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ABSTRACT

In response to recent data from the Department of Education indicating that the number of women earning computer science undergraduate degrees has declined sharply in recent years, a study was conducted to determine gender bias in introductory computer classes. Questionnaires were distributed to students in two classes at Rutgers University and one at Princeton in spring 1995. Sample populations were then constructed of 94 Rutgers students, 30% of whom were female, and 33 Princeton students, 45% of whom were female. An analysis of responses revealed the following: (1) 55% of the Rutgers students, including 43% of the females, and 51% of the Princeton students, including 40% of the females, felt that they were well prepared for the course; (2) women at both schools and the Princeton men strongly disagreed that they could program fluently, but some of the Rutgers men had entered with strong programming skills; (3) at Rutgers, male students were significantly more likely to own a computer than females (91% versus 70%), but at Princeton computer ownership was virtually universal (91%); (4) for both samples, men were significantly more likely to indicate an intent to continue with computer science and men indicated a more positive attitude toward a computer science career; (5) with respect to programming, men rated themselves as more familiar in almost all categories; and (6) the mean grades for men and women were the same for both groups, but women were significantly underrepresented among the highest scorers. It is noted that there seems to be a positive feedback loop operating for men and a negative one operating for women. some changes to introductory courses that might help compensate for varying backgrounds of students and encourage them to try a computer science course include: (1) make the introductory course pass/fail; (2) have multilevel or slower paced introductory courses; (3) have scheduled, supervised labs and smaller classes; (4) involve students in larger collaborative projects; and (5) involve upper level and graduate students as mentors. (Contains 17 references.) (The survey instrument is appended.) (MAB)

An Unlevel Playing Field: Women in the Introductory Computer Science Courses

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I. Introduction

Data from the Department of Education [17] indicates that the number of women earning undergraduate degrees in computer science has declined sharply in recent years, from a high of over 14,000 a year (37% of the total) in the mid 1980's to slightly over 7,000 (29% of the total) in 1991. These figures are surprising in light of the fact that women's participation in other male dominated fields such as law, medicine and engineering is increasing and women's participation in mathematics during this period has remained stable at about 6,900. It is even more surprising given the proliferation of computers in homes, schools and work places.

Women attempting to enter the computer science field encounter some of the same obstacles as women entering other male dominated fields [16] but there are some factors that are somewhat unique to computer science [4, 8, 10].

Sproull et al[12] describe the "culture of computing" which consists of unfamiliar language and with seemingly arbitrary rules and where it is important to learn how to learn as well as what to learn. Becoming comfortable with this culture can be very intimidating and alienating experience for a beginning student. The acculturation process is somewhat more difficult for women since the members of this culture are predominantly male.

The process of acculturation is further complicated by the presence of a very visible "hacker" subculture. The "hackers" are a group of students, overwhelming male, who develop an early and intense attraction to computers. Sherry Turkle [15] described this group as being very individualistic, competitive, isolationist, somewhat asocial, intense and single-minded. The hackers tend to stand out in the early computer courses because they seem so much more confident and knowledgeable than the other students. However, the influence of this group tends to dissipate in the higher level courses because many of them become absorbed in their own projects rather than the standard class assignments and others are interested only in the programming components of the curriculum and not the more theoretical components that predominate in the more advanced classes.

Also, the hackers lose some advantage when the other students become more knowledgeable.

Data from the Office of Technology Assessment [9] indicates that many women drop out of science and engineering in the early college years and two studies at a large midwestern university have shown very significant differences in persistence rates for men and women in computer science (27% women versus 48% men [1] and 28% women versus 58% men [6]).

The introductory computer science course should give students an opportunity to learn about and gain confidence with computers. The introductory course should help the student determine if computer science is a field in which he or she has an interest and/or an aptitude. Therefore, it is important that the introductory classes give students an accurate prospective on the field of computer science and supply students with appropriate feedback.

The introductory computer science course is a very difficult course to teach because it serves as a both a gateway into the major and an introduction to programming and to the discipline of computer science. Also, the population taking this course can be very diverse: ranging from students who have grown up with computers readily available at home or at school, to students who have had virtually no experience with computers. There are students who are already committed to a computer science major, students who are required to take computer science for another technical major and students who are taking computer science out of general interest or curiosity. Since Computer Science is not a regular part of the high school program, there is no standard high school computer science curriculum apart from the Advanced Placement requirements and no certification for high school computer science instructors. The quantity and quality of high school computer science instruction is, therefore, very variable.

Several studies have looked at the introductory computer classes and the experience of women in these courses. [2, 6, 5, 7, 11, 12, 13] These studies have shown that women tend to have a weaker background in computer science and a more tenuous link to the computer culture. Women is these studies

report lower levels of confidence, lower expectations for a high grade, and a feeling of isolation. Students in general report that the introductory courses are time-consuming and stressful and they are often disappointed by their final grade. The research also showed a strong relationship between the final grade and the initial level of preparation.

The results of this study confirmed the previous studies in showing that more men than women intend to continue with and possibly major or minor in computer science. The results also confirmed that men entered the course with greater experience with programming concepts, greater experience with different types of computers and greater experience with computer packages such as spread sheets, wordprocessors and data bases. The men also indicated that they spent more time involved with computer related activities such as playing computer games and exploring the internet. In addition, the men reported a more independent learning style and were more likely to gain computer knowledge through self-teaching, hacking and reading books and magazines. There were no significant differences between the two groups regarding the influence of family or friends. There was no difference in mean grade received by the men and women but the men predominated among the high scorers.

II. Description of Study

A survey (Appendix) was distributed during the fifth week of the spring semester (1995) in two introductory classes at Rutgers and one at Princeton. At Rutgers, one class was a day class with full time students and the other class was an evening class that contained a mixture of full and part-time students. The Rutgers population consisted of approximately 186 students of whom 59 (32%) were female. The sample at Rutgers consisted of 94 students of whom 28 (30%) were women. In the Rutgers sample approximately 42% of the students (53% men, 18% women) indicated an intention to major in computer science. The rest of the class consisted primarily of math and science majors. Many of the women (39%) were math majors.

The Princeton class consisted 94 students of whom 27 (29%) were women. The Princeton sample consisted of 33 students of whom 15 (45%) were

women. The Princeton sample consisted primarily of engineering students and only 16% of the students (18% men, 14% women) were considering pursuing a computer science major. The Princeton instructor reported that the students who are seriously interested in computer science tend to take this course in the fall. This course fulfills a requirement for the engineering students. At Rutgers, the engineering school offers its own introductory computer science course.

The Rutgers students were more diverse in terms of semester and age; the Princeton students were practically all first and second year students.

III. Results of the Survey

There were many communalities among the students. At both schools the students had good math backgrounds, high math SATs and an interest in pursuing a technical area. At both schools the students generally expected the course to be harder and more work than their liberal arts classes. Many significant gender differences appeared in the student responses to some of the questions on preparation and interest. A result will be reported to be significant if it is significant at least the .05 level.

In response to the statement : *I am well prepared for this course.* (Question B5) 55% of the Rutgers students (61% men, 43% women) agreed (either strongly or mildly) as did 51% of the Princeton students (61% men, 40% women) (Table 7).

The women at both schools disagreed strongly with the statement: *I can program fluently.* (Question B15) The Princeton men also disagreed strongly; however, there was a uniform distribution to the responses of the Rutgers men indicating that some of the Rutgers men entered with strong programming skills but very few of the other students entered the course with programming proficiency. (Table 7)

Male students at Rutgers were significantly more likely than the female students to own a personal computer (91% versus 70%) but at Princeton computer ownership was virtually universal (91%) (Question 13).

A. Persistence with computer science.

Men were significantly more likely to indicate an intent to continue with computer science and potentially choose a computer science major or minor (Table 1).

	Princeton			Rutgers		
	men	women		men	women	
Intent to take further computer science electives (definite, likely, or somewhat likely)(Q 10d)	80%	60%	*	87%	64%	*
Intent to choose a computer science major or minor (likely or somewhat likely) (Q 18)	67%	27%	*	86%	43%	*

* indicates a significant difference in the Chi-Square

Table 1

Table 2 shows the breakdown of responses to the question on the likelihood of choosing a computer science major. The women were significantly more likely to respond negatively to this question (question 18).

	Princeton		Rutgers	
	men	women	men	women
definitely not	11.11%	33.33%	12.12%	42.86%
very unlikely	22.22%	40.00%	1.52%	14.29%
somewhat likely	55.56%	13.33%	19.70%	7.14%
very likely	11.11%	13.33%	66.67%	35.71%

Plans to choose a computer Science major or minor (Q 18)

Table 2

Men also indicated a more positive attitude toward a computer science career by agreeing more strongly with the statement : *There are many careers associated with computer science that would interest me.* (Question B11) (Table 7)

B. Mathematics and Computer Science Background

The Math SATs were high for both Rutgers and Princeton students. The scores of the men were slightly higher than those of the women but the difference was small and not statistically significant.

The formal experience with computers was similar for men and women at both Rutgers and Princeton. Table 3 shows the the percentage of students at the two schools who took Introductory Programming or Advanced Placement Computer Science (Question 9).

	Princeton		Rutgers	
	men	women	men	women
Intro (Q9)	28%	40%	42%	25%
AP (Q9)	22%	20%	15%	11%

High School Computer Courses

Table 3

There were not any significant differences in response to the question on work experience with computers (Question 14), but men were slightly more likely to work in more skilled jobs such as programming, operations and using the applications packages.

1. Programming Concepts

The students were asked to rate their degree of familiarity with various programming concepts before entering this course (Question 25). Men rated themselves as more familiar in almost all categories and statistically significant differences on the t-test showed up in familiarity with selection, looping, arrays and procedures (Table 4). Neither group showed much familiarity with pointers. Means of the different groups are shown in Table 4 where an * indicates a statistically significant difference on the t-test.

	Princeton			Rutgers		
	men	women		men	women	
selection	1.56	2.07	*	1.27	1.75	*
looping	1.56	2.13	*	1.37	1.78	*
arrays	2.00	2.33		1.83	2.25	*
procedures	1.83	2.26		1.78	2.17	*
pointers	2.72	2.66		2.42	2.43	

Table 4

Means of Responses on Familiarity with Programming Concepts
scale - 1 (very familiar) to 3 (not at all familiar)
* indicates a significant difference on the t-test

There was a wide range in both classes in terms of familiarity with programming concepts. At Rutgers 17% of the students (11% men, 29% women) indicated that they had virtually no familiarity with programming concepts and 22% of the students (26% men, 14% women) indicated great familiarity with programming concepts. At Princeton, 33% of the students (22% men, 47% women) indicated no familiarity and 18% of the students (17% men, 20% women) indicated great familiarity with programming concepts.

2. Programming Languages, Applications and Operating Systems

The survey asked the students to rate their competency with several programming languages, applications and operating systems before entering this course (Questions 22 and 24). Table 5 gives the means of the responses. The men generally rate themselves as more competent with the different languages. Significant differences appeared in knowledge of BASIC at both schools and neither group showed much experience with either FORTRAN or "C" language.

There were significant differences reported in competency with applications and operating systems. These differences probably reflect the deeper involvement of the men with computers and the reported tendency of the male students to experiment and learn on their own.

	Princeton			Rutgers		
	men	women		men	women	
BASIC (Q 22)	2.4	3.6	*	1.9	2.5	*
PASCAL	3.0	3.0		2.9	3.4	*
FORTRAN	3.9	4.0		3.2	3.6	
C	3.5	3.8		3.6	3.8	
word processor	1.0	1.5	*	1.2	1.4	*
data base	2.3	3.4	*	2.1	2.4	
spread sheet	1.6	2.7	*	1.8	2.0	
MS-DOS	1.6	2.7	*	1.7	2.9	*
UNIX	2.7	3.3	*	2.9	3.5	*
IBM PC (Q 24)	1.2	2.2	*	1.5	2.4	*
MAC	1.6	2.1	*	1.9	2.2	
mini	3.1	3.7	*	3.1	3.4	

Table 5
Means of Responses on Competencies with Languages, Applications and Systems
scale - 1 (very competent) to 3 (not at all competent)
* indicates a significant difference on the t-test

C. Computer culture

Men indicated a greater level of interest and involvement with computers by responding more positively to the statement: *Computers are fun to use* (Question B2 - Table 7) and by responding more positively to questions about the amount of time spent in recreational computer related activities. (Question 21) The results indicated that the men spent more time at these activities than the women and seemed to get more enjoyment than the women in working with computers. The results were coded on a scale from 3 to 0 where 3 indicated the greatest involvement and 0 the least. Table 6 summarizes the results.

	Princeton			Rutgers		
	men	women		men	women	
playing computer games	1.5	0.8	*	1.9	1.0	*
exploring the internet	2.1	1.4	*	2.1	1.4	*
reading computer magazines	1.1	0.6		1.7	0.7	*
attending computer shows	0.6	0.1	*	0.9	0.4	*
engaging in computer related activities with friends	1.2	1.0		1.5	1.1	

Table 6

Means of Responses on Involvement with Computer Related Activities

scale - 3 indicates greatest involvement and 0 indicates no involvement

* indicates a significant difference on the t-test

D. Attitude toward course

The students generally were a generally technically oriented group of students. They agreed that they needed to be competent with computers, that they liked math (women agreed slightly more strongly with this statement), that they are stronger and more interested in math/science areas than liberal arts areas. The Princeton students also indicated that the course was difficult by disagreeing with the statement that *I expect this course to be easier than my liberal arts courses* (Question B6) and agreeing with the statement *I expect this course to be more work than my liberal arts courses.* (Question B20) The Rutgers women gave responses that was similar to those of the Princeton students but the Rutgers men gave a more mixed reaction. The Rutgers class contained a subpopulation of men who entered with confidence in their programming skills and who consequently did not expect to have difficulty with the course. Answers to the questions range from 1 to 5 with 1 indicating strong agreement and 5 indicating strong disagreement and an * indicates a statistically significant difference in response.

	Princeton		Rutgers		
	men	women	men	women	
I expect this course to be easier than my liberal arts courses. (B6)	3.8	4.4	2.9	4.2	*
I expect this course to be more work than my liberal arts courses. (B20)	2.1	1.7	2.5	1.7	*
I know that it will be important for me to be competent with computers. (B12)	1.1	1.2	1.2	1.3	
I am stronger in math/science areas than in liberal arts areas. (B13)	2.1	2.1	1.9	2.0	
I enjoy mathematics. (B7)	2.3	2.1	2.2	1.6	*
I am more interested in liberal arts areas than in math/science areas. (B19)	3.4	3.8	3.9	4.1	
Computers are fun to use. (B2)	1.6	2.0	1.4	2.1	*
I am well prepared for this course. (B5)	2.4	3.3	2.4	2.8	
I can program fluently. (B15)	3.6	4.2	3.0	3.5	
There are many careers associated with computer science that would interest me. (B11)	2.0	2.5	1.6	2.0	
Computers are frustrating. (B8)	3.1	3.1	3.4	2.1	*

Table 7

scale - 1 indicates strong agreement with the statement
5 indicates strong disagreement
* indicates a significant difference on the t-test

E. Learning Style

In response to questions about how the students acquired computer skills, there were no gender differences reported in response to questions about the importance of high school courses, jobs, family, and friends. Men, however, were significantly more likely to assign more importance to independent activities such as self-teaching, books and magazines and hacking. Table 8

gives the means of responses where 1 indicated the item was very important to acquisition of knowledge and 3 indicated no importance and an * indicates a statistically significant difference.

	Princeton			Rutgers		
	men	women		men	women	
high school courses	2.3	2.3		2.0	2.0	
self-teaching	1.1	1.8	*	1.3	1.6	
books/magazines	2.2	2.7	*	1.9	2.4	*
friends	2.2	1.8		1.9	2.2	
family	2.3	2.1		2.5	2.5	
job	2.2	2.5		2.4	2.1	*
hacking	2.4	3.0	*	2.3	2.6	*

Table 8

Means of Responses on Acquisition of Computer Knowledge
scale - 1 indicates very important and 3 indicates not at all important
* indicates a significant difference on the t-test

E. Outcomes

At the end of the semester the final grades were collected for the students in the sample and for the class as a whole. The sample grades were used to see which factors on the survey were predictive of success in the course and the grades of the whole group were used to see if there were differences in achievement between the men and women.

At Rutgers, 85 of the 94 students in the sample completed the course and at Princeton 32 of the 33 students completed the course. The grades of all the students in the Rutgers group and for 25 of the students in the Princeton group were obtained. There was significant correlation between preparation and final grade in both classes (.49 at Princeton and .27 at Rutgers). There was no correlation between the grade and the interest variables.

Examination of the data for the whole class in both schools showed that the mean grade of men and women was the same in both groups but the women

were significantly underrepresented among the highest scorers (A and A+ students).

IV. Conclusions

Even at the start of the course women seemed less experienced in computer science and less interested in pursuing computer science than the men. Since the women accounted for only about 30% of the introductory course and only a small percentage indicated an intent to continue in computer science, if this group is any indicator, the number of women in the upper level courses will be very small.

There seems to be a positive feedback loop operating for the men and a negative one operating for the women. The men become drawn into computer related activities in high school which leads to greater success in their computer classes which in turn leads them to continue in the field. Women experience the opposite effect. They enter with little outside experience and find the courses difficult and time consuming, they get less positive feedback and thus have less reason to persevere.

Both of these courses were difficult courses and covered in one semester as much material as we cover in two at Middlesex. They were both taught in large lecture classes and recitation sections conducted by TAs.

Some changes to the introductory courses might help compensate for the varying backgrounds of the students and encourage more students to try a computer science course. Some changes that have been proposed include:

- Making the introductory course pass/fail. This would give the students an opportunity to become comfortable with programming before being put in a competitive situation.

- Multilevel or slower paced introductory courses - Klawe and Leveson [8] noted that the introductory courses have become more difficult over time as more students entered with advanced knowledge and pressure has mounted to include more material in the undergraduate computer science curriculum.

This might encourage more students to try a programing course and possibly entice some students into the major.

• Scheduled, supervised labs and smaller classes - At Middlesex County College, we have small classes and three hour supervised labs for the introductory course. This enables the instructor to get to know the students and to provide more feedback. The instructor is present during the lab time to teach the students how to use the system, how to design their programs and to help them debug their programs. Having the instructor present in the lab enables the student to get the programs done more quickly and cuts down on the frustration beginning programmers face. It also helps the students get to know each other and provide support and assistance to each other. One of the instructors recommended that the introductory computer courses be taught in small sections like the introductory writing and language classes.

• Collaborative Learning - Computer Science classes tend to be competitive, with each student working alone on assignments; whereas, industry environments tend to be collaborative. Involving the students in larger collaborative projects might give students a truer picture of the work environment and also help combat the feeling of isolation reported by many female students.

• Mentoring - Involving upper level students or graduate students to help provide role models and assistance to the introductory students.

There is a program that was developed at Berkeley by mathematician Uri Treisman [14] to help minority students succeed in calculus. The program involved educational and social aspects. The program involved extra time for problems sessions, extensive interaction with the TA's and group projects to involve the students in collaborative efforts. The program succeeded very well at Berkeley and has been successfully implemented at Rutgers [3] and other colleges. At Rutgers, students who completed this program received higher grades than a control group in their calculus courses and continued to do better than the control group two years later. This type of program encompasses many of the remedies described above and might work well for introductory computer science students by providing more support with the

course and helping the students become more comfortable with the each other and the computer culture.

This project confirmed the results of other studies on women in computer science and suggests that some changes might be necessary to attract more women to the field. From my experience at Middlesex County College and in industry, I have found that many women do very well in computer science careers although they often do not fit the compulsive "hacker" stereotype. At Middlesex, we get many "older" women with degrees in other fields who come to Middlesex for retraining in computer science. Many more women can succeed in computer science but some recruiting efforts and some changes to the introductory courses might be necessary to attract more women to this field.

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1. Program B.A. _____ B.S.E. _____ undecided _____

2 Sex Male _____ Female _____

3. Ethnicity African-American ___ Asian/Asian-American ___ Asian Indian ___ Hispanic/Latino ___ Caucasian ___ Other ___

4. Age ____

5. Do you currently have an undergraduate degree? Yes ____ No ____

6. Class Freshman ___ Sophomore ____ Junior ____ Senior ___ Continuing ___

7. SAT Verbal _____ Math _____

8. What was the highest level of math you completed in high school?

calculus or higher ____ precalculus ____ less than precalculus _____

9. Which computer courses did you take in high school? (check all that apply)

None _____ AP Computers _____ Introductory Programming ____ Computer Literacy _____ Other (list)_____

10. Indicate your plans with respect to taking the following courses:

	already taken	currently taking	definitely will take	very likely to take	somewhat likely to take	very unlikely to take
a) Calculus I	_____	_____	_____	_____	_____	_____
b) Calculus II	_____	_____	_____	_____	_____	_____
c) Math Elective above Calculus II	_____	_____	_____	_____	_____	_____
d) Computers and Computing (111)	_____	_____	_____	_____	_____	_____
f) Computer Science elective 200 or higher	_____	_____	_____	_____	_____	_____

11. Do you have a parent or close relative working or studying in a math or computer science related field. Yes ___ No ____

12. What is the highest level of education completed by

mother: high school or less____ some college____ college degree_____
Master's degree___ Ph.D., medical, or law degree____

father: high school or less____ some college ____ college degree _____
Master's degree___ Ph.D., medical, or law degree____

13. Do you own a personal computer? (either at home or at school) Yes ___ No ____

14. Have you worked at a job that uses computers? Yes ___ No___
If so in what capacity? (check all that apply)

Data entry ___ Packages ____ Operations ____ Programming ____

15. What is your most likely major? _____ minor?_____

16. Which careers are you most seriously considering?

1. _____ 2. _____ 3. _____

17. Indicate the importance of each of the following in your decision to take this course.

	very important	slightly important	not at all important
a) I am considering a computer science major or minor.	1	2	3
b) I am considering another technical major.	1	2	3
c) I want to learn about computers.	1	2	3
d) I feel programming is a skill that will be useful.	1	2	3
e) Computer Science is required by my major.	1	2	3
f) It was suggested by my family.	1	2	3
g) Other - state _____	1	2	3

18. How likely it it that you will choose a computer science major or minor?

very likely ___ somewhat likely ____ very unlikely _____ definitely not ____

Answer **either** question 19 **or** 20 depending on your response to question 18.

19. If you **are** likely to major or minor in computer science, indicate the importance of the following factors in your decision:

	very important	moderately important	not very important	not at all important
a) I enjoy working with computers.	1	2	3	4
b) There are good job opportunities in computer science.	1	2	3	4
c) Computer Science courses are easy for me.	1	2	3	4
d) My family has advised me to concentrate in computer science.	1	2	3	4
e) I have friends in computer science.	1	2	3	4
f) I am good at programming.	1	2	3	4

20. If you **are not** likely to major or minor in computer science, indicate the importance of the following factors in your decision:

	very important	moderately important	not very important	not at all important
a) I do not enjoy working with computers.	1	2	3	4
b) There are few good job opportunities in computer science.	1	2	3	4
c) Computer Science courses are hard for me.	1	2	3	4
d) My family has advised me to concentrate in a different field.	1	2	3	4
e) I have few friends in computer science.	1	2	3	4
f) Computer Science classes are too much work.	1	2	3	4
c) I prefer another field.	1	2	3	4

21. How often do you participate in the following activities?

a) Playing computer games	more than 2 hours weekly	1-2 hours a week	less than 1 hour a week	never
b) Exploring internet	more than 2 hours weekly	1-2 hours a week	less than 1 hour a week	never
c) Programming	more than 2 hours weekly	1-2 hours a week	less than 1 hour a week	never
d) Reading computer magazines	more than twice a month	once or twice a month	rarely	never
e) Attending computer shows	more than twice a year	once or twice a year	rarely	never
f) Participating in computer related activities with friends	several times a week	several times a month	rarely	never

22. Before taking this course, how competent did you feel using the following operating systems, languages and applications?

	highly competent	moderately competent	slightly competent	not at all competent
a) MS-DOS	1	2	3	4
b) UNIX	1	2	3	4
c) PASCAL	1	2	3	4
d) BASIC	1	2	3	4
e) FORTRAN	1	2	3	4
f) "C" Language	1	2	3	4
g) Word Processors	1	2	3	4
h) Spread Sheets	1	2	3	4
i) Data Bases	1	2	3	4

23. List other operating systems and computer languages with which you have experience.

1. _____

2. _____

3. _____

24. Before taking this course, how competent did you feel with the following types of computers?

	highly competent	moderately competent	slightly competent	not at all competent
a) IBM PC and compatibles	1	2	3	4
b) Macintosh	1	2	3	4
c) Minicomputer (workstation) (VAX, Prime, SUN etc)	1	2	3	4
d) Mainframe and super computers (IBM 370 and compatibles etc)	1	2	3	4
e) other - state _____	1	2	3	4

25. Before taking this course, how familiar were you with the following computer constructs?

	very familiar	somewhat familiar	not at all familiar
a) Selection (IF THEN)	1	2	3
b) Loops (FOR WHILE DO)	1	2	3
c) Arrays	1	2	3
d) Procedures and Functions	1	2	3
e) Pointers	1	2	3

26. Before taking this course, how important were each of the following in helping you acquire computer skills and knowledge?

	very important	slightly important	not at all important
a) high school courses	1	2	3
b) college courses	1	2	3
c) self-teaching	1	2	3
d) books and magazines	1	2	3
e) friends	1	2	3
f) family	1	2	3
g) job	1	2	3
h) hacking	1	2	3

B. Indicate your degree of agreement with each of the following statements.

	strongly agree	mildly agree	no opinion	mildly disagree	strongly disagree
1. Computer Science is primarily programming.	1	2	3	4	5
2. Computers are fun to use.	1	2	3	4	5
3. Computer Science is a good field for a woman.	1	2	3	4	5
4. You need to be a hacker to work as a computer scientist.	1	2	3	4	5
5. I am well prepared for this course.	1	2	3	4	5
6. I expect this course to be easier than my liberal arts courses.	1	2	3	4	5
7. I enjoy mathematics.	1	2	3	4	5
8. Computers are frustrating.	1	2	3	4	5
9. My family encouraged me to take this course.	1	2	3	4	5
10. Working with computers is a solitary activity.	1	2	3	4	5
11. There are many careers associated with computer science that would interest me.	1	2	3	4	5
12. I know that it will be important for me to be competent with computers.	1	2	3	4	5
13. I am stronger in math/science areas than in liberal arts areas.	1	2	3	4	5
14. Computer Science majors tend to be less social than other students.	1	2	3	4	5
15. I can program fluently.	1	2	3	4	5
16. Several of my friends are interested in computers.	1	2	3	4	5
17. I have good interpersonal skills.	1	2	3	4	5
18. Men are better with computers than women.	1	2	3	4	5
19. I am more interested in liberal arts areas than in math/science areas.	1	2	3	4	5
20. I expect this course to be more work than my liberal arts courses.	1	2	3	4	5
21. Programming is fun and challenging.	1	2	3	4	5