18]

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[16] Automatic Data Processing Glossary, op. cit., p. 27.

[17] Automatic Data Processing Glossary, op. cit., p. 29.

[18] Automatic Data Processing Glossary, loc. cit.

Magnetic Disk

"Magnetic disk" is a storage device on which information is recorded on the magnetizable surface of a rotating disk. A magnetic disk storage system is an array of such devices, with associated reading and writing heads which are mounted on movable arms.[19]

Magnetic Tape

"Magnetic tape" is tape or ribbon of any material impregnated or coated with magnetic or other material on which information may be placed in the form of magnetically polarized spots.[20]

Organizations

The term "organizations" refers to those business and other establishments that were presumed to be using data processing equipment.

Program

The word "program" refers to the complete plan for the solution of a problem, more specifically the complete sequence of machine instructions and routines necessary to solve a problem and to plan the procedures for solving a problem. This may involve among other things the analysis of the problem, preparation of a flow chart, preparing details, testing, and developing subroutines, allocation of storage locations, specifications of input and output formats, and the incorporation of a computer run into a complete data processing system.[21]

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[19] Automatic Data Processing Glossary, op. cit., p. 19.

[20] Automatic Data Processing Glossary, op. cit., p. 56.

[21] Automatic Data Processing Glossary, op. cit., p. 41.

Programmer

A "programmer" analyzes and defines detailed computer systems to
develop programs for electronic data processing. He is usually competent
in most phases of programming to work on his own and requires only general
direction for the balance of activities. He conducts detailed analyses
of all defined systems specifications and develops all levels of block
diagrams and machine logic flow charts. He codes; prepares test data;
tests and debugs programs; revises and refines programs as required; and
documents all procedures used throughout the computer program when it is
formally established. He evaluates and modifies existing programs to take
into account changes in systems requirements or equipment input and output
devices. He may give technical assistance to lower level classifications.[22]

Procedure

A "procedure" is a series of related tasks that make up the chrono-
logical sequence and the established way of performing the work to be
accomplished.[23]

Qualifications for Programmers

"Qualifications for programmers" is a term used to describe the
characteristics and specific requirements for conditions of employment as
a programmer.

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[22]Philip H. Weber, Descriptions for Data Processing Personnel,
(Elmhurst, Illinois: The Business Press, n. d.), p. 4.

[23]George R. Terry, Principles of Management, (Homewood, Illinois:
Richard D. Irwin, Inc., Revised Edition, 1964), p. 288.

Software

"Software" is the totality of programs and routines used to extend the capabilities of computers, such as subroutines.[24]

Systems Analyst

A "systems analyst" is a person who examines an activity, procedure, method or a technique to determine what must be accomplished and how the necessary operations may best be accomplished.[25]

Basic Assumptions

It was assumed that the organizations in the Richmond Metropolitan area prefer to hire individuals with some knowledge, experience, and training in computer programming to work in the data processing installations. Therefore, it was assumed that a demand existed for persons who are graduates of a curriculum in electronic data processing that provides training in programming. Currently, no educational institution in the Richmond Metropolitan area provides such a curriculum.

Delimitations

The study was conducted subject to the following delimitations:

Organizations Included in the Study

The study was limited to selected organizations that were members of the Data Processing Management Association, Richmond, Virginia, Chapter, and approximately ten additional organizations that were presumed to be

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[24]Automatic Data Processing Glossary, op. cit., p. 50.

[25]Philip H. Weber, loc. cit.

using data processing equipment. A majority of the organizations were located in the city of Richmond, Virginia. However, several of the organizations were located in Chesterfield and Henrico counties. Four of the organizations were located in the city of Hopewell, Virginia. Organizations in other cities throughout the state of Virginia were not included in this investigation because the information provided by the study will be used in developing a data processing curriculum at the Richmond Professional Institute. This data processing curriculum is at first scheduled to meet the requirements of organizations in the Richmond Metropolitan area, where all the selected organizations are located.

Personnel Included in the Study

The study was limited to the organizations' programming personnel, since a similar study was simultaneously being conducted for unit record personnel.

CHAPTER II

PROCEDURES IN COLLECTING DATA

A questionnaire was used to collect the information for this study. This versatile instrument could be mailed to the selected organizations. The prompt return of the information from the varied sources was important. Therefore, the questionnaire was considered to be the best method of obtaining data from the selected organizations in the Richmond Metropolitan area.

Formulation and Validation of the Questionnaire

The questionnaire was divided into four sections (see Appendix C) and designed to secure answers to the questions stated in the sub-problems.

The four sections of the questionnaire were classified as follows:

I. General

II. Job duties and qualifications of programmers

III. Job duties and qualifications of unit record technicians

IV. Electronic data processing utilization – present and future

Sections I, II, and IV were used in this study. Sections I and IV pertained to all the organizations participating in the study. Section II pertained only to those organizations using programmers in their electronic data processing installations. Section III was not used in this study, but was used in another study. The division of the questionnaire into four sections was helpful in tabulating the returns. The majority of the questions were designed in a way that the respondent could check the appropriate category.

The initial draft of the questionnaire was submitted to a thesis committee for review. After suggested changes were made in the format of certain questions, the questionnaire was presented to the following for their analysis:

1. Manager of Data Processing
   Nitrogen Division
   Allied Chemical Corporation
   Hopewell, Virginia

2. Programmer/Analyst
   Automated Equipment Sales of Virginia
   Richmond, Virginia

3. Chairman of Business and Data Processing Department
   Danville Technical Institute
   Danville, Virginia

4. Supervisor of Data Processing
   Dan River Mills, Incorporated
   Danville, Virginia

Additional changes were made based on the recommendations of the gentlemen listed above.

The questionnaire was further examined in an interview with the manager of data processing of the Nitrogen Division of Allied Chemical Corporation, Hopewell, Virginia. His reactions led to the changing of several questions and the addition and deletion of several other questions.

An interview was arranged with a Programmer Analyst employed by the Automatic Equipment Sales of Virginia, Incorporated. The purpose of this interview was to determine additional job duties performed by programmers. This information was relevant to the further development of Section II of the questionnaire. His suggestions led to the addition of several job duties performed by programmers. The questionnaire was then revised based on the recommendations.

Distribution of the Questionnaire

Each organization to be mailed a questionnaire was assigned a separate index card. The organization's name, mailing address, and telephone number were written on the cards. Each card was than consecutively numbered from 1 through 55. These numbers served as identification codes and were posted on the questionnaire in the special space provided for them. No other identification code appeared on the questionnaire.

The questionnaires were than mailed to the selected organizations in the Richmond Metropolitan area, addressed to the manager of data processing. Each questionnaire had a cover letter (a copy of this letter may be seen in Appendix B) signed by Mr. David P. Jones and this investigator. A self-addressed, stamped envelope also accompanied the questionnaire. The questionnaire was mailed on May 1, 1966.

Follow-Up Procedure

On Monday, May 16, 1966, a follow-up letter (a copy of this letter may be seen in Appendix D) was mailed to all the selected organizations. Another copy of the questionnaire did not accompany this letter. The follow-up letter was designed first, to thank the selected organizations that responded during the first two weeks, and second, to encourage those organizations that had not responded to complete the questionnaire sometime during the ensuing week. On Wednesday, May 25, 1966, a telephone call was placed to those organizations that still had failed to reply.

Since it was assumed that another telephone call would be of little value, no other follow-up procedure was used.

CHAPTER III

PRESENTATION AND INTERPRETATION OF DATA

Introduction

Fifty-five questionnaires were sent to the selected organizations in the Richmond Metropolitan area. Of the total mailed, 44 (a list of respondents may be seen in Appendix A) were returned before the cut-off date of June 3, 1966. This represented a return of 80 percent. Four of the questionnaires were returned unanswered. This meant that 40 of the 44 returned were usable. That number represented 73 percent of the questionnaires mailed. Thirty-five organizations answered Section II, a 64 percent response, while 40 organizations answered Sections I and IV.

Several questions in the questionnaire could be answered by checking more than one category. Therefore, the response indicated in certain tables in this chapter, did not total to the 35 organizations completing Section II of the questionnaire. The response in other tables in this chapter did not total to the 40 organizations completing Sections I and IV of the questionnaire.

The data presented in this chapter represents the information furnished by the 40 organizations answering Sections I and IV of the questionnaire, and 35 of these 40 organizations that completed Section II of the questionnaire.

Types of Organizations

The organizations that completed and returned the questionnaire were classified into ten different groups. Manufacturing organizations and banks

constituted the largest number of respondents (Table 1). Manufacturing,
banking, insurance, and wholesale organizations accounted for 72.5 percent
of the returned questionnaires. Government, service, and retail organizations
accounted for 20 percent. Education, transportation, and utility organi-
zations accounted for seven and one-half percent.

TABLE 1

NUMBER AND PERCENT OF THE TYPES OF ORGANIZATIONS
REPRESENTED IN THE STUDY

Type of Organizations	Number of Organizations	Percent of Organizations
Manufacturing	12	30.0
Banking	7	17.5
Insurance	6	15.0
Wholesale	4	10.0
Government	3	7.5
Service	3	7.5
Retail	2	5.0
Education	1	2.5
Transportation	1	2.5
Utility	1	2.5
Total	40	100.0

Total Number of Employees

The organizations varied in size from those that employed less than 50 to those that employed in excess of 1,000 (Table 2). Thirty percent of the organizations employed more than 1,000 persons, while 30 percent employed less than 150 employees. Fifty percent of the respondents employed less than 500 persons. Ten percent of the organizations employed between 501 and 750 persons.

TABLE 2

TOTAL NUMBER OF EMPLOYEES IN THE ORGANIZATIONS

Number of Employees	Number of Organizations	Percent of Organizations
Less than 50	4	10.0
50 - 150	8	20.0
151 - 250	1	2.5
251 - 500	7	17.5
501 - 750	4	10.0
751 - 1,000	4	10.0
More than 1,000	12	30.0
Total	40	100.0

Number of Data Processing Employees

The data processing installations varied in size from those that employed less than ten to those that employed in excess of 100 (Table 3). Approximately 32 percent of the organizations had less than ten data processing persons. Approximately seven percent of the surveyed installations

employed more than 100 individuals, and approximately 62 percent had less than 25 persons working in data processing. Approximately 27 percent of the organizations had between 26 and 75 persons in data processing.

TABLE 3

NUMBER OF DATA PROCESSING EMPLOYEES
REPRESENTED IN THE STUDY

Number of Employees	Number of Organizations	Percent of Organizations
Less than 10	13	32.5
10 - 25	12	30.0
26 - 50	5	12.5
51 - 75	6	15.0
76 - 100	1	2.5
More than 100	3	7.5
Total	40	100.0

Qualifications, Selection, and Training of Data Processing Employees

The organizations participating in this study were asked questions related to qualifications, selection, and training of data processing employees. The answers are given in the following paragraphs.

Previous Work Experience Required

The organizations were asked if they preferred to hire programming personnel with some previous experience. Approximately 91 percent answered this question affirmatively. Two organizations answered this question negatively and one organization did not answer the question.

Eleven of the respondents indicated they required at least one year of experience (Table 4). Approximately 34 percent of the organizations required at least two years of experience. Between one year and two years of experience was required by six organizations. Two respondents indicated they required between two and four years of experience. Three organizations failed to answer this question.

TABLE 4

NUMBER OF YEARS OF PREVIOUS
EXPERIENCE REQUIRED OF PROGRAMMERS

Years	Number of Organizations	Percent of Organizations
1 year	11	31.43
2 years	12	34.28
1 - 2 years	6	17.14
1 - 3 years	1	2.86
2 - 4 years	2	5.72
No answer	3	8.57
Total	35	100.00

Age Range

Approximately 54 percent of the persons who responded to Section II of the questionnaire said they preferred programmers between 23 and 27

years of age. Twelve respondents preferred programmers between 28 and 32 years of age. One organization preferred programmers between 33 and 37 years of age. Only one organization stated that they preferred programmers between the ages of 18 and 22. Programmers over 37 years of age were not preferred by any of the respondents (Table 5).

TABLE 5

AGE RANGE PREFERRED FOR PROGRAMMERS

Age Range	Number of Organizations	Percent of Organizations
18 - 22	1	2.86
23 - 27	19	54.28
28 - 32	12	34.29
33 - 37	1	2.86
Over 37	0	
No Preference	2	5.71
Total	35	100.00

Education Level Required

Table 6 shows the level of education the organizations required of programming personnel. The majority of the organizations required that a programmer be only a high school graduate. Approximately 34 percent of the respondents preferred the programmer to be a college graduate. Two organizations preferred business school graduates and one organization had no requirement.

TABLE 6

LEVEL OF EDUCATION REQUIRED
OF PROGRAMMERS

Education Level	Number of Organizations	Percent of Organizations
High School	20	57.14
College	12	34.29
Business School	2	5.71
No Prerequisite	1	2.86
Total	35	100.00

Locating Data Processing Employees

The nine different types of media found to be of value in locating personnel to work in the field of electronic data processing, are listed in Table 7. Employment agencies and personal applications were the leading sources reported. Thirty-five percent of the organizations used advertisements. Electronic data processing manufacturers, personal contacts, and special electronic data processing schools were used by 17 organizations. Two organizations promoted from within the organization. The state employment agency was used less than any other source for obtaining personnel.

TABLE 7

SOURCES USED IN LOCATING DATA
PROCESSING PERSONNEL

Source	Number of Organizations	Percent of Organizations
Employment Agencies	27	67.5
Personal Applications	15	37.5
Advertisements	14	35.0
Data Processing Equipment Manufacturers	7	17.5
Personal Contacts	5	12.5
Special Data Processing Schools	5	12.5
Promote From Within	2	5.0
State Employment Agency	1	2.5

Personnel Requirements

Approximately 57 percent of the respondents had experienced diffi-
culty in filling programming positions. Approximately 27 percent of the
respondents had not experienced difficulty in filling programming positions.
Six organizations did not answer this question.

Only 15 percent of the organizations felt their needs for programmers
were being met by the present college curricula. Sixty percent of the
organizations indicated their needs for programmers were not being met by
the present college curricula. Ten organizations did not answer this
question.

Approximately 62 percent of the installations have no established educational training program to prepare personnel for work in the electronic data processing departments. Approximately 37 percent of the installations have an established educational training program to prepare personnel for work in the electronic data processing departments.

Testing Devices

The IBM Programmers Aptitude Test and the Wonderlic Test were the two tests used most often in selecting programmers. Table 8 shows that 26 organizations were using the IBM Programmers Aptitude Test. Ten organizations were using specifically designed company tests. An arithmetic

TABLE 8

TESTING DEVICES USED IN SELECTING PROGRAMMERS

Testing Device	Number of Organizations	Percent of Organizations
IBM Programmers Aptitude Test	26	74.36
Wonderlic Test	17	48.62
Company Tests	10	28.57
Arithmetic Test	7	20.00
NCR Pat Test	2	5.71
Federal Entrance Exam	1	2.86
Kuder Preference Test	1	2.86

test was used by seven organizations. Two organizations used the NCR Pat Test. Only one organization stated it was using the Kuder Preference Test and one organization was using the Federal Entrance Exam. Many organizations used more than one test.

Methods of Training

On-the-job training and manufacturers' schools were used more often than any other methods of training data processing personnel. Seventy percent of the organizations used on-the-job training and approximately 67 percent used manufacturers' schools. Seven of the respondents preferred technical schools for training. Ten percent of the organizations used company educational programs. Certain organizations used more than one method for training data processing personnel (Table 9).

TABLE 9

METHODS PREFERRED FOR TRAINING
DATA PROCESSING PERSONNEL

Method	Number of Organizations	Percent of Organizations
On-the-job training	28	70.0
Manufacturers' schools	27	67.5
Technical school	7	17.5
Company educational program	4	10.0

Employability of Two-Year Graduates

Seventy-five percent of the respondents indicated that they would hire a graduate of a two-year program in electronic data processing. However, two of these organizations stated that a graduate of such a program would be hired only as a trainee. Six organizations indicated they would not hire graduates of a two-year program. This represented 15 percent. Four organizations did not answer this question (Table 10).

TABLE 10

NUMBER AND PERCENT OF ORGANIZATIONS INDICATING THEY WOULD EMPLOY
GRADUATES OF A TWO-YEAR PROGRAM

Response	Number of Organizations	Percent of Organizations
Would employ	30	75
Would not employ	6	15
No answer	4	10
Total	40	100

Job Duties of Programmers

The study was designed to find out the job duties required of programmers in the Richmond Metropolitan area. It should be mentioned that there are different methods of determining the relative importance of each job duty. Two different methods were used in this study. The first method was to determine how many of the surveyed organizations had their programmers performing each of the 15 different job duties. The second method was to determine how frequent each of the 15 job duties were performed.

All of the organizations responding to Section II of the questionnaire indicated that their programmers performed the job duty of debugging programs. Conferring with the personnel requesting the problem solution, defining the problem, flow charting, and testing programs on the computer were four job duties performed by the programmers of all but one of the answering organizations. Thirty-three of the organizations stated that their programmers attended educational classes. Three organizations stated that their programmers did not perform the job duties of block diagramming, making changes to existing programs, preparing sample data, and translating block diagrams into coded machine language (coding). Designing report forms, making changes to existing report formats, and preparing instruction sheets for console operators were three job duties performed by programmers of 88.57 percent of the organizations. Assisting console operators in production runs of new programs was a job duty performed by programmers in 30 organizations. Twenty-one or 60.01 percent of the organizations stated that their programmers received the problem from the systems analyst. A complete list of the job duties and the number of organizations in which programmers perform these job duties may be seen in Table 11.

The frequencies of the various job duties were weighted as follows:

Frequency	Weight
Daily	6
Several times a week	5
Average of once a week	4
Several times a month	3
Occasionally	2
Not at all	1

TABLE 11

NUMBER AND PERCENT OF SELECTED ORGANIZATIONS IN WHICH 15
JOB DUTIES WERE PERFORMED BY PROGRAMMERS

Job Duty	Number of Organizations in Which Programmers Perform Job Duties	Percent of Organizations Responding
Debugs the Program	35	100.00
Confers with the Personnel Requesting the Problem Solution	34	97.14
Defines the Problem	34	97.14
Flow Charting	34	97.14
Tests Program on the Computer	34	97.14
Attends Educational Classes	33	94.29
Block Diagramming	32	91.43
Makes Changes to Existing Programs	32	91.43
Prepares Sample Data	32	91.43
Translates Block Diagram into Coded Machine Language (coding)	32	91.43
Designs Report Forms	31	88.57
Makes Changes to Existing Report Formats	31	88.57
Prepares Instruction Sheets For Console Operator	31	88.57
Assists Console Operator in Production Runs of New Programs	30	85.71
Receives the Problem from the Systems Analyst	21	60.01

For example, the job duty of block diagramming was weighted as follows:

Frequency	Respondents	Weight	Total
Daily	8	6	48
Several times a week	10	5	50
Average of once a week	3	4	12
Several times a month	6	3	18
Occasionally	5	2	10
Not at all	3	1	3
Total	35		141

All 15 job duties were weighted in this manner. Table 12 shows the 15 weighted job duties.

The most frequently performed job duty was debugging programs. Testing programs on the computer, translating block diagrams into coded machine language (coding), block diagramming, flow charting, and making changes to existing programs were the next most frequently performed job duties. Preparing sample data, preparing instruction sheets for console operators, conferring with personnel requesting the problem solution, and defining the problem were the next most frequently performed job duties. Assisting the console operator in production runs of new programs, making changes to existing report formats, and designing report forms were the next most frequently performed job duties. Receiving the problem from the systems analyst and attending educational classes were the two job duties performed least frequently. The number and percent of the respondents who reported the frequency of each job duty may be seen in Appendix E.

TABLE 12

WEIGHTED TOTAL OF 15 JOB DUTIES
PERFORMED BY PROGRAMMERS

Job Duty	Weighted Total
Debugs the Program	158
Tests Program on the Computer	153
Translates Block Diagram into Coded Machine Language	149
Block Diagramming	141
Flow Charting	137
Makes Changes to Existing Programs	133
Prepares Sample Data	128
Prepares Instruction Sheets for Console Operators	125
Confers with Personnel Requesting the Problem Solution	124
Defines the Problem	123
Assists Console Operator in Production Runs of New Programs	113
Makes Changes to Existing Report Formats	104
Designs Report Forms	100
Receives the Problem from the Systems Analyst	82
Attends Educational Classes	72

Job Titles

The job title of programmer was being used by 60.02 percent of the respondents. Three organizations used the job title of programmer analyst. Chief programmer was the job title used by two respondents. Computer programmer was also used by two respondents. Junior programmer and senior programmer were job title used by 11.42 percent of the organizations. Two organizations used the job title systems analyst/programmer. All of the organizations used some variation of the word programmer in the job title (Table 13).

TABLE 13

JOB TITLES OF PERSONS PERFORMING THE
DUTIES OF PROGRAMMERS IN THE
SELECTED ORGANIZATIONS

Job Title	Number of Organizations	Percent of Organizations
Programmer	21	60.02
Programmer Analyst	3	8.57
Chief Programmer	2	5.71
Computer Programmer	2	5.71
Junior Programmer	2	5.71
Senior Programmer	2	5.71
Systems Analyst/Programmer	2	5.71
Staff Assistant Programmer	1	2.86
Total	35	100.0

Solutions to Scientific and Business Problems

Table 14 reveals that 85.72 percent of the programmers are not confronted with developing solutions to scientific problems. Three organizations indicated that their programmers developed solutions to scientific problems. Two organizations did not provide a response. Approximately 91 percent of the organizations stated that their programmers developed solutions to business problems. Three organizations indicated that their programmers did not develop solutions to business problems.

TABLE 14

NUMBER AND PERCENT OF ORGANIZATIONS INDICATING THAT
THEIR PROGRAMMERS DEVELOPED SOLUTIONS
TO SCIENTIFIC AND BUSINESS PROBLEMS

Response	Number of Organizations With Programmers Solving Scientific Problems	Percent of Organizations	Number of Organizations With Programmers Solving Business Problems	Percent of Organizations
Performed	3	8.57	32	91.43
Not Performed	30	85.72	3	8.57
No Answer	2	5.71	—	——
Total	35	100.00	35	100.00

Computer Languages Used By Programmers

Twenty of the organizations had their programmers writing programs in the Autocoder computer language. This represented 57.14 percent of the respondents. Thirteen of the respondents used COBOL and another 13 used RPG. Ten organizations used the SPS programming language. Five organizations had programmers writing in the Fortran language. Only one organization used Neat and only one organization used Easy Coder. Certain respondents used more than one computer language (Table 15).

TABLE 15

COMPUTER LANGUAGES USED IN WRITING
COMPUTER PROGRAMS

Computer Language	Number of Organizations	Percent of Organizations
Autocoder	20	57.14
COBOL	13	37.14
RPG	13	37.14
SPS	10	28.57
Fortran	5	14.29
Neat	1	2.86
Easy Coder	1	2.86

Supervision of Data Processing Personnel by Programmers

Three organizations, or approximately nine percent, stated that supervision of data processing personnel was required of the programmers. Approximately 89 percent of the organizations said that their programmers did no supervising of data processing personnel. One organization did not provide a response (Table 16).

TABLE 16

NUMBER AND PERCENT OF ORGANIZATIONS IN WHICH PROGRAMMERS
SUPERVISED OR DID NOT SUPERVISE OTHERS

Response	Number of Organizations	Percent of Organizations
Programmers Supervised Others	3	8.57
Programmers Did Not Supervise Others	31	88.57
No Answer	1	2.86
Total	35	100.00

Data Processing Equipment

The majority of questions relating to data processing equipment were located in Section IV of the questionnaire. The questions were designed to determine information about computers and unit record equipment. The information is provided in the following paragraphs.

Computers in Use

There were 38 computers being used by 31 organizations. Approximately 76 percent of these computers were manufactured by International Business Machines Corporation. Of the 29 IBM computers being used, 16 were IBM 1401 computers. There were five UNIVAC 1004 computers and one NCR 315 computer being used in the selected organizations. One organization used a Honeywell 200 computer and one organization used a Honeywell 400 computer (Table 17).

Computers on Order

Sixty-five percent of the organizations indicated that they had new computers on order. Fourteen organizations indicated that they did not have new computers on order. The 26 organizations (65 percent) with new computers on order had a total of 32 computers ordered. Thirty-one of these were manufactured by International Business Machines Corporation. Of these 31, there were 29 IBM 360 computers on order. One organization had a NCR 315 on order. Table 18 shows the manufacturers and model numbers of the new computers on order.

Unit Record Equipment in Use

The different types of unit record equipment that were in use in the selected organizations are shown in Table 19. The key punch and

TABLE 17

NUMBER OF COMPUTERS IN USE IN THE
SELECTED ORGANIZATIONS

Computer Manufacturer	Computer Model Number	Number of Computers Reported
IBM	1401	16
IBM	1410	5
UNIVAC	1004	5
IBM	1440	3
IBM	1620	3
AVCO	PCS	1
HONEYWELL	200	1
HONEYWELL	400	1
IBM	1460	1
IBM	7074	1
NCR	315	1
	Total	38

TABLE 18

NUMBER OF NEW COMPUTERS
ORDERED BY THE SELECTED ORGANIZATIONS

Computer	Number of Computers
IBM 360 (No Model Number)	12
IBM 360, Model 20	7
IBM 360, Model 30	6
IBM 360, Model 40	2
IBM 360, Model 50	2
IBM 1401	2
NCR 315	1

sorter were being used by all the organizations completing the question-naire. Approximately 93 percent of the organizations had reproducers and 90 percent had collators. Seventy percent of the respondents had verifiers and approximately 63 percent had accounting machines. Ten organizations had interpreters. Five percent of the organizations had card to tape and data transmitters. The organizations were not asked the manufacturer of the unit record equipment because it was assumed that the International Business Machines Corporation was the only manu-facturer of unit record equipment in use in the Richmond Metropolitan area.

Years Equipment Had Been in Use

Approximately 28 percent of the organizations had been using their data processing equipment less than five years. Twenty-five percent of

TABLE 19

TYPES OF UNIT RECORD EQUIPMENT IN USE IN THE
SELECTED ORGANIZATIONS

Unit Record Equipment	Number of Organizations	Percent of Organizations
Key Punch	40	100.00
Sorter	40	100.00
Reproducer	37	92.50
Collator	36	90.00
Verifier	28	70.00
Accounting Machine	25	62.50
Interpreter	10	25.00
Tape to Card Punch	3	7.50
Card to Tape	2	5.00
Data Transmitter	2	5.00

the organizations reported using equipment between six and ten years.
Twenty percent indicated the use of equipment between 11 and 15 years.
Nine organizations had been using equipment between 16 and 25 years.
Only five percent reported using equipment more than 25 years. Complete
figures are shown in Table 20.

TABLE 20

LENGTH OF TIME DATA PROCESSING
EQUIPMENT HAD BEEN USED BY THE SELECTED ORGANIZATIONS

Years	Number of Organizations	Percent of Organizations
1 - 5	11	27.5
6 - 10	10	25.0
11 - 15	8	20.0
16 - 20	5	12.5
21 - 25	4	10.0
26 - 30	2	5.0
Total	40	100.0

Operating Shifts

Table 21 shows the number of eight-hour shifts that the organizations operated their data processing equipment. Approximately 53 percent of the respondents operated on the basis of one eight-hour shift per day. Five organizations operated their equipment two eight-hour shifts per day. Thirty percent of the installations ran their equipment 24 hours a day. One organization operated on the basis of a 12 hour day while one other organization operated on the basis of a 20 hour day. No organization reported operating less than one eight-hour shift.

TABLE 21

EQUIPMENT UTILIZATION BASED ON THE
NUMBER OF EIGHT-HOUR SHIFTS

Eight-Hour Shifts Per Day	Number of Organizations	Percent of Organizations
One	21	52.5
Two	5	12.5
Three	12	30.0
One and a Half	1	2.5
Two and a Half	1	2.5
Total	40	100.0

Equipment Applications

The electronic data processing equipment applications of the organizations participating in the study were categorized into three areas. Specific details are shown in Table 22. Approximately 68 percent of the organizations used their equipment only for business applications. Ten organizations (25 percent) used their equipment for both business and research. Three organizations used their equipment only for government applications.

Equipment Rental and Ownership

The majority of the organizations reported that they rented their data processing equipment. Thirty-two, or 80 percent, of the installations rented equipment. Detailed enumeration can be seen in Table 23.

TABLE 22

EQUIPMENT UTILIZATION BASED ON
TYPES OF APPLICATIONS

Application	Number of Organizations	Percent of Organizations
Business only	27	67.5
Both Business and Research	10	25.0
Government only	3	7.5
Total	40	100.0

Approximately 13 percent of the organizations rented and owned equipment. Approximately seven percent of the organizations owned their equipment.

TABLE 23

EQUIPMENT RENTAL AND OWNERSHIP
IN THE SELECTED ORGANIZATIONS

Equipment Basis	Number of Organizations	Percent of Organizations
Rent	32	80.0
Rent and Own	5	12.5
Own	3	7.5
Total	40	100.0

Titles of Questionnaire Respondents

The titles of the individuals completing the questionnaires are listed in Table 24. Twenty-eight of the respondents had the title of Data Processing Manager, while two had the title of Office Manager. Two other respondents used the title Supervisor of Unit Record Equipment. Assistant Vice-President, Auditor, Branch Manager, and Controller were four titles used by four different respondents. Programmer Manager, Staff Supervisor, Systems Analyst Manager, and Treasurer were four other titles used by four different respondents.

TABLE 24

INDICATED TITLES OF THE QUESTIONNAIRE RESPONDENTS

Title	Number of Organizations	Percent of Organizations
Data Processing Manager	28	70.0
Office Manager	2	5.0
Supervisor of Unit Record Equipment	2	5.0
Assistant Vice-President	1	2.5
Auditor	1	2.5
Branch Manager	1	2.5
Controller	1	2.5
Programmer Manager	1	2.5
Staff Supervisor	1	2.5
Systems Analyst Manager	1	2.5
Treasurer	1	2.5
Total	40	100.0

CHAPTER IV

SUMMARY AND CONCLUSIONS

Restatement of Problem and Procedure

This study was conducted primarily to determine the specific job duties and qualifications of a programmer in selected organizations in the Richmond Metropolitan area. It was hoped that results would offer some criteria for establishing a future data processing curriculum and data processing courses at the Richmond Professional Institute.

Five specific steps were followed in this study. First, a questionnaire was formulated that would provide the required data. Second, interviews were conducted with data processing personnel to revise the questionnaire. Third, the questionnaire was mailed to 55 selected organizations in the Richmond Metropolitan area. A cover letter and self-addressed, stamped envelope also accompanied the questionnaire. Fourth, the information from the completed questionnaires was interpreted and presented in tables. Fifth, the findings of this study were presented and implications were suggested that might be helpful to the Richmond Professional Institute in establishing a data processing curriculum and data processing courses.

Findings

The study was designed to determine the job duties and qualifications of programmers in the Richmond Metropolitan area. The findings provide answers to the sub-problems in chapter I. However, the findings are not in the identical sequence of the sub-problems.

Types of Organizations

Ten different types of organizations were represented in this study. A majority of the organizations were classified as manufacturing, banking, and insurance. These three types of organizations accounted for 62.5 percent of the respondents. Twelve manufacturing organizations were included in the study. Twelve of the organizations employed more than 1,000 employees. This represented 30 percent of the organizations. Twelve organizations employed less than 150 employees. This represented 30 percent of the organizations.

Computers in Use

Twenty-nine of the 38 computers being used by the respondents were manufactured by International Business Machines Corporation. Sixteen of these 29 were 1401 computers. This indicates that computers manufactured by International Business Machines Corporation were predominate in the selected organizations in the Richmond Metropolitan area. The IBM 1401 computer accounted for approximately 52 percent of the computers currently in use. Five of the computers were manufactured by UNIVAC, and two were produced by Honeywell.

Computers on Order

More than half of the organizations (65 percent) had new computers on order. The most predominant computer being ordered was the IBM 360 computer. Of the new computers on order, 90.3 percent were various models of the new 360 manufactured by International Business Machines Corporation. There were five different models of the IBM 360 computer being ordered.

Hours Equipment Is in Use

Almost one third (30 percent) of the organizations operated their equipment 24 hours each day. However, approximately 52 percent of the organizations used their equipment only one eight hour shift per day. It was interesting to note that no organization indicated that they operated their equipment less than one eight hour shift per day.

Equipment Utilization

The key punch and the sorter were the only two types of unit record equipment in use in all the selected organizations. Twenty-one (52.5 percent) of the organizations had been using their data processing equipment less than 10 years. Approximately 68 percent of the organizations were using their equipment for business applications only. Twenty-five percent of the organizations used their equipment for both business and research applications. Eighty percent of the selected organizations rented their data processing equipment.

Number of Data Processing Employees

The number of persons employed in the data processing installations varied in size from those that employed less than ten to those that employed in excess of 100. Thirty of the organizations employed less than 50 people in their data processing installations. This represented 75 percent of the organizations.

Approximately 68 percent of the respondents used employment agencies to locate data processing personnel. Fifteen of the selected organizations used personal applications while fourteen organizations used advertisements in locating personnel.

The organizations were not asked specifically about the outlook for future employment in their data processing installations. However, approximately 57 percent of the respondents indicated they were experiencing a difficulty in fulfilling their requirements for programmers.

Educational Program for Data Processing Personnel

Many of the organizations had no established educational program for training personnel for work in the electronic data processing department. On-the-job training and electronic data processing manufacturers' schools were the two most used means of training data processing personnel.

Testing Devices for Data Processing Personnel

There was no uniform testing procedure for selecting data processing programming personnel being used by the surveyed organizations. The IBM Programmers Aptitude Test was the most predominantly noted test. Twenty-six of the 40 organizations mentioned this test was being used for the selection of programmers. Seventeen of the respondents were administering the Wonderlic Test.

Several of the organizations required the use of more than one test in the selection of programmers.

Job Title of Programmers

All of the organizations indicated that the word programmer appears somewhere in the job title of the person performing the job duties listed in this study. The job title of programmer was used by sixty percent of the organizations. Three organizations used the title programmer analyst. This job was referred to as computer programmer by only two organizations.

Job Duties of Programmers

All of the organizations indicated that their programmers performed the job duty of debugging programs. Of the 15 job duties performed by programmers, this was the only one performed by programmers of all the selected organizations. Conferring with the personnel requesting the problem solution, defining the problem, flow charting, and testing programs on the computer were job duties performed by programmers in 34 organizations. Approximately 94 percent of the organizations indicated that their programmers attended educational classes. Block diagramming, making changes to existing programs, preparing sample data, and coding were job duties performed by programmers in 33 organizations. Only 21 organizations indicated that their programmers received the problem from the systems analyst.

The job duty most frequently performed by programmers was debugging the program. Testing programs on the computer, coding, block diagramming, flow charting, and making changes to existing programs were the next most frequently performed job duties by programmers. Designing report forms, receiving the problem from the systems analyst, and attending educational classes were the three job duties performed the least by programmers.

Approximately 91 percent of the selected organizations indicated that their programmers solved business problems. The Autocoder computer language was used by the programmers in 20 of the organizations. Thirteen of the organizations used COBOL and RPG while approximately 29 percent of the organizations had their programmers using SPS to write computer programs. Thirty-one organizations indicated that their programmers did not supervise other data processing personnel.

Age Range of Programmers

More than one-half of the organizations (54.27 percent) preferred programmers between 23 and 27 years of age. The age range from 18 to 22 was the least indicated age preferred for programmers in the Richmond Metropolitan area. Approximately 34 percent of the organizations preferred programmers ranging in age from 28 to 32.

Work Experience of Programmers

A majority of the organizations indicated they preferred to hire programmers with some previous experience. Approximately 65 percent of the organizations indicated they required either one or two years of experience. Twelve of the respondents indicated they required at least two years of experience.

Educational Requirements of Programmers

A majority of the organizations (57.14 percent) stated that a high school education was the necessary minimum for programmers. Approximately 34 percent of the organizations desired a college graduate to fill their programming jobs. Only one organization had no requirement.

Employability of Graduates of a Two-Year Program

The outlook for graduates of a two-year program in electronic data processing is ostensibly encouraging. A majority of the organizations indicated that they would hire graduates of such a program. However, several of the organizations stated that graduates of such a program would be hired as data processing trainees.

Fifty-seven percent of the organizations had experienced difficulty in filling openings for programmers. Sixty percent of the respondents felt that present college curricula were not meeting their needs for programmers.

Titles of Questionnaire Respondents

Twenty-eight of the respondents had the title of Data Processing Manager. Office Manager was a title used by two respondents and two other respondents had the title of Supervisor of Unit Record equipment.

Implications for the Richmond Professional Institute

The findings of this study suggest several implications for the Richmond Professional Institute. The implications are:

1. Since 57.5 percent of the organizations participating in this study indicated they were having difficulty filling openings in their data processing installations, the Richmond Professional Institute should consider establishing a program to prepare persons for work in electronic data processing.

2. There should be emphasis placed on business applications as related to electronic data processing, since the study indicated that a majority of the programmers developed solutions to business problems while few were solving scientific problems.

3. In order to prepare students for work in the Richmond Metropolitan area data processing installations, as programmers, the two-year curriculum should stress the following job duties:

    a. debugging programs

    b. testing programs on the computer

    c. translating block diagrams into coded machine language (coding)

    d. block diagramming

    e. flow charting

    f. writing Autocoder and COBOL computer language

4. Many of the organizations indicated that on-the-job training was a prime means of training personnel for work in the electronic data processing department. Therefore, the Richmond Professional Institute should consider placing students for summer and part-time employment with these organizations. Such placements would provide students with work experience in the field of electronic data processing and at the same time help the selected organizations find outside employees.

Needed Research

It has been established that the selected organizations in the Richmond Metropolitan area would hire a graduate of a two-year data processing curriculum. With this in mind, an investigator could contact the surveyed organizations. He could ascertain the approximate programmer salary that students successfully completing a two-year data processing curriculum could be expected to receive upon initial employment.

A study could be conducted to determine whether the Richmond Professional Institute could serve the Richmond Metropolitan area by establishing data processing training program outlines for the individual organizations. Approximately 62 percent of the organizations have no established educational training program to prepare personnel for work in the electronic data processing departments.

An analysis of each job duty could offer a future area for research. Individual job duties could be isolated and then broken down into the functions and components that comprise each duty. Statistical analysis

of the functions and components of each job duty performed by programmers could provide data for curriculum development at the Richmond Professional Institute.

An analogous study could be conducted to determine the job duties and qualifications of systems analyst in the Richmond Metropolitan area. This is an area closely associated with the programming field.

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BIBLIOGRAPHY

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APPENDIX A

Albemarle Paper Company
330 South 4th Street
644-6081

Allied Chemical Corporation
Industrial Street
458-7811

Automated Computer Services
Grace Street
643-5315

C. and P. Telephone Company
703 East Grace Street
648-9121

The Central National Bank
219 East Broad Street
644-6011

County of Henrico
21st and Main Street
649-1461

Defense General Supply Center
Bellwood, Petersburg Pike
275-3861

E. I. Dupont de Nemours
Ampthill, Petersburg Pike
275-8311

Federal Reserve Bank
9th and Franklin Street
643-7773

First and Merchants National Bank
827 East Main Street
649-2311

First Mortgage Corporation
1512 Willowlawn Drive
282-9741

E. I. Dupont de Nemours, Film Dept.
Ampthill, Petersburg Pike
275-8311

Larus and Brothers Company
22nd and Cary Street
643-3511

David M. Lea and Company
Hopkins Road
233-8301

Life Insurance Company of Va.
914 Capital Street
644-8561

Miller and Rhoads, Inc.
517 East Broad Street
648-3111

R. F. and P. Railroad
Broad Street Station
355-3211

Richmond Food Stores, Inc.
2901 Hermitage Road
359-6061

Richmond Life Insurance Company
603 West Grace Street
643-9055

Richmond Petersburg Turnpike Auth.
P. O. Box 1R
748-2271

Richmond Professional Institute
901 West Franklin Street
353-2711

Southern Bank and Trust Company
2nd and Grace Street
644-7651

Southern Biscuit Company
Terminal Place
355-7801

Southwestern Life Insurance Co.
609 East Grace Street
648-4761

State Planters Bank
9th and Main Street
644-3451

Virginia Carolina Chemical Corp.
401 East Main Street
644-7611

Virginia Department of Highways
1221 East Broad Street
272-1428

Phillip Morris
P. O. Box 1895
275-8361

J. C. Wheat Company
1001 East Main Street
644-4211

Thalhimers
P. O. Box 2408
643-4211

Blue Cross - Blue Shield
4010 West Broad Street
358-7081

Continental Can Company
Industrial Street
458-9831

Bank of Virginia
Main and 8th Street
644-1821

Ford Motor Company
Lewis and Ferncrofts Road
737-4121

Automatic Equipment Sales of Va.
1737 Summit Avenue
353-5581

Coca-Cola Bottling Company
3123 West Broad Street
358-4966

Hercules Powder Company
Hopewell, Virginia
458-9821

Whitaker Brothers and Company
4203 North Avenue
358-6104

Virginia Commonwealth Services, Inc.
Main and 8th Street
644-4111

Service Bureau Corporation
3228 West Cary Street
355-5758

North American Assurance Society
Main and Brunswick
355-2891

George H. Meyers and Son
1601 West Overbrook Road
643-3171

Markel Services, Inc.
5001 West Broad Street
282-5423

Cliff Weil, Inc.
1315 East Main Street
643-3526

APPENDIX B

Richmond Professional Institute

I WEST FRANKLIN STREET

CHMOND, VIRGINIA 23220

May 1, 1966

Gentlemen:

The enclosed questionnaire is designed to obtain information regarding the job duties and qualifications of a programmer and a unit record technician in the metropolitan area of Richmond, Virginia. The Richmond Professional Institute will find this information of great value in supplementing their courses for the two year E.D.P. Technical Program which will commence during the next school year.

Many definitions have been applied to the job descriptions of programmers and unit record technicians. For purposes of this investigation, a programmer is defined to include all persons performing the functions listed in Section II of this questionnaire and a unit record technician is defined to include all persons performing the functions listed in Section III of this questionnaire.

We are eager here at the Richmond Professional Institute to teach what should be taught people who plan to work in the data processing departments of your organization. We need your cooperation, assistance, and suggestions concerning the most applicable material to cover in our data processing courses.

May we count on your help? May we ask for a few minutes of your time? Please complete the enclosed questionnaire and return it to us by May 15, 1966. A stamped self-addressed envelope is enclosed for your convenience.

Many thanks,

David P. Jones, Graduate Student
Edwin E. Blanks, Graduate Student

APPENDIX C

Section I

General

1. What media have you found valuable in locating personnel to work in the field of Electronic Data Processing?

   _____ Advertisements
   _____ College and University Placement Services
   _____ Electronic Data Processing Equipment Manufacturers
   _____ Employment Agencies
   _____ Personal Applications
   _____ Special Electronic Data Processing Courses and Schools
   _____ Others (please specify) _____

2. Have you experienced difficulty in fulfilling your personnel requirements for programmers?

   _____ Yes
   _____ No

3. Have you experienced difficulty in fulfilling your personnel requirements for unit record technicians?

   _____ Yes
   _____ No

4. Do you feel that the present college curricula are meeting your needs for programmers?

   _____ Yes
   _____ No

5. Do you feel that the present college curricula are meeting your needs for unit record technicians?

   _____ Yes
   _____ No

6. Would you hire a graduate of a two-year program in Electronic Data Processing?

_____Yes
_____No

7. Which, if any of the following tests are used in the selection of your programmers and unit record technicians?

_____Arithmetic Test
_____IBM Programmers Aptitude Test
_____Kuder Preference
_____No Testing Procedure
_____Wonderlic Tests
_____Others (please specify) _____

8. What type of organization do you represent?

_____Banking
_____Government
_____Insurance
_____Manufacturing
_____Retail
_____Service
_____Other (please specify) _____

9. How many people are employed by your organization in the Metropolitan area of Richmond, Virginia?

_____below 50
_____ 50 - 150
_____151 - 250
_____251 - 500
_____501 - 750
_____751 - 999
_____over 1,000

10. How many people are employed by your organization in the Metropolitan area of Richmond, Virginia in your data processing installations?

_____below 10
_____10 - 25
_____26 - 50
_____51 - 75
_____76 - 99
_____over 100

11. Please indicate the title that best describes your position.

    _____ Controller or Comptroller
    _____ Data Processing Manager
    _____ Office Manager
    _____ Programmer
    _____ Programmer Manager
    _____ Systems Analyst
    _____ Systems Analyst Manager
    _____ Supervisor of Unit Record Equipment
    _____ Unit Record Technician
    _____ Other (please specify) _____

12. Do you have an established educational program to prepare personnel for your Electronic Data Processing Department?

    _____ Yes
    _____ No

13. Which of the following do you prefer in training data processing personnel?

    _____ Company Educational Program
    _____ Manufacturers' School
    _____ On-the-job training
    _____ Technical School
    _____ Other (please specify)

14. Would you be interested in the results of this study?

    _____ Yes
    _____ No

Section II

Job Duties and Qualifications of a Programmer

Please check the most appropriate item for each of the job duties listed below.	Daily	Several times a week	Average of once a week	Several times a month	Occasionally	Not at all
1. Defines the problem						
2. Confers with the personnel requesting the problem solution						
3. Receives the problem from the systems analyst						
4. Flow charting						
5. Block diagramming						
6. Translates block diagram into coded machine language (coding)						
7. Prepares sample data						
8. Tests program on the computer						
9. Debugs the program						
10. Prepares instruction sheets for console operator						
11. Assists console operator in production runs of new programs						
12. Designs report forms						
13. Makes changes to existing programs						
14. Makes changes to existing report formats						
15. Attends educational classes						
16. Other (please specify)						

17. Does the programmer develop solutions to scientific problems?

_____ Yes
_____ No

18. Does the programmer develop solutions to business problems?

_____ Yes
_____ No

19. Do you prefer to hire programming personnel with some previous experience?

_____ Yes
_____ No

20. If your answer to question 19 is yes, how many years of previous experience do you require?

_____

21. Are any women employed as programmers with your organization?

_____ Yes
_____ No

22. What age range do you prefer for a programmer in your organization?

_____ 18-22
_____ 23-27
_____ 28-32
_____ 33-37
_____ 38-42
_____ over 42

23. What level of education, if any, is a prerequisite in the selection of a programmer with your organization?

_____ High School
_____ College
_____ Business School
_____ None
_____ Other (please specify) _____

24. What computer language do your programmers utilize in writing computer programs?

_____ Autocoder
_____ COBOL
_____ Fortran
_____ RPG
_____ SPS
_____ Other _____

25. Is supervision of data processing personnel required of programmers in your organization?

_____ Yes
_____ No

26. If answer to question 25 is yes, how many are supervised?

_____ less than 3
_____ 4-7
_____ 8-11
_____ 12-15
_____ over 15

27. What job title is used in your organization to describe the employee performing the duties listed in the table in Section II?

_____

Section III

1. Does the unit record technician operate equipment for production runs?

_____ Yes
_____ No

2. If answer to question 1 is yes, which equipment does he operate?

_____ Collator
_____ Keypunch
_____ Reproducer
_____ Sorter
_____ Tabulating or accounting machine
_____ Verifier
_____ Other (please specify) _____

3. Do you prefer to hire unit record technicians with previous experience?

_____ Yes
_____ No

Job Duties and Qualifications of a Unit Record Technician

Please check the most appropriate item for each of the job duties listed below.	Daily	Several times a week	Average of once a week	Several times a month	Occasionally	Not at all
4. Defines the problem						
5. Confers with the personnel requesting the problem solution						
6. Receives the problem from the systems analyst						
7. Flow charting						
8. Prepares sample data						
9. Wires control panels						
10. Prepares control panel diagrams						
11. Test problems on the unit record equipment						
12. Prepares instructions for machine operators						
13. Assists machine operators in production runs of new problems						
14. Locates errors in control panel wiring						
15. Designs report forms						
16. Prepares card format						
17. Attends educational classes						
18. Other (please specify)						

19. If answer to question 3 is yes, how many years of previous experience do you require?

_____

20. Are any women employed as unit record technicians in your organization?

_____ Yes
_____ No

21. What age range do you prefer for a unit record technician in your organization?

_____ 18 - 22
_____ 23 - 27
_____ 28 - 32
_____ 33 - 37
_____ 38 - 42
_____ over 42

22. What level of education, if any, is a prerequisite in the selection of a unit record technician in your organization?

_____ High School
_____ College
_____ Business School
_____ None
_____ Other (please specify) _____

23. Is supervision of data processing personnel required of unit record technicians in your organization?

_____ Yes
_____ No

24. If answer to question 23 is yes, how many are supervised?

_____ Less than 3
_____ 4 - 7
_____ 8 - 11
_____ 12 - 15
_____ over 15

25. What job title is used in your organization to describe the employee performing the duties listed in Section III?

_____

Section IV

Electronic Data Processing Utilization — Present and Future

1. What computer(s) are you now using?

_____ IBM 360
_____ IBM 1401
_____ IBM 1410
_____ IBM 1620
_____ IBM 7090
_____ UNIVAC 1004
_____ Other (please specify)_____

2. What unit record equipment are you now using?

_____ Collators
_____ Keypunch
_____ Reproducers
_____ Sorters
_____ Tabulating or accounting machines
_____ Verifiers
_____ Other (please specify) _____

3. Do you rent your equipment?

_____ Yes
_____ No

4. Do you have a new computer on order?

_____ Yes
_____ No

5. If the answer to question 4 is yes, what make computer do you have on order?

_____

6. If your answer to question 4 is yes, what computer language do you anticipate using with the new computer?

   _____

7. If your answer to question 4 is yes, what is the estimated date of delivery for the computer?

   _____

8. If your answer to question 4 is yes, what forms of input and output will be utilized?

   _____

9. On what basis do you operate your electronic data processing installation?

   _____ one 8 hour shift per day
   _____ two 8 hour shifts per day
   _____ three 8 hour shifts per day

10. What percentage of your electronic data processing applications fall into each of the following catagories?

    _____ Business or Commercial
    _____ Research and Development
    _____ Other (please specify) _____

11. What is the length of time your organization has been using data processing equipment?

    _____

THANK YOU

APPENDIX D

Richmond Professional Institute

1 WEST FRANKLIN STREET
CHMOND, VIRGINIA 23220

May 16, 1966

Gentlemen:

The information we have compiled from the returned data processing
questionnaires has proved very beneficial. The Richmond Professional
Institute is finding this information of great value in formulating its
courses for the two year E.D.P. technical program which will commence
during the next school year.

The questionnaire is of utmost importance in making decisions about
program content and data processing equipment rental and purchases.
You can readily understand our imperative need for the information
contained on the questionnaire. If you have not returned your question-
naire could we count on you to do so by May 23, 1966?

Many thanks for promptly returning the questionnaire and your cooper-
ation is greatly appreciated and of tremendous value to us.

Sincerely,

David P. Jones, Graduate Student
Edwin E. Blanks, Graduate Student

APPENDIX E

Job Duty	No. Percent	Daily	Several Times A Week	Average of Once a Week	Several Times A Month	Occa- sionally	Not at All
1. Defines the Problem	No.	7	2		16	9	1
	Percent	20.00	5.71		45.72	25.71	2.86
2. Confers with the Personnel requesting the problem solution	No.	5	5	4	12	8	1
	Percent	14.29	14.29	11.43	34.27	22.86	2.86
3. Receives the problem from the Systems Analyst	No.	1	4	1	8	7	14
	Percent	2.86	11.43	2.86	22.86	20.00	39.99
4. Flow Charting	No.	9	7	2	7	9	1
	Percent	25.72	20.00	5.71	20.00	25.71	2.86
5. Block Diagramming	No.	8	10	3	6	5	3
	Percent	22.86	28.57	8.57	17.14	14.29	8.57
6. Translates Block Diagram into coded Machine Language (coding)	No.	13	5	4	7	3	3
	Percent	37.14	14.29	11.43	20.00	8.57	8.57

Job Duty	No. Percent	Daily	Several Times A Week	Average of Once A Week	Several Times A Month	Occa- sionally	Not at All
7. Prepares Sample Data	No.	6	6	4	11	5	3
	Percent	17.14	17.14	11.43	31.43	14.29	8.57
8. Tests Program on the Computer	No.	10	8	6	8	2	1
	Percent	28.57	22.86	17.14	22.86	5.71	2.86
9. Debugs the Program	No.	11	9	4	9	2	
	Percent	31.44	25.71	11.43	25.71	5.71	
10. Prepares Instruction Sheets for Console Operator	No.	7	5	2	12	5	4
	Percent	20.00	14.29	5.71	34.28	14.29	11.43
11. Assists Console Operator in Production Runs of New Programs	No.	6	4	2	8	10	5
	Percent	17.14	11.43	5.71	22.86	28.57	14.29
12. Designs Report Forms	No.	4	4	1	4	18	4
	Percent	11.43	11.43	2.86	11.43	51.42	11.43

Job Duty	No. Percent	Daily	Several Times A Week	Average of Once A Week	Several Times A Month	Occa- sionally	Not at All
13. Makes Changes to Existing Programs	No.	5	11	1	11	4	3
	Percent	14.29	31.42	2.86	31.43	11.43	8.57
14. Makes Changes to Existing Report Formats	No.	3	6	1	6	15	4
	Percent	8.57	17.14	2.86	17.14	42.86	11.43
15. Attends Educational Classes	No.	1				32	2
	Percent	2.86				91.43	5.71