COMPETENCIES NEEDED BY PROFESSIONAL COMPUTER SCIENCE PERSONNEL AS PERCEIVED BY BUSINESS AND INDUSTRY REPRESENTATIVES OF ARKANSAS

By

AMANDA LEAH SLATEN

Bachelor of Science

Arkansas Tech University

Russellville, Arkansas

1984

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
December, 1986

COMPETENCIES NEEDED BY PROFESSIONAL COMPUTER SCIENCE PERSONNEL AS PERCEIVED BY BUSINESS AND INDUSTRY REPRESENTATIVES OF ARKANSAS

Thesis Approved:

Thesis Adviser

Dean of the Graduate College

PREFACE

In preparation of this study, I would like to express my sincere appreciation to all the people who assisted me in this study. I am especially thankful to my major adviser, Dr. Cecil Dugger, for his guidance and valuable help.

Appreciation is also extended to the other members of my committee, Dr. John Baird and Mr. Ray Sanders, for their advisement in the preparation of this work.

Thanks to the Oklahoma State Department of Vocational and Technical Education for supplying the competency profiles that were used in the study.

My deepest appreciation goes to my husband Brad for his patience and support.

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

CHAPTER I

THE RESEARCH PROBLEM

Introduction

The fast growth of computer technology has created the need for universities to upgrade their Computer Science curricula on a regular basis. In order for the colleges and universities to upgrade their Computer Science curricula, it has been necessary for them to be aware of what new computer technology has been created. Also, the colleges and universities need to be aware of what competencies have been needed for the new technology by the businesses and industries that will be employing their graduates.

Statement of the Problem

The problem with which this study was concerned was the lack of sufficient information concerning what competencies are needed by professional Computer Science personnel in business and industry.

Purpose of the Study

The purpose of this study was to analyze the competencies needed by professional Computer Science

personnel as perceived by business and industry representatives in Arkansas. This study was also intended to provide information for the colleges and universities in Arkansas to compare their Computer Science curricula with the competencies needed as perceived by representatives of business and industry of Arkansas.

Research Questions

This study obtained information to answer the following questions:

1. Was there a distinct rating of competencies needed by professional Computer Science personnel as perceived by the representatives of business and industry?

2. Was there a distinct rating of competencies needed by professional Computer Science personnel as perceived by the representatives of business and industry in each category such as banking, manufacturing and transportation?

3. Did the rating of the competencies differ among each category?

4. Did the overall rating of the compentencies differ from the rating of the competencies among each category?

Scope and Limitations

This study was limited to the businesses and industries in Arkansas that were listed in Computer Directories, Inc. (1986).

Definitions

For the purpose of this study the following definitions were used:

Data Processing -- Processing of data for transactions such as sales, collections and budgets.

Computer Science -- Bachelor of Science degree programs dealing with the analysis and design of systems that provide information to management for use in the decision making process. Various tools and techniques for solving typical business, engineering, and scientific problems are emphasized. As such the curricula draws heavily upon computer processing methods and mathematical techniques.

Low-level Programming -- Programming in COBOL or RPG.

Industry or Business Representative -- A person who represents a business or industry who hires Computer Science graduates.

Computer -- An electronic device capable of accepting data, performing arithmetic or decision processes on the data and communicating the results.

COBOL -- Common Business Oriented Language, a programming language used primarily for business applications.

RPG -- Report Program Generator, a programming language used for generating reports.

CHAPTER II

REVIEW OF LITERATURE

History

Computer Science courses first started to migrate from the graduate to the undergraduate level in the early 1960's (Booth, 1984). Some schools recognized early that Computer Science was becoming a separate discipline and established a Computer Science department. Purdue University established the first Computer Science department nationally in October of 1962 (Virginia State Council of Higher Education, 1983). However, other schools began to implement Computer Science programs in other departments such as engineering or mathematics. By the 1964-65 academic year there were 50 Computer Science programs and by the 1968-69 academic year there were over 150 (Booth, 1984).

Curriculum Implementation

In a study by Alan Howard (1978) for the Washington State Board for Community College Education, Howard stated that "the objective of Computer Science education is to develop professionally competent and broadly educated computer scientists" (p. 71). Undergraduate education was not designed for preparing students for specific jobs, but to

provide a foundation that would not become obsolete with the advances and changes in technology for any number of present and future jobs.

Howard's position was supported by another similar study conducted by the Virginia State Council of Higher Education (1983). This study reported that data processing requirements were to provide a general education program so that graduates could build a future learning opportunity to prevent technical obsolescence as the industry advanced and changed.

A curriculum in Computer Science generally emphasized one of two areas, mathematics or business (Beidler, Austing and Cassell, 1985). However, regardless of the area in which a student was enrolled, there were certain courses that were important to both areas. These courses were generally referred to as core courses. Taylor Booth (1984) stated that in regard to the Institute of Electrical Engineering Education Computer Society curriculum that

> The core of the program consists of a set of courses dealing with the fundamentals of computing, data structures, system software and software engineering, computer languages, operating systems, logic and digital system design, computer architecture, and interfacing and communications (p. 64).

Beidler, Austing and Cassell (1985) indicated that core courses should consist of elements of programming, machine organization and assembler programming, file structures, operating systems, database systems, data structures, and systems architecture.

Not only were the core courses important but mathematics has been important also. An article by Beidler, Austing and Cassell (1985) stated:

> An understanding of the mathematics underlying various computing topics and a capability to implement those mathematics, at least at a basic level, will enable students to grasp fully and deeply the computer concepts as they occur in courses (p. 610).

The importance of written and oral communication skills as well as an understanding of the humanities and social sciences has also been stressed (Booth, 1984).

Another area that was considered to be very important in Computer Science was the study of algorithms. Algorithms were an area with great breadth and educational impact (Howard, 1978).

> 'A person well-trained in Computer Science knows how to deal with algorithms: how to construct them, manipulate them, understand them. This knowledge prepares him for much more than writing good computer programs; it is a general-purpose mental tool which will be a definite aid to his understanding of other subjects, whether they be chemistry, linguistics, or music... The attempt to formalize things as algorithms leads to a much deeper understanding than if we simply try to comprehend things in the traditional way' (p. 91).

Model curricula for the various areas in Computer Science have been developed by professional organizations such as IEEE/CS, ACM and DPMA. Those curricula were not necessary nor desirable in all institutions. The mission, scope and purpose of the Computer Science program needed to be taken into consideration. The basic competencies identified by model curricula should have been incorporated into the programs (Virginia State Council of Higher

Education, 1983).

Need for Change in Computer Science Education

As the computer industry changed so did the need to update the curriculum in Computer Science. "Early computer applications were often labor intensive" (Booth, 1984, p. 57). All tasks had to be reduced to low-level programming. As technology has developed many of the barriers to computer accessibility have been removed. As a result the user has been able to interact with the computer directly without the assistance of a skilled programmer (Booth, 1984).

In telephone interviews Curt Hartog (1985) found that, according to data processing managers, government, retail and financial organizations, Computer Science graduates did not know how data processing fit into the business structure. Most of the industry interviewees were very satisfied with the technical skills of the Computer Science graduates as stated, "Technical preparation is good. But leadership, communication skills, and business knowledge is lacking" (Hartog, p. 70).

The main problem with change in Computer Science was resistance. Education systems were extremely resistant to change because of their conservativeness. Educational change was slow and almost always came from the outside (Cerych, 1985).

Education and Industry

The gap between industry needs and university curricula has, in many disciplines, been a long tradition. The blame for the gap has not been one-sided; the university's priority was education and industry's was profit (Galvin, 1985). The pressures of the marketplace were more fierce in the technical disciplines like Computer Science. Many faculty members have started listening to the cries of the marketplace (Hartog, 1985).

According to Carl Hartog (1985) educators would tailor to the needs of industry by keeping current, but they would not try to change rapidly according to industry whims. When educators were asked if they were planning to tailor requirements toward industry needs in the near future, they unanimously said that they were not (Hartog, 1985).

Kenneth Carr (1985) indicated that it was important that industry make a commitment to actively support the universities. He also indicated that university and industry cooperation should have specific goals that benefit both.

The cooperation between education and industry has not been new, but it was becoming a major concern in higher education (Michel, 1985). This cooperation can be dated back to the eighteenth century. In France in the middle of the eighteenth century some schools of Engineering had to train engineers to design and manage projects for the state and the young industry (Michel, 1985). In 1829 Ecole Centrale in France was founded by industrialists, bankers and scientists

and in 1865 the Massachusetts Institute of Technology in the United States was created on the same basis (Michel, 1985).

Japan evolved their industrial structures towards knowledge-intensive industries. The Japanese industry employed more people in the area of research and development than Britain, France and West Germany put together. Experts expected their innovation and creativity to mushroom in the future adding more strength to the Japanese challenge. The key to Japan's success was cooperation within companies, with labor, with government and with the higher education institutions (Galvin, 1985).

According to Jean Michel (1985) there were three main areas of cooperation: direct assistance to colleges by industry; assistance that colleges offer industry and cooperative ventures, between industry and colleges.

In these areas of cooperation there were benefits to both education and industry. One of the benefits for education was new financial resources for students and research (Michel, 1985). Another was better facilities (Galvin, 1985). Also, students and staff benefitted from the practical experience (Galvin, 1985). The benefits for industry included: recruitment of personnel; assistance for technological advancement; access to the university's resources and increased productivity by using better educated people (Michel, 1985).

There were barriers to cooperation that needed to be taken into consideration. There seemed to be a lack of

interest in cooperation from both industry and education. There was a fear from both industry and education that cooperation might bring about some changes that would threaten their position. Also, there was no encouragement from senior faculty members to cooperate with industry, and cooperation was not a criterion for promotion in industry or education (Suraweera, 1985).

E. Patrick Galvin (1985) stated:

> Universities have a unique role to play in widening our knowledge and in creating the environment for undertaking projects in a structured way on a confidential basis to meet the needs of Industry. Industry, on the other hand, must define its R & D requirements, recognise the University's need for communication as part of its mission, and provide adequate financial arrangements (p. 125).

Summary

Computer Science should have prepared students with a knowledge that would build learning to prevent technical obsolescence and prepared them for any number of present and future jobs. As the technology has advanced, educators have had to update their curricula. The core courses have always been important but mathematics, communication skills and algorithms were important also. The basic competencies from model curricula should have been incorporated into Computer Science programs. Industry representatives indicated that the technical knowledge was satisfactory but the communication skills of the Computer Science graduates were not satisfactory.

The industry-university gap has always existed. Both education and industry have agreed that the gap exists. Educators indicated that they would tailor to the current needs of industry, but not to industry whims. The cooperation of industry and education can be dated back to France in the eighteenth century, and it was the reason for Japan's success in knowledge-intensive industries. The three main areas of cooperation benefitted both education and industry.

CHAPTER III

PROCEDURES

Introduction

Many of the colleges and universities in Arkansas offer curricula in Computer Science. Technological advances and changing industry needs have created a need to examine, compare and perhaps modify the curricula so that graduates of these programs would be better prepared to meet the job requirements of the businesses and industries.

Purpose of the Study

The purpose of this study was to analyze the competencies needed by professional Computer Science personnel as perceived by business and industry representatives in Arkansas. This study was also intended to provide information for the colleges and universities in Arkansas to compare their Computer Science curricula with the competencies needed as perceived by the representatives of business and industry of Arkansas.

Design of the Questionnaire

Competencies for professional Computer Science personnel were taken from several competency profiles that were

provided by the Oklahoma State Department of Vocational and Technical Education. Only competencies that were directly related to business and industry applications of computers were selected to be included in the questionnaire, and all redundant competencies were excluded. The questionnaire was reviewed by Dr. Donald Grace and Dr. G. E. Hedrick of the Computing and Information Sciences Department of Oklahoma State University for clarity and was revised based on their comments. The questionnaire (Appendix A) was mailed to the selected representatives of business and industry in Arkansas.

Population

The businesses and industries that were selected to be included in this study were the businesses and industries in Arkansas that were listed in Computer Directories, Inc. (1986). The total population was 378. The number that must be surveyed to accurately represent the views of a population of 380 is 191 at the .005 reliability level (Zemke and Kramlinger, 1985). A sample size of two hundred was chosen.

Each business and industry listed in Computer Directories, Inc. (1986) was categorized by a type of business or industry, such as banking, manufacturing and transportation. A percentage of the number in each category to the total population listed was calculated. This percentage was used to obtain the number to be chosen in each category based on the sample size of 200. The percentage and

sample size was recorded in Table I.

Data Treatment

The business and industry representatives were asked to rate each competency as a 1-very important, 2-important, 3-slightly important or 4-not important. A rating of 1 was given the value of 2; a rating of 2 was given the value of 1; a rating of 3 was given a value of -1; a rating of 4 was given a value of -2 and no rating was given a value of 0.

For the composite group, each response was tabulated according to rating and competency. Then the total for each rating in each competency was multiplied by its corresponding value. The mean for each competency was calculated. A mean from 1.51 to 2.00 meant that the competency was considered very important. A mean from 0.51 to 1.50 meant that the competency was considered important. A mean from -0.49 to 0.50 meant that the business and industry representatives were undecided on the importance of the competency. A mean from -1.49 to -0.50 meant that the competency was considered slightly important. A mean from -2.00 to -1.50 meant that the competency was considered not important.

The competencies were ranked by mean. The median, mean, range and standard deviation were then calculated for the entire group.

For each of the 22 categories, the mean was calculated in the same manner as the mean was calculated for the composite group. The competencies of each category were

TABLE I

CALCULATION OF SAMPLE SIZE

Category	Total Size	Percentage	Sample Size
Banking	30	0.08	16
Communications	1	0.00	0
Construction	9	0.02	4
Data Processing	37	0.10	20
Distribution	11	0.03	6
Education	15	0.04	8
Engineering	3	0.01	2
Federal Government	3	0.01	2
Financial	17	0.04	8
Health Service	27	0.07	14
Insurance	11	0.03	6
Legal Services	1	0.00	0
Local Government	9	0.02	4
Manufacturing	75	0.20	40
Miscellaneous	5	0.01	2
Petroleum	7	0.02	4
Publishing	5	0.01	2
Real Estate	2	0.01	2
Retail	5	0.01	2
Service	59	0.16	32
State Government	6	0.02	4

TABLE I (Continued)

Category	Total Size	Percentage	Sample Size
Transportation	6	0.02	4
Utilities	12	0.03	6
Wholesale	22	0.06	12
Totals	378	1.00	200

ranked by their mean. The median, mean, range and standard deviation for each category were then calculated.

CHAPTER IV

FINDINGS

Purpose of the Study

The purpose of this study was to analyze the competencies needed by professional Computer Science personnel as perceived by business and industry representatives in Arkansas. This study was also intended to provide infomation for the colleges and universities in Arkansas to compare their Computer Science curricula with the competencies needed as perceived by representatives of business and industry of Arkansas.

Response Rate

Seventy-six business and industry representatives responded out of the 200 surveyed representing a 38 percent response rate. Eleven of the questionnaires were returned because the post office had no forwarding address on file for those eleven businesses or industries. The response rate for each category is recorded in Table II.

Results

To simplify processing of the business and industry responses, each competency was given a question number as

TABLE II

RESPONSE RATE

Category	Sample Size	Responses	Percentage
Banking	16	5	31
Construction	4	1	25
Data Processing	20	7	35
Distribution	6	2	33
Education	8	4	50
Engineering	2	2	100
Federal Government	2	1	50
Financial	8	1	13
Health Service	14	7	50
Insurance	6	3	50
Local Government	4	1	25
Manufacturing	40	18	45
Miscellaneous	2	1	50
Petroleum	4	1	25
Publishing	2	1	50
Real Estate	2	1	50
Retail	2	0	0
Service	32	7	22
State Government	4	3	75
Transportation	4	2	50
Utilities	6	3	50
Wholesale	12	5	42
Composite	200	76	38

depicted in Table III.

The business and industry representatives as a group rated question one, "Trace the history of Data Processing development.", as -0.87 or slightly important. Twenty-five percent rated this competency as not important; 54 percent responded slightly important; 5 percent were undecided; 14 percent responded important and 1 percent responded very important.

To question two, "Describe Data Processing career paths, duties and responsibilities.", the group rated it as 0.80 or important. One percent rated this competency as not important; 17 percent responded slightly important; 4 percent were undecided; 55 percent responded important and 22 percent responded very important.

To question three, "Understand information systems.", the group rated it as 1.47 or important. Zero percent rated this competency as not important; 4 percent responded slightly important; 4 percent were undecided; 33 percent responded important and 59 percent responded very important.

To question four, "Understand similarities and differences between types of Data Processing systems.", the group rated it as 0.82 or important. Three percent rated this competency as not important; 17 percent responded slightly important; 4 percent were undecided; 49 percent responded important and 28 percent responded very important.

To question five, "Interpret punch card code.", the group rated it as -1.46 or important. Sixty-three percent

TABLE III

COMPETENCIES LISTED BY QUESTION NUMBER

Question Number	Competency
1	Trace the history of Data Processing development.
2	Describe Data Processing career paths, duties and responsibilities.
3	Understand information systems.
4	Understand similarities and differences between types of Data Processing systems.
5	Interpret punch card code.
6	Interpret BCD coding system.
7	Interpret hexadecimal coding system.
8	Operate data entry equipment.
9	Solve problems using flow charting symbols and concepts.
10	Solve problems using decision tables.
11	Understand internal and external storage concepts.
12	Understand Data Communications applications.
13	Design a Data Communications network.
14	Understand data base system components and functions.
15	Manage data base systems.
16	Understand systems analysis concepts.
17	Apply basic system analysis techniques.
18	Understand micro computer applications.
19	Understand mini computer applications.

TABLE III (Continued)

Question Number	Competency
20	Understand mainframe computer applications.
21	Understand analog computer systems.
22	Understand disk operating systems.
23	Understand virtual storage and memory concepts.
24	Design a computer system.
25	JCL programming.
26	FORTRAN Programming.
27	Basic Programming.
28	RPG Programming.
29	COBOL Programming.
30	Pascal Programming.
31	PL/I Programming.
32	C Programming.
33	Microcomputer Programming.
34	SAS Programming.
35	ADA Programming.
36	APL Programming.
37	ALGOL Programming.
38	UNIX Programming.
39	Assembler programming.
40	Check and replace faulty data sets.
41	Operate plotters.

TABLE III (Continued)

Question Number	Competency
42	Operate OCR equipment.
43	Operate communications equipment.
44	Operate teleprocessing controllers.
45	Operate cassette handlers.
46	Perform back up operations.
47	Perform recovery procedures after system failure.
48	Maintain environmental controls.
49	Operate punch paper tape handlers.
50	Interpret manufacturers manual.
51	Perform operating system start-up routines.
52	Perform computer hardware shut-down routines.
53	Care for peripheral equipment.
54	Operate card reader punch equipment.
55	Mount disc packs and tapes.
56	Prepare data entry programs.
57	Operate line printers.
58	Make carriage control tapes for printers.
59	Read operating instructions.
60	Follow and practice safety procedures.
61	Produce cost benefit analysis.
62	Maintain prewritten program packages.
63	Produce production schedules.

TABLE III (Continued)

Question Number	Competency
64	Design and use GANT/PERT/CPM.
65	Make presentations.
66	Conduct feasibility studies.
67	Write index sequential routines.
68	Write multi-file routines.
69	Use top down programming techniques.
70	Write users manuals.
71	Implement computer systems.
72	Perform system follow up.
73	Define relationships between various application systems.
74	Write table handling routines.
75	Write random access routines.
76	Write subroutines.
77	Use structured programming techniques.
78	Create test data.
79	Produce clear and concise documentation.
80	Write program specifications.
81	Write systems operating instructions.
82	Read memory dumps.
83	Debug programs.
84	Carry out program maintenance.
85	Build in program flexibility.

TABLE III (Continued)

Question Number	Competency
86	Define input and output specifications.
87	Design forms.
88	Design files.
89	Apply logic.
90	Work with spooling systems.
91	Define alternative solutions.
92	Maintain tape libraries.
93	Liaise with users.
94	Print legibly.
95	Use utility software.
96	Perform sysgens.
97	Update manuals.
98	Understand the importance of protecting data files and information with integrity and confidentiality.
99	Understand the importance of systems access security.
100	Operate decollator.
101	Operate burster.
102	Write pseudocode.
103	Design screen formats.

rated this competency as not important; 26 percent responded slightly important; 4 percent were undecided; 7 percent responded important and 0 percent responded very important.

To question six, "Interpret BCD coding system.", the group rated it as -0.93 or slightly important. Thirty-eight percent rated this competency as not important; 37 percent responded slightly important; 8 percent were undecided; 14 percent responded important and 3 percent responded very important.

To question seven, "Interpret Hexadecimal coding system.", the group rated it as 0.03 or undecided. Twelve percent rated this competency as not important; 36 percent responded slightly important; 7 percent were undecided; 30 percent responded important and 16 percent responded very important.

To question eight, "Operate data entry equipment.", the group rated it as 0.05 or undecided. Sixteen percent rated this competency as not important; 30 percent responded slightly important; 4 percent were undecided; 33 percent responded important and 17 percent responded very important.

To question nine, "Solve problems using flow charting symbols and concepts.", the group rated it as 0.86 or important. Three percent rated this competency as not important; 20 percent responded slightly important; 4 percent were undecided; 37 percent responded important and 37 percent responded very important.

To question ten, "Solve problems using decision

tables.", the group rated it as 0.75 or important. One percent rated this competency as not important; 20 percent responded slightly important; 7 percent were undecided; 47 percent responded important and 25 percent responded very important.

To question eleven, "Understand internal and external storage concepts.", the group rated it as 1.08 or important. Zero percent rated this competency as not important; 12 percent responded slightly important; 4 percent were undecided; 49 percent responded important and 36 percent responded very important.

To question twelve, "Understand Data Communication applications.", the group rated it as 1.22 or important. Zero percent rated this competency as not important; 8 percent responded slightly important; 4 percent were undecided; 46 percent responded important and 42 percent responded very important.

To question thirteen, "Design a Data Communication network.", the group rated it as 0.64 or important. Three percent rated this competency as not important; 21 percent responded slightly important; 4 percent were undecided; 54 percent responded important and 18 percent responded very important.

To question fourteen, "Understand data base system components and functions.", the group rated it as 1.30 or important. One percent rated this competency as not important; 3 percent responded slightly important; 4 percent

were undecided; 49 percent responded important and 43 percent responded very important.

To question fifteen, "Manage data base systems.", the group rated it as 0.87 or important. One percent rated this competency as not important; 13 percent responded slightly important; 5 percent were undecided; 58 percent responded important and 22 percent responded very important.

To question sixteen, "Understand systems analysis concepts.", the group rated it as 1.44 or important. Zero percent rated this competency as not important; 3 percent responded slightly important; 4 percent were undecided; 39 percent responded important and 54 percent responded very important.

To question seventeen, "Apply basic system analysis techniques.", the group rated it as 1.30 or important. Zero percent rated this competency as not important; 4 percent responded slightly important; 4 percent were undecided; 50 percent responded important and 42 percent responded very important.

To question eighteen, "Understand micro computer applications.", the group rated it as 0.72 or important. One percent rated this competency as not important; 20 percent responded slightly important; 4 percent were undecided; 55 percent responded important and 20 percent responded very important.

To question nineteen, "Understand mini computer applications.", the group rated it as 0.61 or important.

Three percent rated this competency as not important; 24 percent responded slightly important; 4 percent were undecided; 50 percent responded important and 20 percent responded very important.

To question twenty, "Understand mainframe computer applications.", the group rated it as 1.12 or important. One percent rated this competency as not important; 11 percent responded slightly important; 4 percent were undecided; 43 percent responded important and 41 percent responded very important.

To question twenty-one, "Understand analog computer systems.", the group rated it as -0.55 or slightly important. Twenty-nine percent rated this competency as not important; 33 percent responded slightly important; 5 percent were undecided; 30 percent responded important and 3 percent responded very important.

To question twenty-two, "Understand disk operating systems.", the group rated it as 0.91 or important. One percent rated this competency as not important; 17 percent responded slightly important; 4 percent were undecided; 45 percent responded important and 33 percent responded very important.

To question twenty-three, "Understand virtual storage and memory concepts.", the group rated it as 0.76 or important. One percent rated this competency as not important; 21 percent responded slightly important; 5 percent were undecided; 45 percent responded important and 28 percent

responded very important.

To question twenty-four, "Design a computer system.", the group rated it as -0.11 or undecided. Twenty percent rated this competency as not important; 29 percent responded slightly important; 8 percent were undecided; 29 percent responded important and 14 percent responded very important.

To question twenty-five, "JCL programming.", the group rated it as 0.53 or important. Nine percent rated this competency as not important; 17 percent responded slightly important; 9 percent were undecided; 41 percent responded important and 24 percent responded very important.

To question twenty-six, "FORTRAN programming.", the group rated it as -0.64 or slightly important. Twenty-nine percent rated this competency as not important; 39 percent responded slightly important; 5 percent were undecided; 20 percent responded important and 7 percent responded very important.

To question twenty-seven, "Basic programming.", the group rated it as -0.26 or undecided. Sixteen percent rated this competency as not important; 41 percent responded slightly important; 5 percent were undecided; 30 percent responded important and 8 percent responded very important.

To question twenty-eight, "RPG programming.", the group rated it as 0.32 or undecided. Thirteen percent rated this competency as not important; 24 percent responded slightly important; 5 percent were undecided; 34 percent responded important and 24 percent responded very important.

To question twenty-nine, "COBOL programming.", the group rated it as 1.03 or important. Three percent rated this competency as not important; 11 percent responded slightly important; 4 percent were undecided; 47 percent responded important and 36 percent responded very important.

To question thirty, "Pascal programming.", the group rated it as -0.68 or slightly important. Twenty-nine percent rated this competency as not important; 41 percent responded slightly important; 7 percent were undecided; 17 percent responded important and 7 percent responded very important.

To question thirty-one, "PL/I programming.", the group rated it as -0.63 or slightly important. Twenty-eight percent rated this competency as not important; 38 percent responded slightly important; 8 percent were undecided; 22 percent responded important and 4 percent responded very important.

To question thirty-two, "C programming.", the group rated it as -0.52 or slightly important. Twenty-eight percent rated this competency as not important; 33 percent responded slightly important; 9 percent were undecided; 25 percent responded important and 5 percent responded very important.

To question thirty-three, "Microcomputer programming.", the group rated it as 0.07 or undecided. Twelve percent rated this competency as not important; 32 percent responded slightly important; 7 percent were undecided; 38 percent responded important and 12 percent responded very important.

To question thirty-four, "SAS programming.", the group rated it as -0.82 or slightly important. Thirty-three percent rated this competency as not important; 37 percent responded slightly important; 12 percent were undecided; 16 percent responded important and 3 percent responded very important.

To question thirty-five, "ADA programming.", the group rated it as -0.96 or slightly important. Thirty-seven percent rated this competency as not important; 37 percent responded slightly important; 12 percent were undecided; 14 percent responded important and 0 percent responded very important.

To question thirty-six, "APL programming.", the group rated it as -0.99 or slightly important. Thirty-seven percent rated this competency as not important; 38 percent responded slightly important; 12 percent were undecided; 13 percent responded important and 0 percent responded very important.

To question thirty-seven, "ALGOL programming.", the group rated it as -1.07 or slightly important. Thirty-eight percent rated this competency as not important; 41 percent responded slightly important; 11 percent were undecided; 11 percent responded important and 0 percent responded very important.

To question thirty-eight, "UNIX programming.", the group rated it as -0.61 or slightly important. Twenty-eight percent rated this competency as not important; 37 percent

responded slightly important; 9 percent were undecided; 21 percent responded important and 5 percent responded very important.

To question thirty-nine, "Assembler programming.", the group rated it as -0.43 or undecided. Twenty percent rated this competency as not important; 43 percent responded slightly important; 7 percent were undecided; 21 percent responded important and 7 percent responded very important.

To question forty, "Check and replace faulty data sets.", the group rated it as -0.21 or undecided. Sixteen percent rated this competency as not important; 38 percent responded slightly important; 7 percent were undecided; 30 percent responded important and 9 percent responded very important.

To question forty-one, "Operate plotters.", the group rated it as -0.96 or slightly important. Thirty-six percent rated this competency as not important; 42 percent responded slightly important; 8 percent were undecided; 12 percent responded important and 3 percent responded very important.

To question forty-two, "Operate OCR equipment.", the group rated it as -1.24 or slightly important. Fourty-seven percent rated this competency as not important; 37 percent responded slightly important; 9 percent were undecided; 5 percent responded important and 1 percent responded very important.

To question forty-three, "Operate communications equipment.", the group rated it as -0.13 or undecided.

Sixteen percent rated this competency as not important; 37 percent responded slightly important; 4 percent were undecided; 32 percent responded important and 12 percent responded very important.

To question forty-four, "Operate teleprocessing controllers.", the group rated it as -0.41 or undecided. Twenty-five percent rated this competency as not important; 34 percent responded slightly important; 5 percent were undecided; 28 percent responded important and 8 percent responded very important.

To question forty-five, "Operate casette handlers.", the group rated it as -1.24 or slightly important. Forty-nine percent rated this competency as not important; 37 percent responded slightly important; 5 percent were undecided; 8 percent responded important and 1 percent responded very important.

To question forty-six, "Perform backup operations.", the group rated it as 0.86 or important. Eight percent rated this competency as not important; 16 percent responded slightly important; 4 percent were undecided; 28 percent responded important and 45 percent responded very important.

To question forty-seven, "Perform recovery procedures after system failure.", the group rated it as 1.21 or important. Five percent rated this competency as not important; 8 percent responded slightly important; 4 percent were undecided; 26 percent responded important and 57 percent responded very important.

To question forty-eight, "Maintain enviromental controls.", the group rated it as -0.32 or undecided. Fourteen percent rated this competency as not important; 46 percent responded slightly important; 5 percent were undecided; 25 percent responded important and 9 percent responded very important.

To question forty-nine, "Operate punch paper tape handlers.", the group rated it as -1.58 or not important. Sixty-seven percent rated this competency as not important; 26 percent responded slightly important; 4 percent were undecided; 3 percent responded important and 0 percent responded very important.

To question fifty, "Interpret manufacturers manual.", the group rated it as 0.59 or important. Four percent rated this competency as not important; 29 percent responded slightly important; 4 percent were undecided; 30 percent responded important and 33 percent responded very important.

To question fifty-one, "Perform operating system start-up routines.", the group rated it as 0.83 or important. Three percent rated this competency as not important; 21 percent responded slightly important; 4 percent were undecided; 36 percent responded important and 37 percent responded very important.

To question fifty-two, "Perform computer hardware shut-down routines.", the group rated it as 0.79 or important. Four percent rated this competency as not important; 20 percent responded slightly important; 4 percent

were undecided; 38 percent responded important and 34 percent responded very important.

To question fifty-three, "Care for peripheral equipment.", the group rated it as 0.13 or undecided. Twelve percent rated this competency as not important; 30 percent responded slightly important; 4 percent were undecided; 41 percent responded important and 13 percent responded very important.

To question fifty-four, "Operate card reader punch equipment.", the group rated it as -1.54 or not important. Sixty-eight percent rated this competency as not important; 22 percent responded slightly important; 4 percent were undecided; 5 percent responded important and 0 percent responded very important.

To question fifty-five, "Mount disc packs and tapes.", the group rated it as -0.41 or undecided. Twenty-eight percent rated this competency as not important; 33 percent responded slightly important; 4 percent were undecided; 24 percent responded important and 12 percent responded very important.

To question fifty-six, "Prepare data entry programs.", the group rated it as 0.51 or important. Nine percent rated this competency as not important; 24 percent responded slightly important; 5 percent were undecided; 30 percent responded important and 32 percent responded very important.

To question fifty-seven, "Operate line printers.", the group rated it as -0.04 or undecided. Fourteen percent rated

this competency as not important; 38 percent responded slightly important; 4 percent were undecided; 24 percent responded important and 20 percent responded very important.

To question fifty-eight, "Make carriage control tapes for printers.", the group rated it as -1.25 or slightly important. Sixty-two percent rated this competency as not important; 20 percent responded slightly important; 4 percent were undecided; 11 percent responded important and 4 percent responded very important.

To question fifty-nine, "Read operating instructions.", the group rated it as 0.95 or important. Five percent rated this competency as not important; 16 percent responded slightly important; 4 percent were undecided; 29 percent responded important and 46 percent responded very important.

To question sixty, "Follow and practice safety procedures.", the group rated it as 0.82 or important. Three percent rated this competency as not important; 18 percent responded slightly important; 4 percent were undecided; 45 percent responded important and 30 percent responded very important.

To question sixty-one, "Produce cost benefit analysis.", the group rated it as 0.64 or important. Three percent rated this competency as not important; 28 percent responded slightly important; 4 percent were undecided; 34 percent responded important and 32 percent responded very important.

To question sixty-two, "Maintain prewritten program packages.", the group rated it as 0.80 or important. Four

percent rated this competency as not important; 17 percent responded slightly important; 4 percent were undecided; 45 percent responded important and 30 percent responded very important.

To question sixty-three, "Produce production schedules.", the group rated it as 0.33 or undecided. Seven percent rated this competency as not important; 29 percent responded slightly important; 4 percent were undecided; 46 percent responded important and 14 percent responded very important.

To question sixty-four, "Design and use GANT/PERT/CPM.", the group rated it as -0.26 or undecided. Twenty-four percent rated this competency as not important; 29 percent responded slightly important; 9 percent were undecided; 26 percent responded important and 12 percent responded very important.

To question sixty-five, "Make presentations.", the group rated it as 0.76 or important. Four percent rated this competency as not important; 20 percent responded slightly important; 4 percent were undecided; 41 percent responded important and 32 percent responded very important.

To question sixty-six, "Conduct feasibility studies.", the group rated it as 0.53 or important. Eight percent rated this competency as not important; 26 percent responded slightly important; 4 percent were undecided; 29 percent responded important and 33 percent responded very important.

To question sixty-seven, "Write index sequential

routines.", the group rated it as 0.58 or important. Eight percent rated this competency as not important; 20 percent responded slightly important; 4 percent were undecided; 43 percent responded important and 25 percent responded very important.

To question sixty-eight, "Write multi-file routines.", the group rated it as 1.04 or important. Three percent rated this competency as not important; 11 percent responded slightly important; 5 percent were undecided; 43 percent responded important and 38 percent responded very important.

To question sixty-nine, "Use top down programming techniques.", the group rated it as 0.75 or important. Three percent rated this competency as not important; 20 percent responded slightly important; 9 percent were undecided; 37 percent responded important and 32 percent responded very important.

To question seventy, "Write users manuals.", the group rated it as 0.89 or important. Four percent rated this competency as not important; 14 percent responded slightly important; 4 percent were undecided; 43 percent responded important and 34 percent responded very important.

To question seventy-one, "Implement computer systems.", the group rated it as 0.97 or important. Four percent rated this competency as not important; 11 percent responded slightly important; 4 percent were undecided; 47 percent responded important and 34 percent responded very important.

To question seventy-two, "Perform system follow up.",

the group rated it as 0.91 or important. Four percent rated this competency as not important; 14 percent responded slightly important; 5 percent were undecided; 39 percent responded important and 37 percent responded very important.

To question seventy-three, "Define relationships between various application systems.", the group rated it as 0.89 or important. One percent rated this competency as not important; 14 percent responded slightly important; 4 percent were undecided; 54 percent responded important and 26 percent responded very important.

To question seventy-four, "Write table handling routines.", the group rated it as 0.95 or important. One percent rated this competency as not important; 16 percent responded slightly important; 4 percent were undecided; 45 percent responded important and 34 percent responded very important.

To question seventy-five, "Write random access routines.", the group rated it as 0.96 or important. Five percent rated this competency as not important; 11 percent responded slightly important; 4 percent were undecided; 43 percent responded important and 37 percent responded very important.

To question seventy-six, "Write subroutines.", the group rated it as 1.18 or important. One percent rated this competency as not important; 8 percent responded slightly important; 4 percent were undecided; 45 percent responded important and 42 percent responded very important.

To question seventy-seven, "Use structured programming techniques.", the group rated it as 1.04 or important. One percent rated this competency as not important; 14 percent responded slightly important; 5 percent were undecided; 37 percent responded important and 42 percent responded very important.

To question seventy-eight, "Create test data.", the group rated it as 1.26 or important. Zero percent rated this competency as not important; 7 percent responded slightly important; 4 percent were undecided; 46 percent responded important and 43 percent responded very important.

To question seventy-nine, "Produce clear and concise documentation.", the group rated it as 1.53 or very important. Zero percent rated this competency as not important; 3 percent responded slightly important; 4 percent were undecided; 32 percent responded important and 62 percent responded very important.

To question eighty, "Write program specifications.", the group rated it as 1.30 or important. One percent rated this competency as not important; 7 percent responded slightly important; 4 percent were undecided; 37 percent responded important and 51 percent responded very important.

To question eighty-one, "Write system operating instructions.", the group rated it as 0.92 or important. Seven percent rated this competency as not important; 9 percent responded slightly important; 5 percent were undecided; 43 percent responded important and 36 percent

responded very important.

To question eighty-two, "Read memory dumps.", the group rated it as 0.04 or undecided. Eighteen percent rated this competency as not important; 26 percent responded slightly important; 4 percent were undecided; 36 percent responded important and 16 percent responded very important.

To question eighty-three, "Debug programs.", the group rated it as 1.49 or important. One percent rated this competency as not important; 3 percent responded slightly important; 4 percent were undecided; 30 percent responded important and 62 percent responded very important.

To question eighty-four, "Carry out program maintenance.", the group rated it as 1.33 or important. One percent rated this competency as not important; 4 percent responded slightly important; 4 percent were undecided; 42 percent responded important and 49 percent responded very important.

To question eighty-five, "Build in program flexibility.", the group rated it as 1.33 or important. One percent rated this competency as not important; 7 percent responded slightly important; 4 percent were undecided; 34 percent responded important and 54 percent responded very important.

To question eighty-six, "Define input and output specifications.", the group rated it as 1.38 or important. Zero percent rated this competency as not important; 5 percent responded slightly important; 4 percent were

undecided; 38 percent responded important and 53 percent responded very important.

To question eighty-seven, "Design forms.", the group rated it as 0.68 or important. Zero percent rated this competency as not important; 26 percent responded slightly important; 4 percent were undecided; 45 percent responded important and 25 percent responded very important.

To question eighty-eight, "Design files.", the group rated it as 1.29 or important. Zero percent rated this competency as not important; 5 percent responded slightly important; 4 percent were undecided; 47 percent responded important and 43 percent responded very important.

To question eighty-nine, "Apply logic.", the group rated it as 1.70 or very important. Zero percent rated this competency as not important; 0 percent responded slightly important; 4 percent were undecided; 22 percent responded important and 74 percent responded very important.

To question ninety, "Work with spooling systems.", the group rated it as 0.67 or important. Four percent rated this competency as not important; 21 percent responded slightly important; 5 percent were undecided; 43 percent responded important and 26 percent responded very important.

To question ninety-one, "Define alternative solutions.", the group rated it as 1.07 or important. Three percent rated this competency as not important; 9 percent responded slightly important; 4 percent were undecided; 47 percent responded important and 37 percent responded very important.

To question ninety-two, "Maintain tape libraries.", the group rated it as -0.57 or slightly important. Twenty percent rated this competency as not important; 50 percent responded slightly important; 4 percent were undecided; 20 percent responded important and 7 percent responded very important.

To question ninety-three, "Liaise with users.", the group rated it as 1.20 or important. Zero percent rated this competency as not important; 11 percent responded slightly important; 7 percent were undecided; 36 percent responded important and 47 percent responded very important.

To question ninety-four, "Print legibly.", the group rated it as 0.45 or undecided. Nine percent rated this competency as not important; 22 percent responded slightly important; 4 percent were undecided; 43 percent responded important and 21 percent responded very important.

To question ninety-five, "Use utility software.", the group rated it as 1.03 or important. Three percent rated this competency as not important; 9 percent responded slightly important; 4 percent were undecided; 51 percent responded important and 33 percent responded very important.

To question ninety-six, "Perform sysgens.", the group rated it as 0.21 or undecided. Twelve percent rated this competency as not important; 28 percent responded slightly important; 5 percent were undecided; 38 percent responded important and 17 percent responded very important.

To question ninety-seven, "Update manuals.", the group

rated it as 0.37 or undecided. Nine percent rated this competency as not important; 25 percent responded slightly important; 4 percent were undecided; 43 percent responded important and 18 percent responded very important.

To question ninety-eight, "Understand the importance of protecting data files and information with integrity and confidentiality.", the group rated it as 1.68 or very important. Zero percent rated this competency as not important; 1 percent responded slightly important; 4 percent were undecided; 20 percent responded important and 75 percent responded very important.

To question ninety-nine, "Understand the importance of system access security.", the group rated it as 1.61 or very important. Zero percent rated this competency as not important; 3 percent responded slightly important; 4 percent were undecided; 24 percent responded important and 70 percent responded very important.

To question one hundred, "Operate decollator.", the group rated it as -1.43 or slightly important. Sixty-four percent rated this competency as not important; 22 percent responded slightly important; 5 percent were undecided; 8 percent responded important and 0 percent responded very important.

To question one hundred-one, "Operate burster.", the group rated it as -1.46 or slightly important. Sixty-six percent rated this competency as not important; 22 percent responded slightly important; 4 percent were undecided; 8

percent responded important and 0 percent responded very important.

To question one hundred-two, "Write pseudocode.", the group rated it as -0.57 or slightly important. Twenty-nine percent rated this competency as not important; 37 percent responded slightly important; 7 percent were undecided; 17 percent responded important and 11 percent responded very important.

To question one hundred-three, "Design screen formats.", the group rated it as 1.13 or important. One percent rated this competency as not important; 12 percent responded slightly important; 4 percent were undecided; 38 percent responded important and 45 percent responded very important.

The composite responses are recorded in Table IV by number and percentage of responses for each level of importance. The responses to Part II of the questionnaire are shown in Appendix C.

TABLE IV

COMPOSITE GROUP RESPONSES

Question Number	Not Important		Slightly Important		Undecided		Important		Very Important	
1	19	25%	41	54%	4	5%	11	14%	1	1%
2	1	1%	13	17%	3	4%	42	55%	17	22%
3	0	0%	3	4%	3	4%	25	33%	45	59%
4	2	3%	13	17%	3	4%	37	49%	21	28%
5	48	63%	20	26%	3	4%	5	7%	0	0%
6	29	38%	28	37%	6	8%	11	14%	2	3%
7	9	12%	27	36%	5	7%	23	30%	12	16%
8	12	16%	23	30%	3	4%	25	33%	13	17%
9	2	3%	15	20%	3	4%	28	37%	28	37%
10	1	1%	15	20%	5	7%	36	47%	19	25%
11	0	0%	9	12%	3	4%	37	49%	27	36%
12	0	0%	6	8%	3	4%	35	46%	32	42%
13	2	3%	16	21%	3	4%	41	54%	14	18%
14	1	1%	2	3%	3	4%	37	49%	33	43%
15	1	1%	10	13%	4	5%	44	58%	17	22%
16	0	0%	2	3%	3	4%	30	39%	41	54%
17	0	0%	3	4%	3	4%	38	50%	32	42%
18	1	1%	15	20%	3	4%	42	55%	15	20%
19	2	3%	18	24%	3	4%	38	50%	15	20%
20	1	1%	8	11%	3	4%	33	43%	31	41%
21	22	29%	25	33%	4	5%	23	30%	2	3%
22	1	1%	13	17%	3	4%	34	45%	25	33%
23	1	1%	16	21%	4	5%	34	45%	21	28%

TABLE IV (Continued)

Question Number	Not Important		Slightly Important		Undecided		Important		Very Important	
24	15	20%	22	29%	6	8%	22	29%	11	14%
25	7	9%	13	17%	7	9%	31	41%	18	24%
26	22	29%	30	39%	4	5%	15	20%	5	7%
27	12	16%	31	41%	4	5%	23	30%	6	8%
28	10	13%	18	24%	4	5%	26	34%	18	24%
29	2	3%	8	11%	3	4%	36	47%	27	36%
30	22	29%	31	41%	5	7%	13	17%	5	7%
31	21	28%	29	38%	6	8%	17	22%	3	4%
32	21	28%	25	33%	7	9%	19	25%	4	5%
33	9	12%	24	32%	5	7%	29	38%	9	12%
34	25	33%	28	37%	9	12%	12	16%	2	3%
35	28	37%	28	37%	9	12%	11	14%	0	0%
36	28	37%	29	38%	9	12%	10	13%	0	0%
37	29	38%	31	41%	8	11%	8	11%	0	0%
38	21	28%	28	37%	7	9%	16	21%	4	5%
39	15	20%	33	43%	5	7%	16	21%	7	9%
40	12	16%	29	38%	5	7%	23	30%	7	9%
41	27	36%	32	42%	6	8%	9	12%	2	3%
42	36	47%	28	37%	7	9%	4	5%	1	1%
43	12	16%	28	37%	3	4%	24	32%	9	12%
44	19	25%	26	34%	4	5%	21	28%	6	8%
45	37	49%	28	37%	4	5%	6	8%	1	1%
46	6	8%	12	16%	3	4%	21	28%	34	45%

TABLE IV (Continued)

Question Number	Not Important		Slightly Important		Undecided		Important		Very Important	
47	4	5%	6	8%	3	4%	20	26%	43	57%
48	11	14%	35	46%	4	5%	19	25%	7	9%
49	51	67%	20	26%	3	4%	2	3%	0	0%
50	3	4%	22	29%	3	4%	23	30%	25	33%
51	2	3%	16	21%	3	4%	27	36%	28	37%
52	3	4%	15	20%	3	4%	29	38%	26	34%
53	9	12%	23	30%	3	4%	31	41%	10	13%
54	52	68%	17	22%	3	4%	4	5%	0	0%
55	21	28%	25	33%	3	4%	18	24%	9	12%
56	7	9%	18	24%	4	5%	23	30%	24	32%
57	11	14%	29	38%	3	4%	18	24%	15	20%
58	47	62%	15	20%	3	4%	8	11%	3	4%
59	4	5%	12	16%	3	4%	22	29%	35	46%
60	2	3%	14	18%	3	4%	34	45%	23	30%
61	2	3%	21	28%	3	4%	26	34%	24	32%
62	3	4%	13	17%	3	4%	34	45%	23	30%
63	5	7%	22	29%	3	4%	35	46%	11	14%
64	18	24%	22	29%	7	9%	20	26%	9	12%
65	3	4%	15	20%	3	4%	31	41%	24	32%
66	6	8%	20	26%	3	4%	22	29%	25	33%
67	6	8%	15	20%	3	4%	33	43%	19	25%
68	2	3%	8	11%	4	5%	33	43%	29	38%
69	2	3%	15	20%	7	9%	28	37%	24	32%

TABLE IV (Continued)

Question Number	Not Important		Slightly Important		Undecided		Important		Very Important	
70	3	4%	11	14%	3	4%	33	43%	26	34%
71	3	4%	8	11%	3	4%	36	47%	26	34%
72	3	4%	11	14%	4	5%	30	39%	28	37%
73	1	1%	11	14%	3	4%	41	54%	20	26%
74	1	1%	12	16%	3	4%	34	45%	26	34%
75	4	5%	8	11%	3	4%	33	43%	28	37%
76	1	1%	6	8%	3	4%	34	45%	32	42%
77	1	1%	11	14%	4	5%	28	37%	32	42%
78	0	0%	5	7%	3	4%	35	46%	33	43%
79	0	0%	2	3%	3	4%	24	32%	47	62%
80	1	1%	5	7%	3	4%	28	37%	39	51%
81	5	7%	7	9%	4	5%	33	43%	27	36%
82	14	18%	20	26%	3	4%	27	36%	12	16%
83	1	1%	2	3%	3	4%	23	30%	47	62%
84	1	1%	3	4%	3	4%	32	42%	37	49%
85	1	1%	5	7%	3	4%	26	34%	41	54%
86	0	0%	4	5%	3	4%	29	38%	40	53%
87	0	0%	20	26%	3	4%	34	45%	19	25%
88	0	0%	4	5%	3	4%	36	47%	33	43%
89	0	0%	0	0%	3	4%	17	22%	56	74%
90	3	4%	16	21%	4	5%	33	43%	20	26%
91	2	3%	7	9%	3	4%	36	47%	28	37%
92	15	20%	38	50%	3	4%	15	20%	5	7%

TABLE IV (Continued)

Question Number	Not Important		Slightly Important		Undecided		Important		Very Important	
93	0	0%	8	11%	5	7%	27	36%	36	47%
94	7	9%	17	22%	3	4%	33	43%	16	21%
95	2	3%	7	9%	3	4%	39	51%	25	33%
96	9	12%	21	28%	4	5%	29	38%	13	17%
97	7	9%	19	25%	3	4%	33	43%	14	18%
98	0	0%	1	1%	3	4%	15	20%	57	75%
99	0	0%	2	3%	3	4%	18	24%	53	70%
100	49	64%	17	22%	4	5%	6	8%	0	0%
101	50	66%	17	22%	3	4%	6	8%	0	0%
102	22	29%	28	37%	5	7%	13	17%	8	11%
103	1	1%	9	12%	3	4%	29	38%	34	45%

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to analyze the competencies needed by professional Computer Science personnel as perceived by business and industry representatives in Arkansas. This study was also intended to provide information for the colleges and universities in Arkansas to compare their Computer Science curricula with the competencies needed as perceived by the representatives of business and industry of Arkansas. A questionnaire was used to solicit responses from the business and industry representatives in Arkansas. Descriptive statistics was used to analyze the responses.

This study obtained information to answer the following questions:

1. Was there a distinct rating of the competencies needed by professional Computer Science personnel as perceived by the representatives of business and industry?

2. Was there a distinct rating of the competencies needed by professional Computer Science personnel as perceived by the representatives of business and industry in each category?

3. Did the rating of the competencies differ among each category?

4. Did the rating of the competencies differ from the rating of the competencies between each category?

Questionnaires were mailed to the selected business and industry representatives in Arkansas. The responses were tabulated according to the rating of not important, slightly important, undecided, important or very important. The mean, median, range and standard deviation were then calculated for each category. From these statistics, overall conclusions were drawn.

The findings indicated that the competencies which fell into the very important range, 1.51 to 2.00, were as follows in rank order:

89. Apply logic.

98. Understand the importance of protecting data files and information with integrity and confidentiality.

99. Understand the importance of systems access security.

79. Produce clear and concise documentation.

The competencies which fell into the important range, 0.51 to 1.50, were as follows in rank order:

83. Debug programs.

3. Understand information systems.

16. Understand systems analysis concepts.

86. Define input and output specifications.

84. Carry out program maintenance.

85. Build in program flexibility.

14. Understand data base systems components and functions.

17. Apply basic system analysis techniques.

80. Write program specifications.

88. Design files.

78. Create test data.

12. Understand Data Communications applications.

47. Perform recovery procedures after system failure.

93. Liaise with users.

76. Write subroutines.

103. Design screen formats.

20. Understand mainframe computer applications.

11. Understand internal and external storage concepts.

91. Define alternative solutions.

68. Write multi-file routines.

77. Use structured programming techniques.

29. COBOL programming.

95. Use utility software.

71. Implement computer systems.

75. Write random access routines.

59. Read operating instructions.

74. Write table handling routines.

81. Write system operating instructions.

22. Understand disk operating systems.

72. Perform system follow up.

70. Write users manual.

73. Define relationships between various application systems.

15. Manage data base systems.

9. Solve problems using flow charting symbols and concepts.

46. Perform back up operations.

51. Perform operating system start-up routines.

4. Understand similarities and differences between types of Data Processing systems.

60. Follow and practice safety procedures.

2. Describe Data Processing career paths, duties and responsibilities.

62. Maintain prewritten program packages.

52. Perform computer hardware shut-down routines.

23. Understand virtual storage and memory concepts.

65. Make presentations.

10. Solve problems using decision tables.

69. Use top down programming techniques.

18. Understand micro computer applications.

87. Design forms.

90. Work with spooling systems.

13. Design a Data Communications network.

61. Produce cost benefit analysis.

19. Understand mini computer applications.

50. Interpret manufacturers manual.

67. Write index sequential routines.

25. JCL programming.

66. Conduct feasibility studies.

56. Prepare data entry programs.

The competencies which fell into the undecided range, -0.49 to 0.50, were as follows in rank order:

94. Print legibly.

97. Update manuals.

63. Produce production schedules.

28. RPG programming.

96. Perform sysgens.

53. Care for peripheral equipment.

33. Microcomputer programming.

8. Operate data entry equipment.

82. Read memory dumps.

7. Interpret hexadecimal coding system.

57. Operate line printers.

24. Design a computer system.

43. Operate communications equipment.

40. Check and replace faulty data sets.

27. Basic programming.

64. Design and use GANT/PERT/CPM.

48. Maintain environmental control.

44. Operate teleprocessing controllers.

55. Mount disc packs and tapes.

39. Assembler programming.

The competencies which fell into the slightly important range, -1.49 to -0.50, were as follows in rank order:

32. C programming.

21. Understand analog computer systems.

92. Maintain tape libraries.

102. Write pseudocode.

38. UNIX programming.

31. PL/I programming.

26. FORTRAN programming.

30. Pascal programming.

34. SAS programming.

1. Trace the history of Data Processing development.

6. Interpret BCD coding system.

35. ADA programming.

41. Operate plotters.

36. APL programming.

37. ALGOL programming.

42. Operate OCR equipment.

45. Operate cassette handlers.

58. Make carriage control tapes for printers.

100. Operate decollator.

5. Interpret punch card code.

101. Operate burster.

The competencies which fell into the <u>not important</u> range, -2.00 to -1.50, were as follows in rank order:

54. Operate card reader punch equipment.

49. Operate punch paper tape handlers.

The ratings for each category can be found in Table V.

TABLE V

RATING OF THE COMPETENCIES BY CATEGORY

Question Number*	Composite	Banking	Construction	Data Processing	Distri-bution
89	1.70	1.80	1.00	1.57	1.00
98	1.68	1.80	2.00	1.57	1.00
99	1.61	1.80	2.00	1.43	1.00
79	1.53	1.80	2.00	1.29	1.00
83	1.49	1.60	2.00	1.57	1.00
3	1.47	1.80	1.00	1.00	0.50
16	1.45	0.80	2.00	1.57	1.00
86	1.38	1.80	2.00	1.43	1.00
84	1.33	1.60	2.00	1.29	1.00
85	1.33	1.40	1.00	1.43	1.00
14	1.30	1.20	1.00	1.14	1.00
17	1.30	0.80	1.00	1.57	1.00
80	1.30	1.80	2.00	1.00	1.00
88	1.29	1.20	1.00	1.43	1.00
78	1.26	1.80	2.00	1.14	1.00
12	1.22	1.80	1.00	1.43	1.00
47	1.21	1.00	2.00	1.43	1.00
93	1.20	1.00	-1.00	0.71	1.00
76	1.18	1.60	2.00	1.14	1.00
103	1.13	1.20	2.00	0.86	1.00
20	1.12	1.20	1.00	1.29	1.00
11	1.08	1.80	1.00	1.29	1.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Education	Engineering	Federal Government	Financial
89	1.70	1.75	2.00	2.00	2.00
98	1.68	2.00	2.00	1.00	2.00
99	1.61	2.00	2.00	1.00	2.00
79	1.53	2.00	1.50	1.00	2.00
83	1.49	1.50	2.00	2.00	2.00
3	1.47	2.00	1.50	1.00	2.00
16	1.45	2.00	1.50	1.00	2.00
86	1.38	1.50	1.50	1.00	2.00
84	1.33	1.00	2.00	1.00	1.00
85	1.33	1.00	0.50	1.00	2.00
14	1.30	1.75	0.00	1.00	2.00
17	1.30	1.75	1.50	1.00	2.00
80	1.30	1.75	0.00	1.00	2.00
88	1.29	1.50	2.00	1.00	2.00
78	1.26	1.50	0.50	1.00	1.00
12	1.22	0.75	0.50	2.00	2.00
47	1.21	0.50	2.00	1.00	2.00
93	1.20	1.50	-0.50	-1.00	2.00
76	1.18	1.50	2.00	1.00	2.00
103	1.13	1.50	0.50	-1.00	2.00
20	1.12	1.25	2.00	2.00	2.00
11	1.08	1.25	1.00	1.00	-1.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Health Service	Insurance	Local Government	Manufacturing
89	1.70	1.86	1.33	2.00	1.72
98	1.68	1.86	1.33	2.00	1.61
99	1.61	2.00	0.67	1.00	1.56
79	1.53	1.57	1.33	2.00	1.50
83	1.49	1.57	0.00	2.00	1.56
3	1.47	1.71	0.67	1.00	1.56
16	1.45	1.14	0.33	2.00	1.67
86	1.38	1.29	1.00	2.00	1.17
84	1.33	1.57	0.00	2.00	1.22
85	1.33	1.71	0.67	2.00	1.39
14	1.30	1.57	0.33	1.00	1.33
17	1.30	1.14	0.67	2.00	1.33
80	1.30	1.43	0.67	2.00	1.39
88	1.29	1.29	1.00	2.00	0.89
78	1.26	1.43	1.00	1.00	1.11
12	1.22	1.29	0.33	-1.00	1.22
47	1.21	1.71	-0.33	1.00	1.39
93	1.20	1.14	0.67	1.00	1.39
76	1.18	1.71	-0.33	1.00	0.94
103	1.13	1.43	-0.67	2.00	1.11
20	1.12	1.14	-0.33	-2.00	1.39
11	1.08	1.29	-0.33	2.00	1.22

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Miscellaneous	Petroleum	Publishing	Real Estate
89	1.70	2.00	2.00	2.00	1.00
98	1.68	2.00	2.00	2.00	2.00
99	1.61	1.00	2.00	2.00	2.00
79	1.53	2.00	2.00	1.00	2.00
83	1.49	2.00	2.00	1.00	2.00
3	1.47	2.00	2.00	2.00	2.00
16	1.45	2.00	2.00	1.00	2.00
86	1.38	1.00	2.00	2.00	1.00
84	1.33	2.00	2.00	1.00	1.00
85	1.33	1.00	2.00	-1.00	1.00
14	1.30	1.00	2.00	1.00	1.00
17	1.30	1.00	2.00	1.00	1.00
80	1.30	-1.00	2.00	2.00	1.00
88	1.29	1.00	2.00	2.00	2.00
78	1.26	1.00	2.00	2.00	1.00
12	1.22	1.00	1.00	2.00	1.00
47	1.21	2.00	2.00	2.00	-2.00
93	1.20	1.00	2.00	2.00	2.00
76	1.18	1.00	1.00	1.00	1.00
103	1.13	1.00	2.00	2.00	2.00
20	1.12	-1.00	-1.00	1.00	2.00
11	1.08	-1.00	1.00	-1.00	-1.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Service	State Government	Transportation
89	1.70	1.14	2.00	2.00
98	1.68	1.14	2.00	2.00
99	1.61	1.00	2.00	2.00
79	1.53	1.00	2.00	2.00
83	1.49	0.71	2.00	2.00
3	1.47	1.14	2.00	1.00
16	1.45	1.14	2.00	1.50
86	1.38	1.14	2.00	2.00
84	1.33	1.00	1.67	2.00
85	1.33	1.00	2.00	1.50
14	1.30	1.29	2.00	1.00
17	1.30	1.00	2.00	1.50
80	1.30	0.86	2.00	1.50
88	1.29	1.00	2.00	2.00
78	1.26	0.86	1.67	2.00
12	1.22	1.00	2.00	1.50
47	1.21	0.86	2.00	2.00
93	1.20	1.14	2.00	2.00
76	1.18	1.00	2.00	2.00
103	1.13	1.00	1.67	2.00
20	1.12	0.71	1.33	1.00
11	1.08	0.43	1.33	1.50

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Utilities	Wholesale
89	1.70	2.00	2.00
98	1.68	2.00	1.80
99	1.61	2.00	1.80
79	1.53	1.67	1.40
83	1.49	2.00	1.40
3	1.47	2.00	1.40
16	1.45	1.67	1.40
86	1.38	1.67	1.20
84	1.33	2.00	1.40
85	1.33	2.00	1.40
14	1.30	1.67	1.60
17	1.30	1.67	1.20
80	1.30	1.67	1.20
88	1.29	1.67	1.40
78	1.26	1.33	1.40
12	1.22	1.33	1.40
47	1.21	1.00	0.80
93	1.20	1.67	1.20
76	1.18	1.00	0.80
103	1.13	0.33	1.40
20	1.12	1.67	1.40
11	1.08	2.00	1.60

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Banking	Construction	Data Processing	Distri-bution
91	1.07	1.40	-1.00	1.14	1.00
68	1.04	1.20	2.00	0.86	0.50
77	1.04	1.60	2.00	0.86	1.00
29	1.03	1.60	2.00	0.71	0.50
95	1.03	1.00	-1.00	0.71	1.00
71	0.97	0.40	1.00	1.29	1.00
75	0.96	1.40	2.00	0.14	1.00
59	0.95	0.80	2.00	1.14	0.50
74	0.95	1.00	2.00	1.00	1.00
81	0.92	1.60	2.00	0.57	1.00
22	0.91	0.60	1.00	1.14	1.00
72	0.91	0.20	1.00	1.14	1.00
70	0.89	0.20	2.00	0.86	1.00
73	0.89	0.20	1.00	1.29	1.00
15	0.87	1.20	1.00	0.29	0.50
9	0.86	1.20	1.00	0.57	1.00
46	0.86	0.80	2.00	1.00	0.50
51	0.83	0.60	2.00	0.29	1.00
4	0.82	0.80	1.00	1.00	0.50
60	0.82	0.00	1.00	0.43	-0.50
2	0.80	0.80	1.00	1.14	-0.50

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Education	Engineering	Federal Government	Financial
91	1.07	1.75	2.00	1.00	1.00
68	1.04	0.75	2.00	1.00	1.00
77	1.04	1.75	0.00	2.00	-1.00
29	1.03	0.75	0.50	2.00	-2.00
95	1.03	1.50	2.00	1.00	2.00
71	0.97	1.75	1.50	-1.00	1.00
75	0.96	0.75	2.00	1.00	2.00
59	0.95	0.75	2.00	1.00	2.00
74	0.95	1.00	2.00	1.00	2.00
81	0.92	1.25	0.00	1.00	1.00
22	0.91	0.00	0.50	1.00	2.00
72	0.91	1.50	0.50	-1.00	2.00
70	0.89	2.00	0.50	-1.00	2.00
73	0.89	1.00	1.50	-1.00	1.00
15	0.87	0.75	-0.50	1.00	1.00
9	0.86	0.75	0.50	1.00	1.00
46	0.86	0.25	0.00	1.00	1.00
51	0.83	0.75	2.00	2.00	2.00
4	0.82	1.00	1.00	1.00	2.00
60	0.82	0.50	2.00	1.00	2.00
2	0.80	0.75	1.00	1.00	2.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Health Service	Insurance	Local Government	Manufacturing
91	1.07	0.57	-1.33	1.00	1.28
68	1.04	1.43	-0.33	2.00	0.94
77	1.04	1.29	0.00	1.00	0.67
29	1.03	0.86	0.33	2.00	1.28
95	1.03	1.71	0.00	1.00	0.78
71	0.97	0.71	-0.67	1.00	1.06
75	0.96	1.29	-0.33	2.00	0.78
59	0.95	1.43	-0.67	2.00	1.06
74	0.95	1.14	-1.00	2.00	0.78
81	0.92	0.43	1.33	2.00	0.72
22	0.91	1.29	-0.67	1.00	1.28
72	0.91	0.71	-0.67	1.00	1.00
70	0.89	0.14	0.33	1.00	0.72
73	0.89	0.57	0.33	1.00	0.72
15	0.87	1.43	0.33	1.00	1.00
9	0.86	0.71	0.67	1.00	1.28
46	0.86	1.43	-0.33	1.00	1.06
51	0.83	1.29	0.00	2.00	0.89
4	0.82	0.00	-0.33	2.00	1.11
60	0.82	0.71	0.33	2.00	1.00
2	0.80	1.00	0.67	1.00	0.61

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Miscellaneous	Petroleum	Publishing	Real Estate
91	1.07	1.00	2.00	1.00	-1.00
68	1.04	1.00	1.00	1.00	1.00
77	1.04	1.00	2.00	2.00	2.00
29	1.03	1.00	1.00	1.00	2.00
95	1.03	1.00	1.00	-1.00	1.00
71	0.97	1.00	2.00	1.00	1.00
75	0.96	1.00	1.00	1.00	1.00
59	0.95	-1.00	2.00	-1.00	2.00
74	0.95	1.00	1.00	1.00	1.00
81	0.92	-1.00	-1.00	2.00	2.00
22	0.91	-1.00	1.00	-1.00	-1.00
72	0.91	-1.00	2.00	1.00	2.00
70	0.89	1.00	2.00	1.00	2.00
73	0.89	1.00	2.00	2.00	1.00
15	0.87	1.00	2.00	1.00	-1.00
9	0.86	1.00	2.00	-1.00	2.00
46	0.86	2.00	2.00	2.00	-2.00
51	0.83	1.00	1.00	-1.00	1.00
4	0.82	-1.00	2.00	1.00	1.00
60	0.82	-1.00	2.00	-1.00	1.00
2	0.80	1.00	2.00	-1.00	1.00

*See pages 21-25

TABLE V (Contined)

Question Number*	Composite	Service	State Government	Transportation
91	1.07	0.86	1.33	1.50
68	1.04	1.00	1.33	2.00
77	1.04	1.00	1.00	1.50
29	1.03	0.43	1.33	1.50
95	1.03	0.86	1.67	2.00
71	0.97	0.57	1.67	2.00
75	0.96	1.00	1.67	2.00
59	0.95	0.71	0.33	1.50
74	0.95	0.71	1.67	1.50
81	0.92	0.86	2.00	2.00
22	0.91	1.00	1.00	2.00
72	0.91	0.57	2.00	1.50
70	0.89	1.00	2.00	1.50
73	0.89	1.00	1.67	2.00
15	0.87	1.00	1.67	0.00
9	0.86	-0.29	0.67	1.50
46	0.86	0.29	2.00	2.00
51	0.83	0.86	0.67	2.00
4	0.82	0.29	1.00	1.00
60	0.82	0.86	1.33	1.50
2	0.80	0.71	1.33	0.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Utilities	Wholesale
91	1.07	1.67	1.40
68	1.04	1.00	1.00
77	1.04	1.67	1.20
29	1.03	1.67	1.20
95	1.03	1.33	1.20
71	0.97	1.67	0.80
75	0.96	1.00	0.80
59	0.95	0.00	1.40
74	0.95	1.00	0.80
81	0.92	0.67	1.20
22	0.91	1.00	1.00
72	0.91	1.67	1.00
70	0.89	1.67	0.80
73	0.89	1.33	0.60
15	0.87	1.67	0.40
9	0.86	1.00	1.00
46	0.86	0.33	0.40
51	0.83	-0.33	0.60
4	0.82	2.00	0.60
60	0.82	1.33	1.00
2	0.80	0.67	1.20

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Banking	Construction	Data Processing	Distri-bution
62	0.80	1.00	1.00	0.43	0.50
52	0.79	0.60	2.00	0.29	1.00
23	0.76	1.00	1.00	1.14	1.00
65	0.76	0.80	2.00	0.57	1.00
10	0.75	1.00	-1.00	0.71	1.00
69	0.75	1.00	1.00	0.86	-0.50
18	0.72	1.00	1.00	0.71	1.00
87	0.68	0.80	1.00	1.14	0.50
90	0.67	1.00	1.00	1.29	0.50
13	0.64	1.60	1.00	0.57	0.50
61	0.64	0.20	2.00	0.14	1.00
19	0.61	0.40	-1.00	0.86	1.00
50	0.59	1.40	1.00	0.71	1.00
67	0.58	0.80	2.00	-0.14	0.50
25	0.53	0.80	1.00	0.57	1.00
66	0.53	0.00	-1.00	0.29	1.00
56	0.51	1.20	2.00	0.43	0.50
94	0.45	0.60	2.00	0.71	-0.50
97	0.37	-0.20	2.00	0.14	-0.50
63	0.33	-1.20	1.00	0.86	-0.50
28	0.32	-0.20	2.00	0.57	0.50

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Education	Engineering	Federal Government	Financial
62	0.80	1.00	0.00	1.00	2.00
52	0.79	0.75	1.50	2.00	2.00
23	0.76	0.75	2.00	1.00	-1.00
65	0.76	1.50	0.00	-1.00	2.00
10	0.75	1.25	0.00	1.00	2.00
69	0.75	1.50	0.50	1.00	2.00
18	0.72	0.75	0.50	1.00	-1.00
87	0.68	1.50	0.50	1.00	1.00
90	0.67	0.75	2.00	1.00	1.00
13	0.64	0.75	-0.50	2.00	2.00
61	0.64	1.50	0.50	-1.00	2.00
19	0.61	0.75	1.50	1.00	-1.00
50	0.59	-0.25	-0.50	-1.00	-1.00
67	0.58	-0.50	0.50	1.00	2.00
25	0.53	0.50	1.50	1.00	1.00
66	0.53	1.50	0.00	-2.00	2.00
56	0.51	-0.50	2.00	-1.00	2.00
94	0.45	-0.50	0.50	1.00	-1.00
97	0.37	0.00	-1.50	1.00	0.00
63	0.33	0.25	0.50	1.00	1.00
28	0.32	-1.00	0.00	-1.00	2.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Health Service	Insurance	Local Government	Manufacturing
62	0.80	1.14	-0.33	1.00	0.89
52	0.79	1.29	-0.33	2.00	0.89
23	0.76	1.14	-1.33	-1.00	0.83
65	0.76	0.14	0.67	1.00	0.78
10	0.75	0.57	0.00	1.00	1.00
69	0.75	-0.29	-1.33	1.00	0.83
18	0.72	0.29	-0.33	1.00	1.06
87	0.68	0.29	0.33	2.00	-0.06
90	0.67	1.29	-1.33	-1.00	0.56
13	0.64	1.00	-0.33	-1.00	0.61
61	0.64	0.71	-0.33	-1.00	0.72
19	0.61	0.29	-1.00	1.00	0.89
50	0.59	1.14	-0.67	2.00	0.72
67	0.58	1.00	-1.33	2.00	0.78
25	0.53	0.86	0.33	1.00	0.39
66	0.53	0.29	-0.33	-1.00	0.50
56	0.51	0.43	-0.67	2.00	0.56
94	0.45	0.14	-0.67	1.00	0.56
97	0.37	0.14	-0.67	1.00	0.28
63	0.33	0.00	0.00	-1.00	0.56
28	0.32	0.86	-0.33	1.00	0.72

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Miscellaneous	Petroleum	Publishing	Real Estate
62	0.80	-1.00	2.00	-1.00	-1.00
52	0.79	1.00	1.00	-1.00	1.00
23	0.76	-1.00	2.00	-1.00	1.00
65	0.76	-1.00	2.00	1.00	1.00
10	0.75	-1.00	1.00	-1.00	1.00
69	0.75	1.00	2.00	2.00	1.00
18	0.72	-1.00	1.00	1.00	-1.00
87	0.68	-1.00	2.00	2.00	-1.00
90	0.67	-1.00	1.00	1.00	-1.00
13	0.64	-1.00	1.00	1.00	-1.00
61	0.64	-1.00	2.00	-1.00	-1.00
19	0.61	-1.00	1.00	1.00	2.00
50	0.59	1.00	2.00	-1.00	-1.00
67	0.58	1.00	1.00	1.00	-1.00
25	0.53	1.00	-2.00	-1.00	1.00
66	0.53	-1.00	2.00	-1.00	1.00
56	0.51	1.00	2.00	-2.00	2.00
94	0.45	-1.00	1.00	-1.00	1.00
97	0.37	1.00	1.00	-2.00	2.00
63	0.33	-1.00	2.00	1.00	-1.00
28	0.32	-1.00	2.00	1.00	2.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Service	State Government	Transportation
62	0.80	0.43	1.33	1.50
52	0.79	0.86	0.67	2.00
23	0.76	0.71	2.00	0.00
65	0.76	0.57	1.67	2.00
10	0.75	0.14	1.33	1.00
69	0.75	0.71	1.00	1.50
18	0.72	0.71	1.33	1.00
87	0.68	0.86	1.67	2.00
90	0.67	0.43	-0.33	1.50
13	0.64	0.29	0.67	1.00
61	0.64	0.43	2.00	1.00
19	0.61	0.43	1.33	0.00
50	0.59	0.14	0.67	1.50
67	0.58	0.57	1.33	1.50
25	0.53	-0.29	-0.33	1.50
66	0.53	0.29	2.00	2.00
56	0.51	0.43	-0.67	1.50
94	0.45	1.00	1.33	1.50
97	0.37	0.86	2.00	0.50
63	0.33	0.00	1.67	1.00
28	0.32	-0.43	-1.67	2.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Utilities	Wholesale
62	0.80	1.33	1.40
52	0.79	-0.33	0.40
23	0.76	0.33	0.80
65	0.76	-0.33	1.20
10	0.75	1.33	0.80
69	0.75	1.00	1.00
18	0.72	0.67	0.80
87	0.68	1.33	0.80
90	0.67	0.67	1.00
13	0.64	1.33	0.60
61	0.64	0.67	1.40
19	0.61	0.33	0.80
50	0.59	-0.33	1.40
67	0.58	0.00	0.80
25	0.53	0.67	1.20
66	0.53	1.33	1.00
56	0.51	0.67	0.40
94	0.45	0.33	0.00
97	0.37	0.00	0.80
63	0.33	1.00	1.40
28	0.32	0.67	0.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Banking	Construction	Data Processing	Distri-bution
96	0.21	0.00	-1.00	-0.14	-0.50
53	0.13	0.00	2.00	-0.14	0.50
33	0.07	-0.60	1.00	0.00	-0.50
8	0.05	1.00	1.00	-0.71	-1.00
82	0.04	1.40	1.00	0.57	-0.50
7	0.03	1.00	-1.00	0.43	0.50
57	-0.04	0.00	1.00	0.00	0.50
24	-0.11	-1.00	1.00	-0.57	-0.50
43	-0.13	0.40	2.00	0.71	1.00
40	-0.21	-0.40	1.00	-0.43	0.50
27	-0.26	1.00	-1.00	-0.57	-0.50
64	-0.26	-0.20	1.00	-0.57	-0.50
48	-0.32	0.00	1.00	-0.43	-0.50
44	-0.41	0.00	1.00	0.57	1.00
55	-0.41	-1.40	1.00	-0.43	0.50
39	-0.43	0.40	2.00	0.29	-0.50
32	-0.53	-0.40	-1.00	-0.43	-0.50
21	-0.55	-0.20	1.00	-1.14	-0.50
92	-0.57	-1.20	2.00	0.00	-0.50
102	-0.57	-0.60	-1.00	-1.00	-1.00
38	-0.61	-1.00	-1.00	-0.86	-0.50

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Education	Engineering	Federal Government	Financial
96	0.21	0.50	-1.00	1.00	2.00
53	0.13	0.00	0.50	-1.00	1.00
33	0.07	0.25	0.00	1.00	-1.00
8	0.05	-0.50	-0.50	-1.00	2.00
82	0.04	0.00	-0.50	1.00	-2.00
7	0.03	0.00	0.50	-1.00	1.00
57	-0.04	-1.00	1.00	1.00	-1.00
24	-0.11	0.50	-0.50	1.00	-1.00
43	-0.13	-1.00	-1.50	1.00	2.00
40	-0.21	-0.25	-1.50	-1.00	1.00
27	-0.26	0.00	-1.50	-1.00	-2.00
64	-0.26	0.75	-0.50	-1.00	-2.00
48	-0.32	-1.00	0.00	-1.00	-1.00
44	-0.41	-1.00	-2.00	1.00	-1.00
55	-0.41	-1.00	-0.50	1.00	-1.00
39	-0.43	0.50	-1.00	-1.00	0.00
32	-0.53	0.00	0.00	-1.00	-2.00
21	-0.55	-0.75	-2.00	1.00	1.00
92	-0.57	-1.00	-1.50	-1.00	-1.00
102	-0.57	-0.50	-2.00	-2.00	-2.00
38	-0.61	0.00	0.00	-1.00	-1.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Health Service	Insurance	Local Government	Manufacturing
96	0.21	1.14	-1.67	-1.00	0.06
53	0.13	0.43	-1.33	2.00	0.33
33	0.07	-0.14	-1.00	1.00	0.44
8	0.05	-0.29	0.67	1.00	0.22
82	0.04	0.71	-1.00	-1.00	-0.22
7	0.03	-0.43	-0.33	-1.00	0.06
57	-0.04	0.00	-0.67	2.00	0.06
24	-0.11	0.14	-1.33	-1.00	0.00
43	-0.13	0.00	-1.00	-2.00	-0.28
40	-0.21	0.00	-1.33	2.00	-0.33
27	-0.26	-0.14	-1.00	-1.00	0.00
64	-0.26	-0.14	-1.00	-2.00	-0.50
48	-0.32	-0.29	-1.33	1.00	-0.28
44	-0.41	-0.43	-1.67	-2.00	-0.50
55	-0.41	0.00	-1.67	-1.00	-0.11
39	-0.43	-1.14	-0.67	-2.00	-0.56
32	-0.53	-0.29	-1.67	-2.00	-0.28
21	-0.55	-0.71	-2.00	-2.00	0.06
92	-0.57	-0.43	-1.67	-1.00	-0.61
102	-0.57	-0.29	-2.00	-1.00	-0.56
38	-0.61	0.29	-1.33	-2.00	-0.67

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Miscellaneous	Petroleum	Publishing	Real Estate
96	0.21	1.00	1.00	-1.00	-2.00
53	0.13	-1.00	-1.00	-1.00	-2.00
33	0.07	-1.00	1.00	-2.00	-2.00
8	0.05	-1.00	-1.00	-1.00	2.00
82	0.04	1.00	-2.00	-2.00	-2.00
7	0.03	1.00	-1.00	1.00	1.00
57	-0.04	-1.00	-1.00	-2.00	1.00
24	-0.11	1.00	2.00	-1.00	-2.00
43	-0.13	-1.00	-2.00	-1.00	1.00
40	-0.21	-1.00	-1.00	-1.00	-2.00
27	-0.26	-2.00	-1.00	-1.00	-2.00
64	-0.26	-2.00	2.00	-1.00	-2.00
48	-0.32	-1.00	1.00	-1.00	-2.00
44	-0.41	-1.00	-2.00	-1.00	1.00
55	-0.41	1.00	1.00	-2.00	-1.00
39	-0.43	-1.00	-2.00	-2.00	-2.00
32	-0.53	-1.00	-2.00	-2.00	-2.00
21	-0.55	-2.00	-1.00	1.00	-2.00
92	-0.57	-1.00	-1.00	-1.00	-1.00
102	-0.57	2.00	1.00	-2.00	1.00
38	-0.61	-2.00	-1.00	-1.00	-2.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Service	State Government	Transportation
96	0.21	0.43	1.00	2.00
53	0.13	0.43	0.67	1.50
33	0.07	0.57	1.00	0.00
8	0.05	-0.14	-1.00	2.00
82	0.04	0.29	-0.33	0.00
7	0.03	-0.14	-1.67	0.50
57	-0.04	0.14	-1.33	2.00
24	-0.11	-0.14	0.00	0.00
43	-0.13	-0.14	-1.00	0.00
40	-0.21	0.00	0.67	1.00
27	-0.26	0.29	-0.33	0.50
64	-0.26	-0.71	0.67	1.50
48	-0.32	0.00	0.67	0.50
44	-0.41	-0.29	-1.00	-0.50
55	-0.41	-0.14	-0.67	0.00
39	-0.43	-0.29	-0.67	-0.50
32	-0.53	-0.57	0.00	-0.50
21	-0.55	-0.71	-0.33	-0.50
92	-0.57	-0.71	0.00	1.00
102	-0.57	-0.14	-0.33	-1.00
38	-0.61	-0.29	0.33	-1.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Utilities	Wholesale
96	0.21	0.33	0.00
53	0.13	-0.67	-0.20
33	0.07	0.67	-0.60
8	0.05	0.33	0.40
82	0.04	-0.33	0.20
7	0.03	-0.33	0.20
57	-0.04	-0.33	-0.20
24	-0.11	0.33	0.80
43	-0.13	-0.67	0.40
40	-0.21	0.33	-0.20
27	-0.26	-0.67	-0.40
64	-0.26	0.67	0.60
48	-0.32	-0.67	-0.60
44	-0.41	-1.33	0.20
55	-0.41	-1.67	-0.20
39	-0.43	-0.67	-0.20
32	-0.53	-1.00	-0.40
21	-0.55	-1.67	0.00
92	-0.57	0.00	-0.40
102	-0.57	0.67	-0.20
38	-0.61	-1.00	-0.60

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Banking	Construction	Data Processing	Distri-bution
31	-0.63	-0.20	1.00	-0.43	-0.50
26	-0.64	-0.80	-1.00	-1.00	-0.50
30	-0.68	-1.00	-1.00	-1.29	0.50
34	-0.82	-1.00	1.00	-0.86	-1.00
1	-0.87	-1.00	-1.00	-0.29	-0.50
6	-0.93	-1.00	-1.00	-1.00	-0.50
35	-0.96	-1.00	1.00	-1.14	-1.00
41	-0.96	-1.20	-1.00	-0.86	-0.50
36	-0.99	-0.80	1.00	-1.29	-1.00
37	-1.07	-1.00	-1.00	-1.29	-1.00
42	-1.24	-1.40	-1.00	-1.14	-1.00
45	-1.24	-0.60	-1.00	-0.57	-1.00
58	-1.25	-1.60	1.00	-1.71	-1.00
100	-1.43	-1.20	-1.00	-1.43	-1.00
5	-1.46	-1.60	-1.00	-1.00	-1.00
101	-1.46	-1.60	-1.00	-1.43	-1.00
54	-1.54	-1.40	-1.00	-1.57	-1.00
49	-1.58	-1.80	-1.00	-1.43	-1.00

*See pages 21-25

TABLE V (Continued)

Question Number	Composite	Education	Engineering	Federal Government	Financial
31	-0.63	-0.75	0.00	-1.00	-2.00
26	-0.64	0.25	-2.00	2.00	-2.00
30	-0.68	0.25	-1.00	1.00	-2.00
34	-0.82	0.25	-2.00	-1.00	-1.00
1	-0.87	0.00	0.50	-1.00	0.00
6	-0.93	-1.25	-1.50	-1.00	1.00
35	-0.96	0.00	-2.00	-1.00	-1.00
41	-0.96	-0.50	-2.00	-1.00	1.00
36	-0.99	-0.75	-1.50	-1.00	-1.00
37	-1.07	-0.75	-1.50	-1.00	-1.00
42	-1.24	-1.75	-2.00	-1.00	-1.00
45	-1.24	-1.75	-1.50	-1.00	-1.00
58	-1.25	-1.75	-2.00	1.00	-2.00
100	-1.43	-1.75	-1.50	-2.00	-2.00
5	-1.46	-1.00	-1.50	-2.00	-2.00
101	-1.46	-1.75	-1.50	-2.00	-2.00
54	-1.54	-1.75	-1.50	-2.00	-2.00
49	-1.58	-1.75	-2.00	-2.00	-1.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Health Service	Insurance	Local Government	Manufacturing
31	-0.63	-0.57	-1.67	-2.00	-0.67
26	-0.64	-0.43	-1.33	-2.00	-0.61
30	-0.68	-0.29	-1.67	-2.00	-0.39
34	-0.82	-0.57	-1.33	-2.00	-0.89
1	-0.87	-1.43	-1.00	-1.00	-1.11
6	-0.93	-1.29	-0.67	-1.00	-1.00
35	-0.96	-0.71	-1.33	-2.00	-0.83
41	-0.96	-0.71	-1.67	-2.00	-1.22
36	-0.99	-0.71	-1.33	-2.00	-0.89
37	-1.07	-0.71	-1.33	-2.00	-0.89
42	-1.24	-1.00	-1.67	-2.00	-1.39
45	-1.24	-1.29	-1.67	-2.00	-1.44
58	-1.25	-1.00	-1.67	-2.00	-1.00
100	-1.43	-1.86	-1.67	1.00	-1.56
5	-1.46	-2.00	-1.67	-2.00	-1.50
101	-1.46	-1.86	-1.67	1.00	-1.56
54	-1.54	-2.00	-2.00	-2.00	-1.56
49	-1.58	-1.43	-2.00	-2.00	-1.56

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Miscellaneous	Petroleum	Publishing	Real Estate
31	-0.63	-1.00	-1.00	-2.00	-2.00
26	-0.64	-1.00	-1.00	-2.00	-2.00
30	-0.68	-2.00	-1.00	-2.00	-2.00
34	-0.82	-2.00	-1.00	-2.00	-2.00
1	-0.87	-2.00	2.00	-2.00	-1.00
6	-0.93	-2.00	-1.00	-1.00	1.00
35	-0.96	-2.00	-1.00	-2.00	-2.00
41	-0.96	-2.00	-1.00	-2.00	-2.00
36	-0.99	-2.00	-1.00	-2.00	-2.00
37	-1.07	-2.00	-1.00	-2.00	-2.00
42	-1.24	-1.00	-2.00	-2.00	-2.00
45	-1.24	-2.00	-2.00	-2.00	-2.00
58	-1.25	-2.00	-2.00	-2.00	-2.00
100	-1.43	-2.00	-1.00	-2.00	-2.00
5	-1.46	-2.00	-1.00	-2.00	-2.00
101	-1.46	-2.00	-1.00	-2.00	-2.00
54	-1.54	-1.00	-1.00	-2.00	-2.00
49	-1.58	-2.00	-2.00	-2.00	-2.00

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Service	State Government	Transportation
31	-0.63	-0.57	-0.67	-0.50
26	-0.64	-0.43	0.67	-1.00
30	-0.68	0.00	-1.67	-0.50
34	-0.82	-0.71	-0.34	-1.00
1	-0.87	-1.00	-1.00	-1.50
6	-0.93	-1.14	-1.33	0.00
35	-0.96	-0.71	-1.67	-1.00
41	-0.96	-0.43	-1.33	-0.50
36	-0.99	-0.71	-1.33	-1.00
37	-1.07	-1.00	-1.67	-1.00
42	-1.24	-0.86	-1.33	-0.50
45	-1.24	-1.00	-2.00	-0.50
58	-1.25	-1.14	-2.00	-0.50
100	-1.43	-1.14	-2.00	0.00
5	-1.46	-1.57	-1.67	0.00
101	-1.46	-1.14	-2.00	0.00
54	-1.54	-1.29	-2.67	-0.50
49	-1.58	-1.43	-2.00	-1.50

*See pages 21-25

TABLE V (Continued)

Question Number*	Composite	Utilities	Wholesale
31	-0.63	0.00	-0.40
26	-0.64	-0.67	-0.40
30	-0.68	-1.00	-0.80
34	-0.82	-0.33	-0.40
1	-0.87	-1.33	-0.40
6	-0.93	-0.67	-0.40
35	-0.96	-1.67	-0.60
41	-0.96	-0.67	-0.40
36	-0.99	-1.67	-0.60
37	-1.07	-1.33	-0.80
42	-1.24	-0.67	-0.80
45	-1.24	-1.67	-0.60
58	-1.25	-1.33	-1.00
100	-1.43	-0.67	-1.60
5	-1.46	-1.00	-1.40
101	-1.46	-0.67	-1.60
54	-1.54	-1.67	-1.20
49	-1.58	-1.67	-1.20

*See pages 21-25

Conclusions

The review of literature indicated that written and oral communication skills were important. The business and industry representatives surveyed in this study agreed that these skills were important. All the competencies that related to communication were rated as very important or important.

Another area that was considered very important in the review of literature was the study of algorithms. Since logic and algorithms are closely related, the business and industry representatives supported this by rating "Apply logic." as the most important competency.

The study revealed information which should be beneficial to the colleges and universities in Arkansas as they review their curriculum. This information included:

1. there was a distinct rating of competencies needed by professional Computer Science personnel as perceived by the representatives of business and industry. This was supported by the range which spanned 82 percent of the possible range. More importantly, sixty-three percent of the ratings fell within one standard deviation of the mean, and ninety-five percent fell within two standard deviations of the mean.

2. there was a distinct rating of competencies needed by professional Computer Science personnel as perceived by the representatives of business and industry in the categories of Banking, Data Processing, Distribution,

Education, Financial, Insurance, Manufacturing, Miscellaneous, Petroleum and Service. This was supported by the findings that approximately sixty-eight percent of the ratings fell within one standard deviation of the mean, and approximately ninety-five percent of the ratings fell within two standard deviations of the mean. Descriptive statistics are recorded in Table VI.

3. the ratings of the competencies among the categories did not appear to differ. Upon inspection of each category depicted in Table V the same competencies frequently had the same level of importance in each category.

4. the ratings of the competencies in the composite group did not appear to differ with the ratings in each category.

Recommendations

Since the business and industry representatives appeared to be in general agreement as to the level of importance of each competency, the following are recommended. Colleges and universities in Arkansas should include both written and oral communication skills in their curricula. Also, the study of algorithms or logic should be included. Consideration should be given to including database management and applications to various sizes of computers in their curricula since these were usually rated as very important or important. This study should be made available to the colleges and universities in Arkansas so that they can compare their

TABLE VI

DESCRIPTIVE STATISTICS

Category	Range	Median		Mean	Standard Deviation
		Question Number	Rating		
Banking	3.60	67	0.80	0.42	1.03
Construction	3.00	25	1.00	0.86	1.12
Data Processing	3.29	28	0.57	0.34	0.91
Distribution	2.00	28	0.50	0.30	0.77
Education	3.75	75	0.75	0.44	1.06
Engineering	4.00	103	0.50	0.20	1.33
Federal Government	4.00	84	1.00	0.28	1.20
Financial	4.00	41	1.00	0.58	1.54
Health Service	4.00	73	0.57	0.43	0.98
Insurance	3.33	22	-0.67	-0.52	0.90
Local Government	4.00	73	1.00	0.31	1.55
Manufacturing	3.28	73	0.72	0.39	0.91
Miscellaneous	4.00	13	-1.00	-0.16	1.34
Petroleum	4.00	22	1.00	0.67	1.48
Publishing	4.00	11	-1.00	-0.18	1.51
Real Estate	4.00	86	1.00	0.00	1.60
Service	2.86	29	0.43	0.27	0.74
State Government	4.00	22	1.00	0.61	1.34
Transportation	3.50	90	1.50	0.92	1.06
Utilities	3.67	64	0.67	0.46	1.12
Wholesale	3.60	75	0.80	0.51	0.86
Composite	3.28	90	0.67	0.36	0.88

curriculum to the level of importance given to each competency. This study should also be available to colleges and universities that are interested in designing and implementing a new Computer Science program.

Similar studies should be conducted in every state as well as on the national level. The studies that should be conducted in each state should compare competencies needed by professional Computer Science personnel as perceived by business and industry representatives in that state with Computer Science curricula from colleges and universities also in that particular state. A nation wide study should be conducted to determine the compentencies needed by professional Computer Science personnel who plan to accept employment immediately upon graduation outside the state in which they were trained and also for those who may be transferred outside the state in which they are presently employed. Similar studies should be conducted in other areas of academics to help bridge the gap between industry and education.

BIBLIOGRAPHY

Beidler, John, Richard H. Austing, Lillian N. Cassell. "Computing Programs in Small Colleges." Communications of the ACM, 28, 6 (June, 1985), 605-611.

Booth, Taylor L. "Computer Education." Computer, Vol. 17 (Oct., 1984), pp. 57-68.

Carr, Kenneth L. "The Academic Industrial Interface - It's Time for Improvement." Microwave Journal, Vol. 28 (March, 1985), pp. 32-36.

Cerych, Ladislav. "Computer Education: The Problem of Policy Implementation." Education and Computing, Vol 1 (1985), pp. 5-10.

Computer Directories, Inc. Computer Directories, Inc., Houston, Texas, 1986.

Galvin, E. Patrick. "Industry and University: Paths That Must Converge." European Journal of Engineering Education, 10, 2 (1985), pp. 119-125.

Hartog, Curt. "Of Commerce and Academe." DATAMATION, Vol 31 (Sept., 1985), pp. 68-78.

Howard, Alan. Instructional Computing in the Community Colleges of Washington State. Olympia: Washington State Board for Community College Education, 1978.

Michel, Jean. "Higher Education and Industry: Towards a New Partnership for Improving Engineering Education." European Journal of Engineering Education, 10, 2 (1985), pp. 149-154.

Oklahoma State Department of Vocational and Technical Education, Stillwater, Oklahoma.

Suraweera, Francis. "A Framework for University-Industry Interaction in Computing in Developing Countries." Computers and Education, 9, 2 (1985), pp. 135-139.

Virginia State Council of Higher Education. An Assessment of Computer Science Degree Programs in Virginia. A Report to the Council of Higher Education and Virginia's State-Supported Institutions of Higher Education.

Richmond, Virginia, 1983.

Zemke, Ron and Thomas Kramlinger. Figuring Things Out: A Trainer's Guide to Needs and Task Analysis. Third Printing. Massachusetts: Addison-Wesley Publishing Company, Inc., 1985.

APPENDIX A

BUSINESS AND INDUSTRY QUESTIONNAIRE

BUSINESS AND INDUSTRY REPRESENTATIVE QUESTIONNAIRE

The purpose of this questionnaire is to analyze the competencies needed as perceived by representatives of business and industry in Arkansas. The information obtained from the questionnaire will be for the colleges and universities in Arkansas to update their computer science curriculum if necessary.

PART I

Please indicate the level of importance of the competencies below as you perceive them being needed by four-year computer science graduates. Space is provided at the end of the questionniare for you to name other competencies which you feel are needed by computer science graduates.

Please indicate by circling:
1-Very Important
2-Important
3-Slightly Important
4-Not Important

1	2	3	4	Trace the history of Data Processing development.
1	2	3	4	Describe Data Processing career paths, duties and responsibilities.
1	2	3	4	Understand information systems.
1	2	3	4	Understand similarities and differences between types of Data Processing systems.
1	2	3	4	Interpret punch card code.
1	2	3	4	Interpret BCD coding system.
1	2	3	4	Interpret hexadecimal coding system.
1	2	3	4	Operate data entry equipment.
1	2	3	4	Solve problems using flow charting symbols and concepts.
1	2	3	4	Solve problems using decision tables.
1	2	3	4	Understand internal and external storage concepts.
1	2	3	4	Understand Data Communications applications.
1	2	3	4	Design a Data Communications network.

1-Very Important
2-Important
3-Slighlty Important
4-Not Important

1	2	3	4	Understand data base system components and functions.
1	2	3	4	Manage data base systems.
1	2	3	4	Understand systems analysis concepts.
1	2	3	4	Apply basic system analysis techniques.
1	2	3	4	Understand micro computer applications.
1	2	3	4	Understand mini computer applications.
1	2	3	4	Understand mainframe computer applications.
1	2	3	4	Understand analog computer systems.
1	2	3	4	Understand disk operating systems.
1	2	3	4	Understand virtual storage and memory concepts.
1	2	3	4	Design a computer system.
1	2	3	4	JCL programming.
1	2	3	4	FORTRAN Programming.
1	2	3	4	Basic Programming.
1	2	3	4	RPG Programming.
1	2	3	4	COBOL Programming.
1	2	3	4	Pascal Programming.
1	2	3	4	PL/I Programming.
1	2	3	4	C Programming.
1	2	3	4	Microcomputer Programming.
1	2	3	4	SAS Programming.
1	2	3	4	ADA Programming.
1	2	3	4	APL Programming.
1	2	3	4	ALGOL Programming.
1	2	3	4	UNIX Programming.
1	2	3	4	Assembler programming.

1-Very Important
2-Important
3-Slightly Important
4-Not Important

1	2	3	4	Check and replace faulty data sets.
1	2	3	4	Operate plotters.
1	2	3	4	Operate OCR equipment.
1	2	3	4	Operate communications equipment.
1	2	3	4	Operate teleprocessing controllers.
1	2	3	4	Operate cassette handlers.
1	2	3	4	Perform back up operations.
1	2	3	4	Perform recovery procedures after system failure.
1	2	3	4	Maintain environmental controls.
1	2	3	4	Operate punch paper tape handlers.
1	2	3	4	Interpret manufacturers manual.
1	2	3	4	Perform operating system start-up routines.
1	2	3	4	Perform computer hardware shut-down routines.
1	2	3	4	Care for peripheral equipment.
1	2	3	4	Operate card reader punch equipment.
1	2	3	4	Mount disc packs and tapes.
1	2	3	4	Prepare data entry programs.
1	2	3	4	Operate line printers.
1	2	3	4	Make carriage control tapes for printers.
1	2	3	4	Read operating instructions.
1	2	3	4	Follow and practice safety procedures.
1	2	3	4	Produce cost benefit analysis.
1	2	3	4	Maintain prewritten program packages.
1	2	3	4	Produce production schedules.
1	2	3	4	Design and use GANT/PERT/CPM.
1	2	3	4	Make presentations.

1-Very Important
2-Important
3-Slightly Important
4-Not Important

1	2	3	4	Conduct feasibility studies.
1	2	3	4	Write index sequential routines.
1	2	3	4	Write multi-file routines.
1	2	3	4	Use top down programming techniques.
1	2	3	4	Write users manuals.
1	2	3	4	Implement computer systems.
1	2	3	4	Perform system follow up.
1	2	3	4	Define relationships between various application systems.
1	2	3	4	Write table handling routines.
1	2	3	4	Write random access routines.
1	2	3	4	Write subroutines.
1	2	3	4	Use structured programming techniques.
1	2	3	4	Create test data.
1	2	3	4	Produce clear and concise documentation.
1	2	3	4	Write program specifications.
1	2	3	4	Write systems operating instructions.
1	2	3	4	Read memory dumps.
1	2	3	4	Debug programs.
1	2	3	4	Carry out program maintenance.
1	2	3	4	Build in program flexibility.
1	2	3	4	Define input and output specifications.
1	2	3	4	Design forms.
1	2	3	4	Design files.
1	2	3	4	Apply logic.
1	2	3	4	Work with spooling systems.
1	2	3	4	Define alternative solutions.

1-Very Important
2-Important
3-Slightly Important
4-Not Important

1	2	3	4	Maintain tape libraries.
1	2	3	4	Liaise with users.
1	2	3	4	Print legibly.
1	2	3	4	Use utility software.
1	2	3	4	Perform sysgens.
1	2	3	4	Update manuals.
1	2	3	4	Understand the importance of protecting data files and information with integrity and confidentiality.
1	2	3	4	Understand the importance of systems access security.
1	2	3	4	Operate decollator.
1	2	3	4	Operate burster.
1	2	3	4	Write pseudocode.
1	2	3	4	Design screen formats.

Thank you for completing Part I, please continue and complete Part II on the reverse side.

PART II: OTHER

If there are other competencies which you feel a computer science graduate should possess, please name and indicate the level of importance in the spaces below. The information you provide will be of great help to computer science education programs.

1-Very Important
2-Important
3-Slightly Important
4-Not Important

1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____
1 2 3 4 _____

Please return the completed questionnaire in the self-addressed stamped envelope to:

Mrs. Amanda Slaten
4100 West 19th #F-109
Stillwater, OK 74074

APPENDIX B

COVER LETTER

October 11, 1986

I am a resident of Arkansas but temporarily living in Oklahoma while conducting a study to determine the competencies needed by four-year computer science graduates as perceived by representatives of business and industry in Arkansas. This information is needed by the colleges and universities in Arkansas to evaluate their computer science curricula.

By taking a few minutes now to complete and return the enclosed questionnaire in the stamped self-addressed envelope, you can help shape computer science education in Arkansas.

Please return the questionnaire by October 23, 1986.

Sincerely,

Mrs. Amanda Slaten
4100 West 19th #F-109
Stillwater, OK 74074
(405) 377-2912

Enc.

APPENDIX C

RESPONSES TO PART II

1 "Communication skills"

1 "Project Management"

1 "Interpersonal skills"

1 "Consulting skills"

1 "Has written commercial programs"

1 "Program in use"

1 "CICS experience"

1 "Common sense"

1 "Reality vs Theory"

1 "Knowledge of hardware and software in marketplace"

1 "Evaluate different hardware and/or software"

1 "Customize off-shelf software"

1 "Maintenance programming techniques"

1 "Higher-order thinking skills"

1 "Written and verbal communication skills"

2 "Demonstrated ability to work with others"

2 "Basic understanding of major applications"

2 "Understanding the relationship of Data Processing to the organization"

1 "Teach ethics"

1 "Math problem solving skills"

1 "Work ethics"

1 "Write and design a whole system that works"

"Knowledge of business politics in the real world"

"How to get the support of top management for projects"

"Interviewing techniques"

1 "Write programs with power failures, utmost, and userfriendliness 2nd in design considerations"

1 "Provide on the job training"

1 "Strive to keep curriculum more current"

1 "Stress applied as opposed to theoretical aspects of computer sciences"

1 "Assist students in making and maintaining professional contacts"

1 "Stress with students the importance of communications and team work"

1 "Stress that people make mistakes and should learn from them; a fundamental axiom in Data Processing is that if you make a mistake and don't admit it--you have made a much bigger mistake"

1 "Project Management"

1 "Laision interviews"

1 "Ability to define problem"

1 "Training in logical thinking"

1 "Concentration skills"

1 "Understanding of on-line real-time systems"

1 "Working knowledge of manufacturing systems concepts"

1 "Read file dumps"

1 "Understand realative file access"

1 "4 semesters of Accounting"

1 "2 semesters of Econ"

1 "Speech"

1 "Managerial Finance"

1	"O.J.T labs at various businesses"
1	"Interpersonal skills"
1	"Effective written and verbal communication skills"
2	"General business exposure"
1	"Understand all manufacturing applications"
1	"Understand accounting applications"
1	"Develop on-line CICS programs"
1	"How to be productive in programming and work in general"
1	"Basic understanding of accounting principles"
2	"Vendor hardware evaluation"
2	"Basic manufacturing principles"
2	"Budget preparation"
1	"Ability to speak, listen and write effectively"
1	"Suppress "Jargon" when communicating with users"
1	"Skills to effectively train users"
1	"Understand accounting"
1	"Understand word processing"
1	"DBASE programming"
1	"Other Data Base programming"
1	"Clear logical thinking"
1	"Organize work"
1	"Minor degree in either business or science"
2	"Accounting background"
2	"Creative writing"
1	"4th generation languages"
1	"Application generators"

1	"Integrated development systems"
1	"4 GL programming"
	"With the coming of Robotic systems, if a student had plans to enter that area, he/or she had better gain some understanding in what ever language they used"
1	"Logic"
2	"2 yrs. of Accounting"
2	"English"
3	"Foreign language"
1	"Basic Math"
1	"Get along with others"
1	"4th GL (RAMIS)"
1	"Development methodology (STRADIS)"
1	"Knowledge of business concepts and organization"
1	"Ability to work with people (not just users)"
1	"General business, acctg., marketing etc."
1	"Accounting skills"
1	"Management ability and skills"
1	"System design background"
2	"Technical writing ability"
1	"User interviewing techniques"
2	"User communication skills (non-techinal, non-MIS)"
1	"On-line transaction programming (CICS)"

VITA

Amanda Leah Slaten

Candidate for the Degree of

Master of Science

Thesis: COMPETENCIES NEEDED BY PROFESSIONAL COMPUTER SCIENCE PERSONNEL AS PERCEIVED BY BUSINESS AND INDUSTRY REPRESENTATIVES OF ARKANSAS

Major Field: Technical Education

Biographical:

Personal Data: Born in Seattle, Washington, November 21, 1961, the daughter of Mr. and Mrs. Cleason Henry Cotton.

Education: Graduate from Greenwood High School, Greenwood, Arkansas in May 1980; received Bachelor of Science Degree in Computer Science from Arkansas Tech University, 1984; completed requirements for the Master of Science degree at Oklahoma State University in December, 1986.

Professional Experience: Systems Analyst for the Graduate Department of Arkansas Tech University, 1985; Teaching Assistant, Department of Computing and Information Sciences, Oklahoma State University, 1985-1986; Instructor, Indian Meridian Vo-Tech School, 1986.

Professional Organizations: Cardinal Key National Honor Sorority, Sigma Alpha Iota, Tau Beta Sigma Honorary Band Fraternity, and Who's Who Among Students in American Universities and Colleges.