SELECTED COMPETENCIES NEEDED BY COMPUTER SCIENCE GRADUATES AS PERCEIVED BY REPRESENTATIVES OF BUSINESSES, INDUSTRIES, UNIVERSITIES, AND TECHNICAL INSTITUTES IN EGYPT

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CHAPTER I

INTRODUCTION

The importance of computers and computer science in our times is well known: both are at the heart of all high technology. Technology involving computers is having as great an effect on the twentieth century as did the industrial revolution of the nineteenth century. We definitely are living in the age of complex computers. Computers affect all of our lives and they are a necessity if we as individuals, states, and nations are to survive economically, educationally, militarily, and politically.

In the near future, computers in Egypt and other developing nations will play an important role in increasing productivity in business, industry, and education.

The Problem

The problem is that if Egypt is going to compete with other countries economically, militarily, and politically then an appropriate curriculum must be developed with input from businesses and industries who employ graduates of four-year computer science programs.

Presently there is no data that indicate the competencies needed of four-year computer science graduates

as perceived by representatives of businesses and industries in Egypt.

Purpose of the Study

The purpose of this study was to determine competencies needed by computer science graduates as perceived by representatives of businesses, industries, universities, and technical institutes in Egypt.

Need for the Study

Egypt is a developing country with economic, administrative and political problems. The solution to these problems largely depends on the country's ability to introduce modern technology. Advancement in technology is not possible without the utilization of computers and personnel trained to operate computer systems. Therefore, if Egypt is to survive and prosper in the twenty-first century, it must begin to prepare human resources to work with the required computer systems. Once universities and technical institutes have data regarding competencies needed by computer science graduates schools can establish and/or further develop timely computer science programs.

Limitations of the Study

This study was limited to the universities and four-year college level technical institutes in Egypt who offer

computer science programs, and to selected businesses and industries in Egypt who employ computer science graduates.

Definition of Terms

Given below are the definitions of terms used in this study (Schnake, 1985):

Computer programming: involves the science of logically coding instructions into a sequence and form that is machine readable by a digital computer for the purpose of processing data (p. 29).

Computer terminal: refers to the terminals provided for community college systems by the Triangle Universities College Computation (TUCC). These terminals provide accessibility for teaching many languages in the business data processing programs (p. 342).

Top down: the solving of a problem by beginning with the main ideas first and then working out the details (p. 249).

Terminal: represents an input and/or output device that can be used for transmitting data (p. 249).

Up line dumping: transferring of data or programs from memory to a computer monitor (p. 225).

System analysis: a step-by-step investigation as to how a problem can be solved in the best way (p. 365).

Subroutine: synonymous with subprogram, a program or a small part of a program that is usable by others for calculation or inputting or outputting data (p. 313).

Sorting: placing of data in some order or sequence (p. 79).

Pseudo code: type of English statements that are written to represent the logic pattern when developing analgorithms (p. 251).

Plotters: an output device used for creating drawings and graphs (p. 175).

Processing: how data is worked with to become information (p. 9).

RPG: Report Program Generator language written by programmer that tells the computer what processing is needed (p. 306).

Console: that portion of the computer which contains lights, switches, and buttons (p. 33).

CHAPTER II

REVIEW OF LITERATURE

The literature presented in this study is related to the status of computer curriculums and competencies learned by computer science graduates in universities and technical institutes, and the occupational skills and knowledge required for computer related employment opportunities.

Implication for Business Education

Roman (1966) stated that "One of the primary difficulties of business educators, as with all educators, is to prepare students for life in a changing world in which it is impossible to predict with any great degree of accuracy what the world will be like when they are adults" (p. 21). Normally, the first task for establishing curriculum in business education is to define what businesses and industries need in terms of employees, and what pretraining is required to provide qualified employees for specific jobs.

Carlberg (1966) reported that

> Establishing an instructional program in electronic data processing although ideal is not always practical for most communities. The size of the community and the high school, the degree of local need on the part of business and industry, must determine the type of program offered (p. 235).

In 1968 the U.S. Congress approved Title VII of the National Defense Education Act, which provides for the teaching of specialized courses for two-year preparatory curricula in business electronic data processing. Bangs and Hillsted (1968) observed that a case may be made for educational programs in electronic data processing, but it may not be feasible for local communities to develop such programs. They further observed that many people need to be trained and retrained to meet the personnel requirements of businesses and industries employing computer personnel. From their study the researchers recommended data processing and computer curriculums and courses for high schools and community colleges. They found that entry level jobs such as key punch operators, tape librarians, and computer operators were open for two-year graduates. McIntosch and others (1969) accepted this offer to train students in all levels of electronic data processing ranging from key punch operation to computer programming.

By the 1960s, due to the rapidly expanding use of computers in business and industry, an acute shortage of trained personnel to fill various levels of computer jobs became a major concern. Speaking of this shortage, McIntosch (1962) stated:

> Life insurance companies, machine tool manufacturers, textile industries, banks, as well as numerous state agencies, began to reveal their interest in the matter. The American Society of Tool Engineers of North Carolina made several requests for formal training to be offered for

> technicians to operate and maintain tape-controlled production machines, a recognized vital operation in the rapidly expanding industrial states (mimeographed) (p. 1).

Effect of Automation on Occupational Curriculums

Initially, curriculum developed in the industrial education centers and technical institutes were designed for students with a scientific inclination and those who were interested in computer applications related to the solution of problems pertaining to business. By 1963 the curriculums had become more business-oriented and included courses related to computer science.

In order to maintain an up-to-date data processing curriculum, the community colleges had to know what businesses and industries needed in the computer area. However, due to lack of time for surveys and investigations within the community service areas, instructors found it difficult to determine what these needs were. Furthermore, rapid development of hardware and software in third and fourth generation computers made it difficult for the community colleges to define the specific occupational requirements for computer operators.

McIntosch (1966) indicated that courses common to curriculum included speedreading and industrial psychology, and other courses designed to broaden a student's general knowledge. The primary differences in the scientific and

business computer programs was based on the type of background material required to enable a student to develop self-confidence in his or her chosen career. In addition to common courses, the scientific program included courses in such areas as mathematics, physics, and chemistry. The business program included general accounting, industrial accounting, marketing, and management.

Gibbs and Tucker (1984) indicated that the majority of studies in the computer science area have been conducted at community colleges, but that there is a relationship with those in technical institutes. Therefore, the Bachelor of Arts degree is a strong degree, distinguished by its emphasis on preparation for a lifetime of learning in regard to typical academic disciplines. He also stated that institutions that offer the Bachelor of Arts degree are typically limited. The number of the courses required for any major, including computer science, is limited to slightly more than one year in order to allow the student to pursue a four-year program.

Parker (1969) stated that the technical institutes and community colleges were orienting their curriculum and objectives toward developing computer programs with an option leading to unit record operation. Brightman (1970) emphasized that, if the junior colleges are to do their jobs properly, they must provide students with an up-to-date, career-oriented curriculum that will not hinder the

graduate's potential growth by failing to provide educational experience to meet employer's needs.

Moreover, Frazier (1970) studied the programming function. He attempted to provide a comprehensive body of knowledge about the function in order to assist businesses in starting and operating it. He also assisted educators in developing computer programs.

Parker (1969) determined that there are four components needed in a computer framework: a solid foundation in 1) general and business mathematics with statistic courses; 2) accounting principles and practices; 3) oral and written communications; and 4) computer programming efficiency. Parker developed a curriculum for holding with the primary purpose of developing the desired proficiencies necessary at each level of study regardless of the time required. This program was published and made available to other community colleges and technical institutes.

Computer Science

Denning (1984) defined computer science as a coherent body of scientific principles that will continue to guide the discipline for the next decade or two, rather than allow it to be driven by the needs and priorities of particular technologies.

In discussing computer science curriculum, Denning stated that computer science differs from computer

engineering in that computer science is the systematic study of algorithms and data structures; specifically

1. their formal properties,
2. their mechanical and linguistic realizations, and
3. their applications (p. 204).

He explained that in designing curriculum, it is important to reaffirm the essential ordering of emphasis in the above three components. In order for a program to legitimately be called computer science, the formal properties of algorithms and data structures must be emphasized over their specific machines and languages as well as their applications. If their mechanical and linguistic realizations take precedence, the program might be called computer engineering. If their applications take precedence, the program might be called information systems. Only computer science is considered in this study.

Ralston and Shaw (1980) stated that "A minimum of two mathematic courses is required at the introductory level, a first course in discrete mathematics, and a second course in calculus or linear algebra. What is important is that a strong working relationship exists between the mathematics and computer sciences" (p. 67). Ralston and Shaw (1980) stated that "mathematics plays an essential role in the development of computer science not only in the particular knowledge that is required to understand computer science, but also in the reasoning skills associated with mathematical maturity" (p. 70).

The Technical Specialty Core

A curriculum in Computer Science generally emphasizes one of two areas: mathematics or business. However, regardless of the area in which a student is enrolled, there are certain courses important to both areas. These courses are referred to as "core" courses. Speaking of the Institute of Electrical Engineering Education computer Society curriculum, Booth (1984) stated:

> 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).

Mulder and Dalphin (1984) stated that the core curriculum for a Bachelor of Arts degree program in computer science is based on the working definition of computers. The authors further noted that:

> Because the Bachelor of Arts degree program presupposes that the components of that definition appear in decreasing order of importance in the curriculum, the topics that constitute the core are divided into eight categories each roughly a one-semester courses: Principles of Computer Organization, Algorithms, Theory of Computation, and Principles of Programming Languages, Data Structures, Operating Systems, and File Structures (p. 3).

The study of algorithms is also considered important to computer science. Howard (1978) stated that a person well-trained in Computer Science knows how to deal with algorithms--how to construct, manipulate, and understand

them. Howard (1978) observed that the ability to deal with algorithms prepares a student for much more than writing good computer programs: it is an all-around mental tool which will be of great benefit to his understanding of other subjects.

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

Summary

A review of literature of the computer science field revealed that much effort has been expended to explore the effect of automated and data processing on office occupations and computer science curriculum. Efforts have been made to identify the computer jobs available in America and requirements for these jobs, and units of study and curriculum guidelines have been suggested for teaching computer science. The review of literature revealed that more is known about computer science education in two-year colleges than in universities. Consequently, the present study was designed to determine competencies needed by computer science graduates as perceived by representatives of businesses, industries, and schools.

CHAPTER III

METHODOLOGY

This study was designed to determine competencies needed by computer science graduates as perceived by representatives of businesses, industries, universities and technical institutes in Egypt.

Selection of Population

Two different populations were studied in this investigation: 1) businesses and industries using computer science graduates; and 2) universities and four-year technical institutes offering computer science programs.

A stratified random sample of the businesses and industries who hire computer science graduates was utilized in this study. The minimum number that must be studied in each of the business and industry groupings was arrived at by a formula recommended by Krejcie and Morgan (1970).

According to the Ministry of Labor in Egypt, only 110 businesses and industries employ computer science graduates. Therefore the total population of businesses and industries in this study was 110, but the total business and industry sample size for this study was 104. The number of computer science employees employed by the businesses and industries studied in this study are reported in Table I.

TABLE I

POPULATION, SAMPLE SIZE, PERCENTAGE RESPONDING OF BUSINESSES AND INDUSTRIES BY GROUPS OF COMPUTER SCIENCE EMPLOYERS

Number of Computer Science Employees Strati	Businesses and Industries[a] N	Sample Size[b] n	Number of Respondents	Percent Response by Strati
1-10	35	32	27	84.4
11-20	25	24	16	66.7
21-30	16	15	12	80.0
31-40	17	16	11	68.8
41-50	8	8	6	75.0
> 50	9	9	8	88.9
Total	110	104	80	76.9

[a]According to the Egyptian Ministry of Labor

[b]Krejcie and Morgan (1970)

The names of the businesses and industries employing computer science graduates who were sent questionnaires are recorded in Appendix C.

All thirteen universities and nine college level technical institutes that offer computer science programs in Egypt were included in this study. The names of these universities and technical institutes are recorded in Appendix D.

To obtain the data needed for the study, a questionnaire was developed to obtain responses from representatives of businesses, industries and schools in regard to the perceived competencies needed by four-year computer science graduates. Since Slaten (1986) conducted a similar study involving universities in Arkansas, her questionnaire was used after some modification. Slaten's questionnaire was revised based upon Oklahoma State University (OSU) input from researchers, Egyptian students at OSU, and a special committee in Egypt. A brief explanation of the revision process is as follows:

1. Slaten's questionnaire was first discussed with two OSU researchers, and their recommendations were implemented into the questionnaire.

2. After these modifications were completed, the questionnaire was sent to a special committee made up of thirteen members in Egypt to determine if the items on the questionnaire were applicable to obtain the computer science

competency needs of Egyptian businesses and industries. The special committee members were recommended by the Minister of Higher Education based upon his belief that they were the best computer science experts available. The names and addresses of special committee members are recorded in Appendix E.

3. The special committee made further modifications and returned the questionnaire to the researcher. The recommendations of the special committee were implemented.

4. The modified questionnaire was then given to Egyptian students and an Egyptian visiting professor at OSU, who viewed the instrument and made further suggestions for modifications.

5. After the final modifications were completed, the instrument was taken to Egypt for the special committee's recommendations. The committee stated that the modified questionnaire was appropriately designed to obtain the computer science competencies needed by businesses and industries, universities, and technical institutes in Egypt.

6. The questionnaire was again returned to the researcher, who prepared it for mailing to the participants in Egypt. Those going to businesses and industries were sent to the head of the computer department. Those going to universities and technical institutes were sent to department heads of computer science.

Administering the Questionnaire

The questionnaire used in this study consisted of 100 items designed to obtain responses from representatives of businesses, industries, universities, and technical institutes in Egypt concerning computer science competencies needed by four-year graduates. A letter (Appendix A) and questionnaire (Appendix B) was mailed to each representative in the select businesses, industries and schools along with a self-addressed, stamped envelope for return mailing. The participants were requested to complete the questionnaire and return it to the researcher.

The entire population of universities and technical institutes offering computer science programs was used in this study. Therefore, a total of 13 universities and nine technical institutes were studied. Of the 126 questionnaires mailed to businesses, industries, and schools, 102 were completed and returned, yielding an overall response rate of 80.96%. Of the 104 questionnaires mailed to businesses and industries, 80 were returned (83.2%). Of the 13 questionnaires mailed to universities, 13 were returned (100%). Of the nine questionnaires mailed to technical institutes, nine were returned (100%).

Thirty items on the 100 item questionnaire were not responded to by all the respondents from businesses, industries, and schools. Why all of the respondents did not respond to each question is unknown, but the researcher,

being an Egyptian, believes that those who returned the questionnaire without responding to all the questions perceived the subject of some questions as not being important. However, the data was treated as a no response rather than "not needed." A recommendation relative to this situation is given in Chapter V.

Data Treatment

Each competency in the questionnaire was divided into a five-point rating scale. These five points and their ratings are as follows:

Point #1 = great need (rating = 4)

Point #2 = more need (rating = 3)

Point #3 = some need (rating = 2)

Point #4 = little need (rating = 1)

Point #5 = not needed (rating = 0)

Each response was tabulated according to competency and rating. The mean of each competency was then calculated as follows:

3.5 - 4.00 = great need

2.5 - 3.49 = more need

1.5 - 2.49 = some need

0.5 - 1.49 = little need

0.0 - 0.49 = not needed

The competencies were ranked by mean based on the response. Each competency was given a question number to simplify processing of the responses (Table II).

TABLE II

COMPETENCIES LISTED BY QUESTION NUMBER

Question Number	Competency
1	General Education
2	General Mathematic
3	Linear Algebra
4	Calculus
5	Communication
6	Social Studies
7	Psychology
8	Business Law
9	Technical Writing
10	Art
11	Descret Math
12	Graphics
13	Spread Sheets
14	Statistics
15	COBOL
16	FORTRAN
17	PLI
18	ALGOL
19	PASCAL
20	ASSEMBLY
21	Flow charts
22	Key Punch
23	Punch Card Codes
24	Data Processing
25	Trace History of Computers
26	Usage of Data in Computer Education
27	Data Management Systems
28	Define Input Output
29	System Analysis
30	Data Communication
31	Information Systems
32	Micro Computer
33	Mainframe Computer
34	Using Computer Tools
35	Usage of Subroutines
36	Computer Applications
37	Mini Computer Systems
38	Understanding Registers
39	Usage of Top Down
40	Usage of Spooling System
41	Usage of Loop and Index
42	Usage of Design Computer System
43	Problem Solving

TABLE II (Continued)

Question Number	Competency
44	Understanding of Number Systems
45	Usage of Internal and External
46	Understanding Central Processing Units
47	RPG
48	Program Instruction
49	Computer Programs (library)
50	Understanding Computer Consoles
51	Understanding Unit Record Systems
52	Understanding Office Equipment
53	Usage of Office Machines
54	Accounting
55	Finance
56	Market
57	Understanding of Floating Point
58	Function of Creating Files
59	Understanding of Card Reader
60	Usage of Compilers
61	Understanding Network Systems
62	Characteristics of Core Memory
63	Function of Storage
64	Understanding Logic
65	Understanding Hexadecimals
66	Usage of Manuals
67	Debug Programs
68	Functions of Interpreters
69	Functions of Terminals
70	Advanced Programming
71	Understanding of Equipment Operation
72	Usage of Plotters
73	Economics
74	Understanding of Testing Data
75	Understanding of Basic Program
76	Understanding of Random Techniques
77	Usage of Machine Management
78	Understanding the Differences in Data Type
79	Understanding Carriage Control
80	Fundamentals of Computers
81	Understanding Similarities in Data Types
82	Understanding Computer Organization
83	Maintain Program Package
84	Introduction to BASIC
85	Understand Algorithms
86	Understanding Computer Concepts
87	Understanding Data Structures
88	Understanding Computer Architecture

TABLE II (Continued)

Question Number	Competency
89	Usage of Disk Drives
90	Understanding Files Structures
91	Understanding SAS Programming
92	Understanding Logical Error
93	Understanding Usage of Operating Systems
94	Understanding Data Base Systems
95	C-Language
96	Understanding Pseudocode
97	Understanding Coding Errors
98	Understanding Formats
99	Understanding Data Entry Errors
100	Usage of Printers

CHAPTER IV

RESULTS

This study was designed to determine competencies needed by Computer Science graduates as perceived by representatives of businesses, industries and schools in Egypt. The number of responses from businesses, industries, universities, and technical institutes are recorded in Table IV (Appendix F). Also, competencies are recorded in rank order in Table V (Appendix G). A summary of competencies grouped by subject areas in rank order by means of businesses and industries and schools is given in Table III.

The competencies were grouped as follows:

Group 1: Computer Competencies

Group 2: Business Competencies

Group 3: General Education Competencies

Group 4: Mathematics Competencies

Group 5: Statistics Competencies

Group 1: Computer Competencies was grouped in five sub-groups as follows:

Sub-group A: Computer Language

Sub-group B: Computer Programming

TABLE III

SUMMARY TABLE OF COMPETENCIES GROUPED BY SUBJECT AREAS IN RANK ORDER BY MEANS BY BUSINESSES, INDUSTRIES AND SCHOOLS

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB-GROUP A: COMPUTER LANGUAGE

Competency		Means	
No.	Item	B & I*	S**
19	Pascal	3.7	4.0
95	C-Language	3.6	3.4
17	PL1	3.4	3.4
84	Basic	2.9	2.7
20	Assembly	2.8	3.2
15	COBOL	2.7	2.4
16	Fortran	2.4	3.0
18	Algol	1.2	1.6

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB-GROUP B: COMPUTER PROGRAMMING

Competency		Means	
No.	Item	B & I	S
28	Define Input Output	3.8	4.0
36	Computer Application	3.7	3.6
85	Understand Algorithms	3.4	4.0

*Business and Industry **Schools

TABLE III (Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB-GROUP B: COMPUTER PROGRAMMING (CONTINUED)

Competency		Means	
No.	Item	B & I	S
41	Use of Loop and Index	3.3	2.8
33	Mainframe Computer	3.2	3.1
32	Micro Computer	3.1	3.3
48	Program Instruction	2.8	3.5
82	Computer Organization	2.8	3.5
35	Using Sub Routine	2.7	2.7
13	Spread Sheet	2.4	2.5
96	Understanding Pseudo Code	2.6	1.7
70	Advance Program	2.5	2.5
49	Computer Program (library)	2.0	2.8
67	Debug Program	1.7	1.5
47	RPG	1.6	1.9
86	Computer Concept	1.5	1.4
21	Flowchart	1.2	2.2
25	Trace History of Computer	0.8	1.7

TABLE III (Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY SUB-GROUP C: COMPUTER OPERATING SYSTEM			
Competency		Means	
No.	Item	B & I	S
31	Information System	3.9	3.8
58	Function of Creating File	3.7	4.0
90	Understanding File Structure	3.6	3.8
93	Operating System	3.5	3.8
22	Key Punch	3.4	2.7
89	Use of Disk Drive	3.3	3.0
69	Function of Terminal	3.2	3.7
63	Function of Storing	3.1	3.5
72	Use of Plotters	2.9	3.1
38	Understanding Graphics	2.9	3.2
57	Understand Floating Point	2.7	3.4
45	Use of Internal and External	2.5	3.2
66	Use of Manual	2.4	2.5
37	Mini Computer	2.4	2.1
51	Understanding Record System	2.2	2.8
43	Problem Solving	2.2	2.3
97	Understanding Coding Errors	2.0	2.5

TABLE III (Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY SUB-GROUP C: COMPUTER OPERATING SYSTEM (CONTINUED)			
Competency		Means	
No.	Item	B & I	S
29	System Analysis	1.9	2.2
44	Understand Number System	1.6	2.5
65	Understanding Hexadecimal	1.5	2.4
64	Understanding Logic	1.3	1.8
23	Punch Card Code	1.2	1.4
39	Use of Top Down	1.1	1.6
83	Maintain Program Package	0.8	2.3

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY SUB-GROUP D: COMPUTER ENGINEERING DESIGN			
Competency		Means	
No.	Item	B & I	S
42	Using and Designing Computer Systems	1.7	2.7
50	Understand Computer Console	1.1	1.1
71	Understand Equipment Operation	0.9	2.1
34	Design Computer Tools	0.6	1.3
62	Characteristics of Core Memory	0.5	0.9

TABLE III (Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB-GROUP E: COMPUTER ENGINEERING SYSTEM

Competency		Means	
No.	Item	B & I	S
60	Using Compiler	3.7	3.8
80	Fundamentals of Computer	3.5	3.9
100	Using Line Printer	3.5	3.8
59	Understand Card Reader	3.4	3.2
46	Understand CPU	3.3	4.0
92	Understand Logic Error	3.2	3.7
91	Understand SAS	3.0	3.4
40	Use Spooling System	2.6	3.0
61	Understand Network System	2.5	2.5
88	Computer Architecture	1.9	2.6
68	Function of Interpreter	0.4	0.9

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB-GROUP F: COMPUTER DATA SYSTEM

Competency		Means	
No.	Item	B & I	S
27	Data Management	3.6	3.6
94	Understand Data Base	3.5	3.6

TABLE III (Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB-GROUP F: COMPUTER DATA SYSTEM (CONTINUED)

Competency		Means	
No.	Item	B & I	S
87	Understand Data Structure	3.4	3.6
24	Data Processing	3.3	3.3
5	Communication	3.1	2.2
78	Differences in Data Type	3.1	3.6
26	Use of Data in Computer Education	2.5	2.9
30	Data Communication	2.3	2.5
99	Data Entry Error	2.2	3.0
98	Understand Format	2.0	2.0
79	Carriage Control	1.5	2.5
81	Similarities in Data Type	1.3	1.5

GROUP COMPETENCY NO. 2: BUSINESS COMPETENCY
SUB-GROUP A: BUSINESS

Competency		Means	
No.	Item	B & I	S
54	Accounting	3.0	2.3
55	Finance	2.7	2.0

TABLE III (Continued)

GROUP COMPETENCY NO. 2: BUSINESS COMPETENCY
SUB-GROUP A: BUSINESS (CONTINUED)

Competency		Means	
No.	Item	B & I	S
56	Market	2.1	1.8
73	Economics	1.4	1.8

GROUP COMPETENCY NO. 2: BUSINESS COMPETENCY
SUB-GROUP B: MACHINE BUSINESS

Competency		Means	
No.	Item	B & I	S
75	Understand Basic Business	3.5	3.3
74	Understand Testing Data	3.4	3.5
76	Understand Random Techniques	2.6	3.0
52	Understand Office Equipment	2.4	2.1
53	Using Office Machines	1.3	1.1
77	Using Machine Management	1.3	1.5

TABLE III (Continued)

GROUP COMPETENCY NO. 3: GENERAL EDUCATION COMPETENCY			
Competency		Means	
No.	Item	B & I	S
1	General Education	3.5	3.9
9	Technical Writing	3.2	3.3
10	Art	2.1	1.8
8	Business Law	1.9	2.5
6	Social Studies	1.4	2.2
7	Psychology	0.7	1.3
GROUP COMPETENCY NO. 4: MATHEMATICS COMPETENCY			
Competency		Means	
No.	Item	B & I	S
4	Calculus	3.8	4.0
2	General Math	3.5	3.8
3	Linear Algebra	3.1	3.5
11	Descret Math	2.4	2.4

TABLE III (Continued)

GROUP COMPETENCY NO. 5: STATISTICS COMPETENCY			
Competency		Means	
No.	Item	B & I	S
14	Statistics	3.9	4.0
12	Graphics	2.5	2.0

Sub-group C: Computer Operating

Sub-group D: Computer Engineering Design

Sub-group E: Computer Engineering System

Sub-group F: Computer Data System

Group 1: Computer Competencies

Sub-group A: Computer Language

As shown in Table III, this sub-group consists of eight competencies and their order of importance as perceived by representatives of businesses and industries. These were: Pascal, C-Language, PL1, Basic, Assembly, COBOL, Fortran, and Algol. School representatives were pretty much in agreement except they ranked Assembly, and FORTRAN slightly higher than businesses and industries.

Sub-group B: Computer Programming

As shown in Table III, this sub-group consisted of 18 competencies. These competencies are ranked in their order of importance as perceived by businesses and industries as follows: Define Input Output, Computer Application, Understand Algorithms, Use of Loop and Index, Mainframe Computer, Micro Computer, Program Instruction, Computer Organization, Using of Sub Routine, Spread Sheet, Pseudo Codes, Advance Program, Computer Program (library), Debug Program, Report Program Generator (RPG), Computer Concept,

Flowchart, and Trace History of Computer. Schools were pretty much in agreement with businesses and industries, but differed somewhat from businesses and industries in regard to three competencies. Schools ranked "Understanding Pseudo Code," "Flowchart," and "Trace History of Computer" somewhat lower than businesses and industries.

Sub-group C: Computer Operating

As the information in Table III shows, this sub-group consists of 24 competencies. These competencies are ranked in their order of importance as perceived by businesses and industries. Businesses and industries ranked four competencies (Information System, Function of Creating File, Understanding File Structure, and Operating System) as "Great Need," whereas schools rated these four, plus two more (Function of Terminal, and Function of Storing) as "Great Need."

Sub-group D: Computer Engineering Design

As the information in Table III shows, this sub-group consists of five competencies. These competencies are ranked in their order of importance as perceived by businesses and industries as follow: Using and Design Computer Systems, Understand Computer Console, Understand

Equipment Operation, Design Computer Tools, and Characteristics of Core Memory, whereas schools ranked two competencies somewhat higher, Understand Equipment Operation and Using and Design Computer System.

Sub-group E: Computer Engineering System

As information in Table III shows, this sub-group consists of eleven competencies. Businesses and industries ranked three competencies (Using Compiler, Fundamental of Computer, and Usage of Line Printer) as "Great Need." Schools also perceived these competencies and two more competencies (Understand CPU, and Understand Logic Error) as "Great Need."

Sub-group F: Computer Data System

As the information in Table III shows, this sub-group consists of 12 competencies. Schools perceived the importance of the competencies pretty much as did businesses and industries but schools did rank Differences in Data Type, and Carriage Control somewhat higher.

Group 2: Business Competencies

Sub-group A: Business

As information presented in Table III shows, this sub-group consists of four competencies. Business and industries perceived two competencies (Accounting, and

Finance) as "More Need," whereas schools perceived the same competencies as "Some Need."

Sub-group B: Machine Business

As the information in Table III shows, this sub-group consists of six competencies. Schools were pretty much in agreement with businesses and industries with regard to all competencies in this sub-group.

Group 3: General Education and Selected Competencies

As the information indicates in Table III, this group consists of six competencies. Businesses and industries and schools were in agreement on five competencies which they perceived were "Some Need" and "Little Need." The three competencies Technical Writing, Art, and Business Law were perceived by businesses and industries and schools as "Some Need" while Social Studies, and Psychology were perceived as "Little Need."

Group 4: Mathematics Competencies

Information in Table III shows there to be four competencies in this category. Businesses and industries perceived two competencies (Calculus, and General Math) as "Great Need." Schools perceived the same competencies, plus one more (Linear Algebra), as "Great Need" and

businesses and industries and schools perceived one competency (Descret Math) as "Some Need."

Group 5: Statistics Competencies

The information in Table III shows that this group consists of two competencies. Businesses and industries and schools were in agreement with regard to one competency (Statistics). Both perceived this as "Great Need," but businesses and industries rated Graphics somewhat higher than did schools.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This study was designed to determine competencies needed by Computer Science graduates as perceived by representatives of businesses, industries, universities, and technical institutes in Egypt.

Summary

The total sample for this study was 126. The sample of businesses and industries was 104 out of a possible 110, and the school sample was the entire population, or 22 schools. The number of responses from businesses and industries was 80, which was a 76.9% response rate; and the number of responses from schools was 22, which was a 100% response rate. The total responses from both businesses and industries, and schools was 102, which is a 80.96% response rate.

Information for this study was obtained primarily through the use of a mail questionnaire. The questionnaire used in this study consists of 100 competency items. The questionnaire was modified from Slaten's (1986)

questionnaire. The modification of the questionnaire was taken to two OSU researchers and their recommendations were incorporated into the questionnaire. The questionnaire was then sent to a special committee in Egypt to determine if it would obtain the information needed from business and industry and from school representatives. The researcher then further refined the questionnaire by using six Egyptian graduate students at Oklahoma State University to examine the questionnaire to determine if there was any weakness in the instrument. After this final refinement the questionnaire was sent to each computer science department head in the selected businesses, industries, and schools in Egypt.

The competencies listed in the questionnaire were grouped into five categories. The responses were tabulated based on the rating of "Great Need," "More Need," "Some Need," "Little Need," or "Not Needed."

Each competency was given a question number to simplify processing of the responses. From the data collected, the means of the responses from representatives in businesses, industries, and schools, with regard to the importance of competencies, were calculated and recorded in rank order by importance as perceived by businesses and industries (Table III, Chapter IV). The number and percentage of responses and their means were calculated for each competency in each category (Appendix F). From the

data, the competencies were recorded in rank order of importance as perceived by representatives in businesses and industries (Appendix G). The average for means for each competency were calculated, and the competencies were then ranked in their order of importance by their average of the means (Table IV).

Findings

McIntosch (1966) and Ralston (1984), as reported in the Review of Literature, indicated that mathematics is "Important" to computer science majors and employees. But the findings of this study reveal that representatives of businesses and industries, and schools in Egypt perceived mathematics as being of "Great Need" to computer science majors and graduates.

Booth's study (1984), as reported in the Review of Literature, indicated that logic, computer architecture, systems design, and communication are all "Important." But the findings of this study (as recorded in Table IV) indicated that these competencies, as rated by businesses and industries, and schools in Egypt, are perceived to be of "Some Need."

Mulder and Dalphin (1984) indicated that the theory of computing was "Important." The findings of this study (Appendix F) indicated that this competency, rated by both

TABLE IV

IMPORTANCE OF COMPETENCIES ARE RECORDED IN RANK ORDER BY AVERAGE MEANS AS PERCEIVED BY BUSINESSES AND INDUSTRIES, AND SCHOOLS

Item No.	Competency	Average of Means	Businesses and Industries Means	Schools Means
14	Statistics	3.95	3.90	4.00
4	Calculus	3.88	3.75	4.00
28	Define Input Output	3.87	3.78	3.95
31	Information System	3.86	3.90	3.82
58	Function of Creating File	3.84	3.68	4.00
19	Pascal	3.81	3.66	3.95
60	Using Compiler	3.76	3.70	3.82
90	Understanding File Structure	3.73	3.63	3.82
80	Fundamental of Computer	3.70	3.54	3.86
1	General Education	3.68	3.50	3.86
85	Understand Alogrithms	3.68	3.35	4.00
95	C-Language	3.68	3.44	3.91
46	Understand CPU	3.67	3.33	4.00

TABLE IV (Continued)

Item No.	Competency	Average of Means	Businesses and Industries Means	Schools Means
100	Usage of Line Printer	3.66	3.50	3.82
2	General Math	3.65	3.47	3.82
93	Operating System	3.63	3.48	3.77
36	Computer Application	3.62	3.65	3.59
27	Data Management	3.58	3.56	3.59
94	Understand Data Base	3.54	3.49	3.59
87	Understand Data Structure	3.50	3.36	3.64
92	Understand Logic Error	3.44	3.21	3.67
74	Understand Testing Data	3.43	3.36	3.50
69	Function of Terminal	3.42	3.15	3.68
17	PL1	3.40	3.44	3.36
75	Understand Basic Business	3.37	3.46	3.27
78	Differences in Data Type	3.35	3.06	3.64
3	Linear Algebra	3.34	3.13	3.55

TABLE IV (Continued)

Item No.	Competency	Average of Means	Businesses and Industries Means	Schools Means
63	Function of Storing	3.31	3.07	3.55
24	Data Processing	3.30	3.33	3.27
59	Understand Card Reader	3.29	3.39	3.18
32	Micro Computer	3.21	3.10	3.32
91	Understand SAS	3.20	2.98	3.41
33	Mainframe Computer	3.15	3.15	3.14
48	Program Instruction	3.14	2.78	3.50
89	Use of Disk Drive	3.13	3.25	3.00
22	Key Punch	3.06	3.38	2.73
41	Use of Loop and Index	3.04	3.26	2.82
57	Understand Floating Point	3.04	2.66	3.41
72	Use of Plotters	3.03	2.97	3.09
20	Assembly	2.97	2.75	3.18
45	Use of Internal and External	2.82	2.46	3.18

TABLE IV (Continued)

Item No.	Competency	Average of Means	Businesses and Industries Means	Schools Means
84	Basic	2.80	2.86	2.73
76	Understand Random Technique	2.80	2.55	3.05
40	Use Spooling System	2.78	2.61	2.95
82	Computer Organization	2.71	2.78	2.64
35	Using Sub Routine	2.68	2.68	2.68
5	Communication	2.68	3.18	2.18
16	Fortran	2.67	2.38	2.95
26	Use of Data in Computer Education	2.66	2.46	2.86
54	Accounting	2.65	2.98	2.32
99	Data Entry Error	2.60	2.15	3.05
15	COBOL	2.57	2.73	2.41
70	Advance Program	2.54	2.53	2.55
61	Understand Network System	2.52	2.54	2.50
51	Understanding Record System	2.49	2.21	2.77

TABLE IV (Continued)

Item No.	Competency	Average of Means	Businesses and Industries Means	Schools Means
66	Use of Manual	2.45	2.41	2.48
13	Spread Sheet	2.43	2.41	2.45
30	Data Communication	2.40	2.30	2.50
11	Descret Math	2.39	2.36	2.41
55	Finance	2.36	2.67	2.05
49	Computer Program (library)	2.36	1.95	2.77
12	Graphics	2.28	2.57	2.09
88	Computer Architecture	2.28	1.92	2.64
52	Understand Office Equipment	2.27	2.44	2.09
43	Problem Solving	2.25	2.23	2.27
97	Understand Coding Error	2.25	2.01	2.48
37	Mini Computer	2.22	2.43	2.00
8	Business Law	2.22	1.89	2.55
42	Using and Designing Computer Systems	2.16	1.67	2.65

TABLE IV (Continued)

Item No.	Competency	Average of Means	Businesses and Industries Means	Schools Means
96	Understand Pseudo Code	2.09	2.49	1.68
29	System Analysis	2.02	1.85	2.18
79	Carriage Control	2.02	1.48	2.55
98	Understand Format	2.00	1.95	2.05
56	Market	1.96	2.11	1.80
10	Art	1.93	2.08	1.77
6	Social Studies	1.80	1.36	2.23
21	Flowchart	1.69	1.19	2.18
67	Debug Program	1.63	1.70	1.55
83	Maintain Program Package	1.59	0.85	2.32
73	Economics	1.56	1.35	1.77
64	Understanding Logic	1.55	1.27	1.82
71	Understand Equipment Operation	1.54	0.94	2.13
18	Algol	1.43	1.21	1.64

TABLE IV (Continued)

Item No.	Competency	Average of Means	Businesses and Industries Means	Schools Means
81	Similarities in Data Type	1.37	1.28	1.45
39	Use of Top Down	1.34	1.13	1.55
77	Using Machine Management	1.32	1.32	1.31
23	Punch Card Code	1.30	1.16	1.44
25	Trace History of Computer	1.25	0.79	1.71
53	Using Office Machine	1.21	1.28	1.14
50	Understand Computer Console	1.06	1.07	1.05
7	Psychology	0.99	0.71	1.27
34	Design Computer Tools	0.95	0.65	1.25
62	Characteristics of Core Memory	0.71	0.47	0.95
68	Function of Interpreter	0.65	0.40	0.90

businesses and industries, and schools, was perceived as being of "Little Need."

Also from the Review of Literature it was noted that Booth (1984) and Mulder and Dalphin (1984) indicated fundamentals of computers were "Important." Whereas in this study both businesses and industries, and schools reported the Competency, Fundamental of Computers, as "Great Need."

The perceptions of the importance of the competencies studied, as reported by businesses and industries, and school representatives in this study were basically in agreement.

Conclusions

Based upon the findings of this study it is concluded that businesses, industries, and school representatives perceived:

1. Complex (or more difficult) competencies as being more important for computer science graduates than less complex (or less difficult) competencies (such as Pascal and Basic; Information System; and System Analysis).

2. Competencies requiring analytical skills as being more important than competencies requiring less analytical skills (such as Programming and Business Machines).

Recommendations

Based upon the findings of this study it is recommended:

1. Even though businesses, industries, and school representatives perceived complex competencies and competencies requiring higher analytical skills as being more important to Computer Science graduates, that the developers of curriculum give serious consideration to the background of the students the curriculum is to serve. Students may need to start with the less complex and analytical and advance through the higher levels. The curriculum developers should be cautious of leaving a competency out just because it was perceived as not being important to a graduate. Students may need to master the lower level competencies before they can master the higher level competencies.

2. Four-year university and technical institutes computer science programs in Egypt should be designed to meet the needs of Egypt based upon the findings of this study.

3. A plan should be developed to continually update and modify the computer science program based upon similar studies conducted in the future.

4. Researchers proposing to use the instrument utilized in this study, or developing a new instrument to determine the need of computer science graduates, should

make an active effort to include competencies relating to any new technology such as languages.

5. In designing questionnaires that will be completed by Egyptians, the term "Not Important" should be used rather than "Not Needed," because in this study there was evidence that respondents who perceived the competency as "Not (being) Needed" simply did not place any marks with regard to that competency.

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APPENDIXES

APPENDIX A

LETTER TO PARTICIPANTS

OSU

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION
COLLEGE OF EDUCATION

STILLWATER, OKLAHOMA 74078-0406
CLASSROOM BUILDING 406
(405) 624-6275

May 23, 1987

Dear Sir:

I am an Egyptian graduate student at Oklahoma State University, Stillwater, Oklahoma. I am conducting a study to determine the competencies needed by four-year computer science graduates as perceived by representatives of business and industry in Egypt.

Please fill out the enclosed questionnaire and return it in the enclosed self-addressed, stamped envelope. Also, I will appreciate any suggestions that you believe will improve the computer science programs in Egypt. The information you supply will be invaluable in evaluating the computer science curricula in Egyptian universities and technical institutes.

Please reply at your earliest convenience.

Sincerely,

Abdelwahab Hassanin
14-1 N. University Place
Stillwater, Oklahoma 74075

APPENDIX B

QUESTIONNAIRE

Great Need	Some Need	More Need	Little Need	Not Needed	Question Number	
4	3	2	1	0		Competency
4	3	2	1	0	22	Key Punch
4	3	2	1	0	23	Punch Card
4	3	2	1	0	24	Data Processing
4	3	2	1	0	25	Trace History of Computer
4	3	2	1	0	26	Usage of Data in Computer Education
4	3	2	1	0	27	Data Management System
4	3	2	1	0	28	Define Input/Output
4	3	2	1	0	29	System Analysis
4	3	2	1	0	30	Data Communication
4	3	2	1	0	31	Information System
4	3	2	1	0	32	Micro Computer
4	3	2	1	0	33	Mainframe Computer Application
4	3	2	1	0	34	Design Computer Tools
4	3	2	1	0	35	Usage of Subroutine
4	3	2	1	0	36	Computer Application
4	3	2	1	0	37	Understanding Mini Computer
4	3	2	1	0	38	Understanding Graphics
4	3	2	1	0	39	Usage of Top Down
4	3	2	1	0	40	Usage of Spooling System
4	3	2	1	0	41	Usage of Loop and Index
4	3	2	1	0	42	Usage of a Design Computer System
4	3	2	1	0	43	Problem Solving
4	3	2	1	0	44	Understanding of Number System
4	3	2	1	0	45	Usage of Internal and External
4	3	2	1	0	46	Understanding Central Processing Unit
4	3	2	1	0	47	PRG
4	3	2	1	0	48	Program Instruction
4	3	2	1	0	49	Computer Program (library)
4	3	2	1	0	50	Understanding Computer Console
4	3	2	1	0	51	Understanding Unit Record System

Great Need	Some Need	More Need	Little Need	Not Needed	Question Number	
4	3	2	1	0		Competency
4	3	2	1	0	54	Accounting
4	3	2	1	0	55	Finance
4	3	2	1	0	56	Marketing
4	3	2	1	0	57	Understanding of Floating Point
4	3	2	1	0	58	Function of Creating Files
4	3	2	1	0	59	Understanding of Card Reader
4	3	2	1	0	60	Usage of Compilers
4	3	2	1	0	61	Understanding Network System
4	3	2	1	0	62	Characteristics of Care Memory
4	3	2	1	0	63	Understanding the Function of Sorting
4	3	2	1	0	64	Understanding Logic
4	3	2	1	0	65	Understanding Hexadecimal
4	3	2	1	0	66	Usage of Manuals
4	3	2	1	0	67	Debug Program
4	3	2	1	0	68	Function of Interpreter
4	3	2	1	0	69	Function of Terminal
4	3	2	1	0	70	Advance Programming
4	3	2	1	0	71	Understanding of Equipment Operating
4	3	2	1	0	72	Usage of Platters
4	3	2	1	0	73	Economics
4	3	2	1	0	74	Understanding of Testing Data
4	3	2	1	0	75	Understanding of Basic Program
4	3	2	1	0	76	Understanding of Random Techniques
4	3	2	1	0	77	Usage of Machine Management
4	3	2	1	0	78	Understanding the Differences in Data Type
4	3	2	1	0	79	Understanding Carriage Control
4	3	2	1	0	80	Fundamental of Computer

Great Need	Some Need	More Need	Little Need	Not Needed	Question Number	
4	3	2	1	0		Competency
4	3	2	1	0	81	Understanding Similarities in Data Type
4	3	2	1	0	82	Understanding Computer Organization
4	3	2	1	0	83	Maintain Program Package
4	3	2	1	0	84	Introduction to Business
4	3	2	1	0	85	Understanding Algorithms
4	3	2	1	0	86	Understanding Computer Concepts
4	3	2	1	0	87	Understanding Data Structure
4	3	2	1	0	88	Understanding Computer Architecture
4	3	2	1	0	89	Usage of Disk Drive
4	3	2	1	0	90	Understanding Files Structure
4	3	2	1	0	91	Understanding SAS Programming
4	3	2	1	0	92	Understanding Logical Error
4	3	2	1	0	93	Understanding of Operating Systems
4	3	2	1	0	94	Understanding of Data Base Systems
4	3	2	1	0	95	Other (specify)
4	3	2	1	0	96	Other (specify)
4	3	2	1	0	97	Other (specify)
4	3	2	1	0	98	Other (specify)
4	3	2	1	0	99	Other (specify)
4	3	2	1	0	100	Other (specify)

APPENDIX C

NAMES OF BUSINESSES AND INDUSTRIES

1. Industry and Mining
2. Iron and Steel Company
3. Stones, Cement Industry
4. Glass and Glassware
5. Alexandria Water Company
6. El Nasr Automative
7. Cast Iron (Hematite)
8. Aluminum Cables
9. Aluminum and Copper
10. Hair Pins Company
11. Silver and Tableware Company
12. Cairo Starch & Glucose
13. Gerga Sugar Mill Company
14. Rehabilitation of ?
15. Expansions of Easter Company for Tobacco and Cigarettes
16. MISR for Aluminum Company
17. Suez Canal Company
18. Finance and Insurance
19. MISR National Bank
20. Alexandria Bank
21. MISR-American Bank
22. Port Said Bank
23. Educational Services
24. El Nasr Leather Company
25. Allam Building and Ceramics Company
26. Ieka Food Company
27. Cairo Transport and Communication
28. Hospitals and Medical Centres
29. Public Free Zone in Cairo
30. Public Free Zone in Alexandria
31. Public Free Zone in Port Said
32. Public Free Zone in Suez
33. Alexandria Rubber Company
34. Cairo Glue and Gelatin Company
35. Port Said Matches Company
36. Hellman Paper and Cardboard
37. Suhag Plastic Company
38. Tanta Inks Company
39. Mahala Cotton and Textile Company
40. Sinaa Natural Gas
41. Mansoura Keroasenaw Diesel
42. El Nasr Phosphates Company
43. Ismailia Bank
44. Middle Desert Company
45. Eng Fovad Fawzy
46. Eng Mohamed Hossney
47. Al Dosoky Sons Company
48. Sinaa Manganese
49. Red Sea Phosphate Company
50. Sharkia Timber Architecture (Door-Window)
51. MISR Wooden Furniture (meubles)
52. Islamic Bank

53. Fishzal Bank
54. Sauz Bank
55. Cairo Bank
56. National Insurance Company
57. Alexandria Insurance Company
58. Wadi Cotton Seed Oil
59. Egyptian Olive Oil Company
60. Egyptian Sesame Oil Company
61. Egyptian Soy Bean Oil
62. Egyptian Rice Company
63. Alexandria Keroom for Wine
64. Egyptian Beer Company
65. Giza Bank
66. High Dam Lake Company
67. Schag Sugar Company
68. Cairo Beverage Company
69. Assuit Carpet Company
70. Kafr El Hiekh Grape Company
71. Damietta Furniture Company
72. El Menya Fruit
73. El Shems Company
74. Heliopolis Company
75. Nasr City Company
76. Reconstruction and Popular Housing Company
77. The United Company
78. El Maamourah Company
79. El Maadi Company
80. Beheva Company
81. Quena Company
82. El-Fayum Company
83. El Monofia Company
84. El Dakahlia
85. Beny Suez Glass Company
86. Kenna Sugar Company
87. Aswan Dry Beans Company
88. Red Sea Company
89. Matrookat Company
90. Tanta Oil Company
91. Al Zakazeek Company
92. Al Mansoura Cotton Company
93. Al Mahalla Al Kobra Company
94. Akhmeem Carpet Company
95. Al Oksour Company
96. Malawy Oil Company
97. Belbees Soap Company
98. Meet Ghamr Oil Company
99. Zefta Oil Company
100. Monouf Cotton Company
101. Al Matari Construction
102. Ramses Tourist Company
103. Alexandria Leather Company
104. Damanhour Carpet Company

APPENDIX D

NAMES OF UNIVERSITIES AND TECHNICAL INSTITUTES

Universities

1. Cairo University
2. Alexandria University
3. Aan Shams University
4. Asyut University
5. Al Mansoura University
6. Al Zakazeek University
7. Tanta University
8. Monofia University
9. Al Seuz University
10. Hellwan University
11. Al Azhar University
12. Al Menya University
13. Al Fayum University

Technical Institutes

1. Al Mataria Industry Institute
2. The British Institute
3. Hellwan Electronic Institute
4. IBM Institute
5. ICI Institute
6. Shobra High Institute
7. Africai Institute
8. Statistical Institute
9. Foreign Language Institute

APPENDIX E

NAMES OF SPECIAL COMMITTEE MEMBERS

ALEXANDRIA UNIVERSITY

VICE-PRESIDENT'S OFFICE

1. Atef Hasan Khabil - Cairo University, College of Engineering, Department of Mechanical Engineering.

2. Sayyed Wajih - Alexandria University, College of Agriculture, Department of Plant Pathology.

3. Yusrieh Badawi - Alexandria University - School of Medicine, Department of Public Health.

4. Ahmad Hasan - Alexandria University - School of Medicine, Department of Insecticides.

5. Mahmoud Hasanien - University of Tanta, College of Sciences, Department of Chemistry.

6. Ali Abbas - Monsoura University, College of Agriculture, Department of Rural Community.

7. Mohammad Sa'ad - Quana University, College of Engineering, Department of Chemistry.

8. Mostapfa Saleiman Saleh - Alexandria University, College of Agriculture, Department of Entomology.

9. Sayyed Abu Shousha - Alexandria University, College of Agriculture, Department of Plant Pathology.

10. Abu El Magd - High Statistical Institute, Cairo University.

11. Samir Sharkawi - Cairo University, College of Statistics.

12. Ahmed Elgindi - Asuot University, Department of Computer Engineering.

13. Al Geibeily Mohamed - Zakzik University, Department of Math.

APPENDIX F

COMPETENCIES GROUPS BY SUBJECT AREAS IN ORDER BY BUSINESSES, INDUSTRIES AND SCHOOLS

COMPETENCIES GROUPED BY SUBJECT AREAS IN RANK ORDER BY BUSINESSES, INDUSTRIES, AND SCHOOLS

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB GROUP A: COMPUTER LANGUAGE

				Great Need (4)				More Need (3)				Some Need (2)				Little Need (1)				Not Needed (2)				Means	
Competency		Total Responses		B & I*		S**		B & I		S		B & I		S		B & I		S		B & I		S		B & I	S
No.	Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
19	Pascal	80	22	70	87.5	21	95.5	2	2.5	1	4.5	1	1.3	0	0.0	5	6.3	0	0.0	2	2.5	0	0.0	3.67	3.95
95	C-Language	80	22	59	73.8	20	90.9	13	16.3	2	9.1	0	0.0	0	0.0	0	0.0	0	0.0	8	10.0	0	0.0	3.91	3.44
17	PL1	80	22	50	62.5	14	63.6	20	25.0	6	27.3	7	8.8	0	0.0	1	1.3	0	0.0	2	2.5	2	9.1	3.44	3.36
84	Basic	80	22	30	37.5	14	36.6	27	33.8	0	0.0	14	17.5	2	9.1	0	0.0	0	0.0	9	11.3	6	41.3	2.86	2.73
20	Assembly	80	22	40	50.0	12	54.5	20	25.0	6	27.3	0	0.0	2	9.1	0	0.0	0	0.0	20	25.0	2	9.1	2.75	3.18
15	COBOL	79	22	22	27.8	12	54.5	30	38.0	1	4.5	15	19.0	1	4.5	8	10.0	0	0.0	4	5.1	8	36.4	2.73	2.41
16	Fortran	80	21	15	18.8	7	31.8	30	37.5	9	40.9	13	15.3	3	13.5	14	17.5	1	4.5	8	10.0	1	4.5	2.38	2.95
18	Algol	80	22	0	0.0	3	13.6	25	31.3	8	36.4	0	0.0	0	0.0	22	27.5	0	0.0	33	31.3	11	50.0	1.21	1.64

*Business and Industry **Schools

(Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB GROUP B: COMPUTER PROGRAMMING

Competency	Total Responses		Great Need (4)				More Need (3)				Some Need (2)				Little Need (1)				Not Needed (2)				Means	
			B & I		S		B & I		S		B & I		S		B & I		S		B & I		S		B & I	S
No. Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
85 Understand Algorithms	80	22	33	41.3	22	100.0	42	52.5	0	0.0	5	6.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3.35	4.00
28 Define Input Output	78	22	64	80.0	21	95.5	11	13.8	1	4.5	3	3.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3.78	3.95
36 Computer Application	80	22	60	75.0	15	68.2	15	18.8	5	22.7	2	2.5	2	9.1	3	3.8	0	0.0	0	0.0	0	0.0	3.65	3.59
41 Use of Loop and Index	80	22	27	33.8	14	63.5	47	58.8	2	9.1	6	7.5	0	0.0	0	0.0	0	0.0	0	0.0	6	27.3	3.26	2.82
33 Mainframe Computer	80	22	54	67.5	16	72.7	10	15.7	1	4.5	0	0.0	1	4.5	6	7.5	0	0.0	10	12.5	4	18.2	3.15	3.14
32 Micro Computer	80	22	41	51.3	15	72.7	22	27.7	2	9.1	9	11.3	0	0.0	0	0.0	3	13.6	8	10.0	1	4.5	3.10	3.32
48 Program Instruction	80	22	22	27.5	13	59.1	39	48.8	7	31.8	9	11.3	2	9.1	0	0.0	0	0.0	10	12.5	0	0.0	2.78	3.50
82 Computer Organization	80	22	34	42.5	9	40.9	19	23.8	4	18.2	8	10.0	5	22.7	14	17.5	0	0.0	5	6.3	4	18.2	2.78	2.64
35 Using Sub Routine	80	22	0	0.0	10	45.5	65	81.3	5	22.7	10	12.5	2	9.1	0	0.0	0	0.0	5	6.3	5	22.7	2.68	2.68
13 Spread Sheet	80	22	0	0.0	0	0.0	52	65.0	16	72.7	14	17.5	3	13.6	9	11.3	0	0.0	5	6.3	3	13.6	2.41	2.45

(Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB GROUP B: COMPUTER PROGRAMMING (CONTINUED)

Competency No.	Item	Total Responses B	Total Responses S	Great Need (4) B & I N	Great Need (4) B & I %	Great Need (4) S N	Great Need (4) S %	More Need (3) B & I N	More Need (3) B & I %	More Need (3) S N	More Need (3) S %	Some Need (2) B & I N	Some Need (2) B & I %	Some Need (2) S N	Some Need (2) S %	Little Need (1) B & I N	Little Need (1) B & I %	Little Need (1) S N	Little Need (1) S %	Not Needed (2) B & I N	Not Needed (2) B & I %	Not Needed (2) S N	Not Needed (2) S %	Means B & I	Means S
96	Understanding Pseudo Code	80	22	19	23.8	2	9.1	31	38.0	3	13.6	10	12.5	5	22.7	10	12.5	10	45.5	10	12.5	2	9.1	2.49	1.68
70	Advance Program	80	22	30	37.5	11	50.0	16	20.0	0	0.0	17	21.3	6	27.3	0	0.0	0	0.0	17	21.3	5	27.7	2.53	2.55
49	Compter Program (library)	80	22	17	21.3	9	40.9	20	25.0	7	31.8	8	10.0	1	4.5	12	15.0	2	9.1	23	28.8	2	9.1	1.95	2.77
67	Debug Program	50	22	6	12.0	2	9.1	13	16.3	4	18.2	11	22.0	7	31.8	0	0.0	0	0.0	20	70.0	9	40.9	1.70	1.55
47	RPG	78	22	0	0.0	10	45.5	34	43.6	0	0.0	0	0.0	1	4.5	26	33.3	0	0.0	18	23.1	11	50.0	1.6	1.9
86	Computer Concept	80	21	6	7.5	4	8.1	0	0.0	10	47.0	34	49.5	7	31.8	30	27.5	0	0.0	10	12.5	0	0.0	1.5	2.9
21	Flowchart	80	22	0	0.0	0	0.0	0	0.0	12	54.5	35	43.8	6	27.3	25	31.3	0	0.0	20	25.0	4	18.0	1.19	2.18
25	Trace History of Computer	77	22	6	7.8	0	0.0	0	0.0	8	38.1	10	13.0	6	26.6	17	22.1	0	0.0	44	57.1	7	33.3	0.79	1.71

(Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB GROUP C: COMPUTER OPERATING SYSTEM

Competency	Total Responses		Great Need (4)				More Need (3)				Some Need (2)				Little Need (1)				Not Needed (2)				Means	
			B & I		S		B & I		S		B & I		S		B & I		S		B & I		S		B & I	S
No. Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
31 Information System	80	22	72	90.0	20	90.9	8	10.0	0	0.0	0	0.0	2	9.1	0	0.0	0	0.0	0	0.0	0	0.0	3.90	3.82
58 Function of Creating File	80	22	54	67.5	22	100.0	26	32.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3.68	4.00
90 Understanding File Structure	80	22	61	76.3	19	86.4	8	10.0	2	9.1	11	13.8	1	4.5	0	0.0	0	0.0	0	0.0	0	0.0	3.63	3.82
93 Operating System	80	22	43	53.8	20	90.9	35	43.8	1	4.5	1	1.3	0	0.0	0	0.0	0	0.0	1	1.3	1	4.5	3.48	3.77
2 Key Punch	80	22	62	77.5	13	59.1	6	7.5	1	4.5	2	2.5	0	0.0	0	0.0	5	22.7	10	12.5	3	13.6	3.38	2.73
89 Use of Disk Drive	80	20	44	55.0	6	30.0	19	23.8	9	45.0	10	12.5	4	20.0	7	8.8	1	5.0	0	0.0	0	0.0	3.25	3.00
69 Function of Terminal	80	22	44	55.0	18	18.8	12	15.0	1	4.5	20	25.0	3	13.6	0	0.0	0	0.0	4	5.0	0	0.0	3.15	3.68
72 Use of Plotters	79	22	29	36.7	10	45.5	30	38.0	7	31.8	13	16.5	2	9.1	3	3.8	3	13.6	4	5.1	0	0.0	2.97	3.09
38 Understanding Graphics	76	22	31	40.8	16	72.7	22	28.9	1	4.5	10	13.2	2	9.1	13	17.1	0	0.0	0	0.0	3	13.6	2.93	3.23

(Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB GROUP C: COMPUTER OPERATING SYSTEM (CONTINUED)

Competency	Total Responses		Great Need (4)				More Need (3)				Some Need (2)				Little Need (1)				Not Needed (2)				Means	
			B & I		S		B & I		S		B & I		S		B & I		S		B & I		S		B & I	S
No. Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
63 Function of Storing	80	22	36	45.0	14	63.6	24	30.0	6	27.3	15	18.3	2	9.1	1	1.3	0	0.0	4	5.0	0	0.0	3.07	3.55
57 Understanding Floating Point	80	22	39	48.8	17	77.3	12	15.0	1	4.5	0	0.0	2	9.1	21	26.3	0	0.0	8	10.0	2	9.1	2.66	3.41
45 Use of Internal and External	77	22	6	7.8	10	45.5	37	48.1	8	36.4	25	32.5	3	13.6	5	6.5	0	0.0	4	5.2	1	4.5	2.46	3.18
66 Use of Manual	80	21	29	36.2	6	28.6	13	16.3	8	38.1	15	18.6	2	9.5	8	10.0	0	0.0	15	18.8	5	23.8	2.41	2.48
51 Understanding Record System	71	18	21	29.6	8	44.4	12	16.9	1	5.6	7	9.9	6	33.3	23	32.4	3	16.7	8	11.3	0	0.0	2.21	2.77
43 Problem Solving	80	22	0	0.0	7	31.2	50	62.5	4	18.2	14	17.5	5	22.7	0	0.0	0	0.0	16	20.0	6	27.3	2.23	2.27
37 Mini Computer	67	21	23	34.3	9	42.9	11	16.4	0	0.0	16	23.9	4	19.0	6	9.0	0	0.0	11	16.4	9	38.1	2.43	2.00
97 Understanding Coding Errors	76	21	13	17.1	7	33.3	17	22.4	6	28.6	22	28.9	3	14.3	6	7.9	0	0.0	18	23.7	5	23.8	2.01	2.48

(Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB GROUP C: COMPUTER OPERATING SYSTEM (CONTINUED)

Competency	Total Responses		Great Need (4)				More Need (3)				Some Need (2)				Little Need (1)				Not Needed (2)				Means	
	B & I	S	B & I		S		B & I		S		B & I		S		B & I		S		B & I		S		B & I	S
No. Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
29 System Analysis	80	22	10	12.5	6	27.3	17	21.3	4	18.2	22	27.5	6	27.3	13	16.3	0	0.0	18	22.5	6	27.3	1.85	2.18
44 Understand Number System	67	20	10	14.9	8	40.0	16	23.9	3	15.0	5	7.5	4	20.0	7	10.4	1	5.0	29	43.3	4	20.0	1.6	2.5
65 Understanding Hexadecimal	75	20	0	0.0	5	25.0	0	0.0	7	35.3	47	62.7	3	15.0	16	21.3	0	0.0	12	16.0	5	25.0	1.5	2.4
64 Understanding Logic	67	22	0	0.0	0	0.0	0	0.0	6	27.3	27	40.3	11	50.0	31	46.3	0	0.0	9	13.4	5	22.7	1.27	1.82
23 Punch Card Code	50	18	0	0.0	0	0.0	3	6.0	2	11.1	11	22.0	9	50.0	27	54.0	2	11.1	9	18.0	5	29.4	1.16	1.44
39 Use of Top Down	60	18	0	0.0	0	0.0	0	0.0	2	11.1	16	26.7	11	61.1	36	60.0	0	0.0	8	13.3	5	27.8	1.13	1.55
83 Maintain Program Package	66	19	0	0.0	3	15.8	4	6.1	7	36.8	12	18.2	5	26.3	20	30.3	1	5.3	30	45.5	3	15.8	0.85	2.32

(Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB GROUP D: COMPUTER ENGINEERING

Competency	Total Responses		Great Need (4)				More Need (3)				Some Need (2)				Little Need (1)				Not Needed (2)				Means	
			B & I		S		B & I		S		B & I		S		B & I		S		B & I		S		B & I	S
No. Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
60 Using Compiler	80	22	56	70.0	19	86.4	24	30.0	2	9.1	0	0.0	1	4.5	0	0.0	0	0.0	0	0.0	0	0.0	3.70	3.82
80 Fundamental of Computer	80	22	49	61.3	19	86.4	25	31.3	3	13.6	6	7.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3.54	3.86
100 Usage of Line Printer	80	22	65	81.3	20	90.9	0	0.0	0	0.0	10	12.5	2	9.1	0	0.0	0	0.0	5	6.3	0	0.0	3.50	3.82
59 Understand Card Reader	80	22	39	48.8	10	45.5	35	43.8	8	36.4	4	5.0	2	9.1	2	9.1	2	2.5	0	0.0	0	0.0	3.39	3.18
46 Understand CPU	80	22	62	77.5	22	100.0	0	0.0	0	0.0	0	0.0	0	0.0	18	22.5	0	0.0	0	0.0	0	0.0	3.33	4.00
92 Understand Logic Error	74	21	34	45.9	16	76.2	22	29.7	4	19.0	18	24.3	0	0.0	0	0.0	1	4.8	0	0.0	0	0.0	3.21	3.67
91 Understand SAS	78	22	39	50.0	17	77.3	19	24.4	1	4.5	10	12.8	2	9.1	0	0.0	0	0.0	10	12.8	2	4.5	2.48	3.41
40 Use Spooling System	80	22	41	51.3	13	59.1	9	11.3	1	4.5	7	8.8	5	22.7	4	5.0	0	0.0	19	23.8	3	13.6	2.61	2.95
61 Understand Network System	80	22	17	21.3	8	36.4	40	50.0	6	27.3	3	3.8	2	9.1	9	11.3	1	4.5	11	13.8	5	22.7	2.54	2.50
88 Computer Architecture	78	22	18	23.1	9	40.9	10	12.8	2	9.1	22	28.2	8	36.4	4	5.1	0	0.0	24	30.8	3	13.6	1.92	2.64
68 Function of Interpreter	70	20	0.0	0.0	0.0	0.0	0.0	0.0	6	2.0	10	14.3	0	0.0	10	14.3	0	0.0	50	71.4	14	70.0	0.42	0.9

(Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB GROUP E: COMPUTER ENGINEERING (CONTINUED)

Competency	Total Responses		Great Need (4)				More Need (3)				Some Need (2)				Little Need (1)				Not Needed (2)				Means	
	B & I		B & I		S		B & I		S		B & I		S		B & I		S		B & I		S		B & I	S
No. Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
42 Using and Designing Computer Systems	73	20	0	0.0	2	10.0	19	26.0	11	55.0	28	38.4	6	30.0	9	12.3	0	0.0	17	23.3	3	15.0	1.67	2.65
50 Understand Computer Console	67	20	0	0.0	0	0.0	0	0.0	0	0.0	11	16.4	9	45.0	50	74.6	3	15.0	6	8.9	8	40.0	1.07	1.05
71 Understand Equipment Operation	66	16	0	0.0	1	6.3	6	9.1	10	62.5	18	27.3	4	25.0	8	12.1	0	0.0	34	51.5	5	31.5	0.94	2.13
34 Design Computer Tools	74	20	0	0.0	0	0.0	0	0.0	0	0.0	9	12.2	11	55.9	30	40.5	3	15.0	35	47.3	6	30.0	0.65	1.25
62 Characteristics of Core Memory	70	19	0	0.0	0	0.0	7	10.0	0	0.0	6	8.6	9	47.4	0	0.0	0	0.0	57	81.4	10	52.6	0.47	0.95

(Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB GROUP F: COMPUTER DATA

Competency	Total Responses		Great Need (4) B & I		Great Need (4) S		More Need (3) B & I		More Need (3) S		Some Need (2) B & I		Some Need (2) S		Little Need (1) B & I		Little Need (1) S		Not Needed (2) B & I		Not Needed (2) S		Means B & I	Means S
No. Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
27 Data Management	80	22	55	68.8	17	77.3	15	18.8	3	13.6	10	12.5	0	0.0	0	0.0	2	9.1	0	0.0	0	0.0	3.56	3.59
94 Understand Data Base	80	22	47	58.8	17	77.3	23	28.8	3	13.6	10	12.5	0	0.0	0	0.0	2	9.1	0	0.0	0	0.0	3.49	3.59
87 Understand Data Structure	80	22	53	66.3	18	81.8	10	12.5	2	9.1	13	16.3	1	4.5	1	9.1	0	0.0	3	3.8	1	4.5	3.36	3.64
24 Data Processing	80	22	40	50.0	14	63.6	30	37.5	2	9.1	6	7.5	4	18.2	4	5.0	2	9.1	0	0.0	0	0.0	3.33	3.27
5 Communication	80	23	38	47.5	9	40.9	32	40.0	4	18.2	0	0.0	0	0.0	3	3.8	0	0.0	7	8.8	9	40.9	3.18	2.18
78 Differences in Data Type	78	22	28	35.9	17	77.3	35	44.9	2	9.1	11	14.1	3	16.6	0	0.0	0	0.0	4	5.1	0	0.0	3.06	3.64
26 Use of Data in Computer Ed.	80	22	31	38.8	10	45.5	21	26.3	7	31.8	5	6.3	1	4.5	0	0.0	0	0.0	23	28.8	4	18.2	2.46	2.86
30 Data Communication	80	20	25	31.3	9	45.0	16	20.0	4	20.0	8	10.0	0	0.0	20	25.0	2	10.0	11	13.8	5	25.0	2.30	2.50
99 Data Entry Error	80	22	12	15.0	8	36.4	27	33.8	9	40.8	21	26.3	4	18.2	1	1.3	0	0.0	19	23.8	0	0.0	2.15	3.05
98 Understand Format	65	22	11	69.9	6	27.3	17	26.3	3	13.6	9	13.8	5	22.7	14	21.5	2	9.1	14	21.5	4	18.2	1.95	2.05

(Continued)

GROUP COMPETENCY NO. 1: COMPUTER COMPETENCY
SUB GROUP F: COMPUTER DATA (CONTINUED)

			Great Need (4)				More Need (3)				Some Need (2)				Little Need (1)				Not Needed (2)				Means	
Competency	Total Responses		B & I		S		B & I		S		B & I		S		B & I		S		B & I		S		B & I	S
No. Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
79 Carrige Control	80	22	8	10.0	4	18.2	0	0.0	8	36.4	30	37.5	6	27.3	26	32.5	4	9.1	16	20.0	0	0.0	1.48	2.55
81 Similarities in Data Type	75	20	0	0.0	0	0.0	15	20.0	3	15.0	13	17.3	9	45.0	25	33.3	2	10.0	22	29.3	6	30.0	1.28	1.45

GROUP COMPETENCY NO. 2: BUSINESS COMPETENCY
SUB GROUP A: BUSINESS

			Great Need (4)				More Need (3)				Some Need (2)				Little Need (1)				Not Needed (2)				Means	
Competency	Total Responses		B & I		S		B & I		S		B & I		S		B & I		S		B & I		S		B & I	S
No. Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
54 Accounting	80	22	40	50.0	8	36.4	20	25.0	6	27.3	4	5.0	0	0.0	10	12.5	1	4.5	6	7.5	7	31.8	2.98	2.32
55 Finance	80	22	29	36.3	4	18.2	12	15.0	5	27.7	31	38.8	4	18.2	0	0.0	6	27.3	8	10.0	3	13.6	2.67	2.05
56 Market	75	22	5	6.7	1	4.5	21	28.0	7	31.8	31	41.3	6	27.3	13	17.3	3	16.3	5	6.7	5	27.7	2.11	1.80
73 Economics	80	22	8	10.0	6	27.3	15	18.8	2	9.1	4	5.0	2	9.1	23	28.8	5	22.7	30	37.5	7	31.8	1.35	1.77

(Continued)

GROUP COMPETENCY NO. 2: BUSINESS COMPETENCY
SUB GROUP B: MACHINE

Competency No.	Item	Total Responses B	Total Responses S	Great Need (4) B & I N	Great Need (4) B & I %	Great Need (4) S N	Great Need (4) S %	More Need (3) B & I N	More Need (3) B & I %	More Need (3) S N	More Need (3) S %	Some Need (2) B & I N	Some Need (2) B & I %	Some Need (2) S N	Some Need (2) S %	Little Need (1) B & I N	Little Need (1) B & I %	Little Need (1) S N	Little Need (1) S %	Not Needed (2) B & I N	Not Needed (2) B & I %	Not Needed (2) S N	Not Needed (2) S %	Means B & I	Means S
75	Understand Basic Bus.	80	22	48	60.0	13	59.1	25	31.3	4	18.2	5	6.3	3	13.6	0	0.0	2	9.1	2	2.5	0	0.0	3.46	3.27
74	Understand Testing Data	80	22	56	70.0	17	77.3	4	5.0	1	4.5	13	16.3	2	9.1	7	8.8	2	9.1	0	0.0	0	0.0	3.36	3.50
76	Understand Random Tech.	80	22	16	20.0	3	13.6	38	47.5	17	77.3	13	16.3	2	9.1	0	0.0	0	0.0	13	16.3	0	0.0	2.55	3.05
52	Understand Office Equipment	80	22	18	22.5	1	4.5	13	16.3	9	40.9	41	51.3	6	27.3	2	2.5	3	13.6	6	7.5	3	13.6	2.44	2.09
53	Using Office Machines	80	22	0	0.0	0	0.0	0	0.0	3	13.6	44	55.0	8	36.4	14	17.5	0	0.0	22	27.5	11	50.0	1.28	1.14
77	Using Machine Management	80	22	0	0.0	3	13.6	11	13.8	0	0.0	27	33.8	9	40.9	18	22.5	2	9.1	24	30.0	8	36.4	1.32	1.31

(Continued)

GROUP COMPETENCY NO. 3: GENERAL EDUCATION COMPETENCIES

Competency	Total Responses		Great Need (4)				More Need (3)				Some Need (2)				Little Need (1)				Not Needed (2)				Means	
			B & I		S		B & I		S		B & I		S		B & I		S		B & I		S		B & I	S
No. Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
1 General Education	80	22	60	75.0	20	90.9	5	6.3	1	4.5	10	12.5	1	4.5	5	6.3	0	0.0	0	0.0	0	0.0	3.50	3.86
9 Technical Writing	80	22	52	65.0	14	63.6	10	12.5	2	9.1	8	10.0	5	22.7	0	0.0	1	4.5	10	12.5	0	0.0	3.18	3.32
10 Art	80	22	13	16 3	5	22.7	18	22.5	3	13.6	22	27.5	4	18.2	16	20.0	2	9.1	11	13.8	8	36.8	2.08	1.77
8 Business Law	80	22	0	0.0	7	31.8	22	27.5	4	18.2	37	46.3	8	36.4	11	13.8	0	0.0	10	12.5	3	13.6	1.89	2.55
6 Social Studies	80	22	0	0.0	2	9.1	14	17.5	9	40.9	19	23.8	7	31.8	29	36.3	0	0.0	18	22.5	4	18.2	1.36	2.23
7 Psychology	80	22	0	0.0	0	0.0	0	0.0	0	0.0	25	31.3	11	50.0	7	8.8	6	27.3	48	60.0	5	22.7	0.71	1.27

TABLE IV (Continued)

GROUP COMPETENCY NO. 4: MATHEMATICS COMPETENCIES

Competency	Total Responses		Great Need (4) B & I		Great Need (4) S		More Need (3) B & I		More Need (3) S		Some Need (2) B & I		Some Need (2) S		Little Need (1) B & I		Little Need (1) S		Not Needed (2) B & I		Not Needed (2) S		Means B & I	Means S
No. Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
4 Calculus	80	22	70	87.5	22	100	0	0.0	0	0.0	10	12.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3.75	4.00
2 General Math	80	22	50	62.5	20	90.9	20	25.0	0	0.0	8	10.0	2	9.1	2	2.5	0	0.0	0	0.0	0	0.0	3.47	3.82
3 Linear Algebra	80	22	38	47.5	16	72.7	23	27.8	4	18.2	15	18.8	0	0.0	0	0.0	2	9.1	4	5.0	0	0.0	3.13	3.55
11 Descret Math	80	22	27	33.8	9	40.9	13	16.3	2	9.1	16	20.0	4	18.2	10	12.5	3	13.6	14	17.5	4	18.2	2.36	2.41

GROUP COMPETENCY NO. 5: STATISTICS COMPETENCIES

Competency	Total Responses		Great Need (4) B & I		Great Need (4) S		More Need (3) B & I		More Need (3) S		Some Need (2) B & I		Some Need (2) S		Little Need (1) B & I		Little Need (1) S		Not Needed (2) B & I		Not Needed (2) S		Means B & I	Means S
No. Item	B	S	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
14 Statistics	80	22	72	90.0	22	100	8	10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3.90	4.00
12 Graphics	80	22	32	40.0	4	18.2	18	22.5	9	40.9	0	0.0	1	4.5	19	23.8	0	0.0	11	13.8	7	31.9	2.57	2.09

APPENDIX G

IMPORTANCE OF COMPETENCIES ARE RECORDED IN RANK ORDER BY MEANS AS PERCEIVED BY BUSINESSES, INDUSTRIES, AND SCHOOLS

IMPORTANCE OF COMPETENCIES ARE RECORDED IN RANK ORDER BY MEANS AS PERCEIVED BY BUSINESSES, INDUSTRIES, AND SCHOOLS

Item No.	Competency	Businesses and Industries		School	
14	Statistics	3.90	"Great Need"	4.00	"Great Need"
31	Information System	3.90	"	3.82	"
28	Define Input Output	3.78	"	3.95	"
4	Calculus	3.75	"	4.00	"
19	Pascal	3.66	"	3.95	"
36	Computer Application	3.65	"	3.59	"
60	Using Compiler	3.70	"	3.82	"
58	Function of Creating File	3.68	"	4.00	"
95	C-Language	3.44	"More Need"	3.91	"Great Need"
27	Data Management	3.56	"Great Need"	3.59	"
90	Understand File Structure	3.63	"	3.82	"
94	Understand Data Base	3.49	"More Need"	3.59	"
1	General Education	3.50	"Great Need"	3.86	"
80	Fundamentals of Computer	3.54	"	3.86	"
100	Use of Line Printer	3.50	"	3.82	"
93	Operating System	3.48	"More Need"	3.77	"

(Continued)

Item No.	Competency	Businesses and Industries		School	
2	General Math	3.47	"More Need"	3.82	"Great Need"
75	Understand Basic Business	3.46	"	3.27	"More Need"
17	PL1	3.44	"	3.36	"
85	Understand Alogrithms	3.35	"	4.00	"Great Need"
87	Understand Data Structure	3.36	"	3.64	"
22	Key Punch	3.38	"	2.73	"More Need"
59	Understand Card Reader	3.39	"	3.18	"
74	Understand Testing Data	3.36	"	3.50	"Great Need"
41	Use of Loop and Index	3.26	"	2.82	"More Need"
24	Data Processing	3.33	"	3.27	"
46	Understand CPU	3.33	"	4.00	"Great Need"
89	Use of Disk Drive	3.25	"	3.00	"More Need"
92	Understand Logic Error	3.21	"	3.67	"Great Need"
69	Function of Terminal	3.15	"	3.68	"
33	Main Frame Computer	3.15	"	3.14	"More Need"
9	Technical Writing	3.18	"	3.32	"
3	Linear Algebra	3.13	"	3.55	"Great Need"

(Continued)

Item No.	Competency	Businesses and Industries		School	
63	Function of Storing	3.07	"More Need"	3.55	"Great Need"
32	Micro Computer	3.10	"	3.32	"More Need"
5	Communication	3.18	"	2.18	"Some Need"
78	Differences in Data Type	3.06	"	3.64	"Great Need"
54	Accounting	2.98	"	2.32	"Some Need"
91	Understand SAS	2.98	"	3.41	"More Need"
72	Use of Plotter	2.97	"	3.09	"
38	Understanding Graphics	2.93	"	3.23	"
84	Basic	2.86	"	2.73	"
48	Program Instruction	2.78	"	3.50	"Great Need"
82	Computer Organization	2.78	"	2.64	"More Need"
20	Assembly	2.75	"	3.18	"
35	Using Sub Routine	2.68	"	2.68	"
57	Understand Floating Point	2.66	"	3.41	"
55	Finance	2.67	"	2.05	"Some Need"
15	COBOL	2.73	"	2.41	"
40	Use Spooling System	2.61	"	2.95	"More Need"
96	Understand Pseudo Code	2.49	"Some Need"	1.68	"Some Need"

(Continued)

Item No.	Competency	Businesses and Industries		School	
76	Understand Random Technique	2.55	"More Need"	3.05	"More Need"
61	Understand Network System	2.54	"	2.50	"
70	Advance Program	2.53	"	2.55	"
26	Use of Data in Education	2.46	"Some Need"	2.86	"
45	Use of Internal External	2.46	"	3.18	"
12	Graphics	2.51	"More Need"	2.05	"Some Need"
16	Fortran	2.38	"Some Need"	2.95	"More Need"
13	Spread Sheet	2.41	"	2.45	"Some Need"
52	Understand Office Equipment	2.44	"	2.09	"
11	Descret Math	2.36	"	2.41	"
66	Use of Manual	2.41	"	2.48	"
37	Mini Computer	2.43	"	2.00	"
30	Data Communication	2.30	"	2.50	"More Need"
99	Data Entry Error	2.15	"	3.05	"
51	Understand Record System	2.21	"	2.77	"
43	Problem Solving	2.23	"	2.27	"Some Need"
10	Art	2.18	"	1.77	"
56	Market	2.11	"	1.80	"
98	Understand Format	1.95	"	2.05	"

(Continued)

Item No.	Competency	Businesses and Industries		School	
49	Computer Program (library)	1.95	"Some Need"	2.77	"More Need"
97	Understanding Coding Error	2.01	"	2.48	"Some Need"
29	System Analysis	1.85	"	2.18	"
8	Business Law	1.89	"	2.55	"More Need"
88	Computer Architecture	1.92	"	2.64	"
67	Debug Program	1.70	"	1.55	"Some Need"
42	Using and Designing Computers	1.67	"	2.65	"More Need"
47	RPG	1.6	"	1.9	"Some Need"
44	Understand Number System	1.6	"	2.5	"More Need"
86	Computer Concept	1.5	"	1.4	"Little Need"
65	Understand Hexidecimal	1.5	"	2.4	"Some Need"
79	Carriage Control	1.48	"Little Need"	2.55	"More Need"
73	Economics	1.35	"	1.77	"Some Need"
6	Social Studies	1.36	"	2.23	"
81	Similarities in Data Type	1.28	"	1.45	"Little Need"
64	Understand Logic	1.27	"	1.82	"Some Need"
53	Using of Office Machine	1.28	"	1.14	"Little Need"
77	Using Machine Management	1.32	"	1.31	"

(Continued)

Item No.	Competency	Businesses and Industries		School	
21	Flowchart	1.19	"Little Need"	2.18	"Some Need"
18	Algol	1.21	"	1.64	"
23	Punch Card Code	1.16	"	1.44	"Little Need"
39	Use of Top Down	1.13	"	1.55	"Some Need"
50	Understand Computer Console	1.07	"	1.05	"Little Need"
71	Understand Equipment Operation	0.94	"	2.13	"Some Need"
83	Maintain Program Package	0.85	"	2.32	"
25	Trace History of Computer	0.79	"	1.71	"
7	Psychology	0.71	"	1.27	"Little Need"
34	Design Computer Tools	0.65	"	1.25	"
62	Characteristics of Core Memory	0.47	"Not Needed"	0.95	"
68	Function of Interpreter	0.40	"	0.90	"

APPENDIX H

DETERMINING NEEDED SIZE OF RANDOMLY CHOSEN SAMPLE FROM FINITE POPULATION

DETERMINING NEEDED SIZE OF RANDOMLY CHOSEN SAMPLE FROM FINITE POPULATION

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	100000	384

Note: *N* is population size; *S* is sample size.

:. Krejcie, R. V. and Morgan, D. W. Determining sample size for research activities, *Educational and Psychological Measurement*, 1970, 30, 607–610.

VITA

ABDELWAHAB HASSANIN

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Master of Science

Thesis: SELECTED COMPETENCIES NEEDED BY COMPUTER SCIENCE GRADUATES AS PERCEIVED BY REPRESENTATIVES OF BUSINESSES, INDUSTRIES, UNIVERSITIES AND TECHNICAL INSTITUTES IN EGYPT

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