Expanding the Pipeline

CS gender gap still a problem

LETTERS TO THE EDITOR
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Letters may be edited for
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. **BY Clark Thomborson**

Like Mary Jane Irwin of Pennsylvania State University and many others, I am dissatisfied with the number of women in academic computer science. That's an understatement; I am increasingly alarmed. Over the past decade, gender balance at the undergraduate level in computer science has steadily deteriorated in the United States. I don't like the current situation in the undergraduate classroom, and I am afraid of what it portends for gender balance at the faculty level in the future. My motivation: I don't want to work in a gender-segregated workplace for the rest of my life.

When I first started teaching, at the University of California at Berkeley in 1979, there weren't many female students in my undergraduate classes. In a class of 30, there might be five women. The gender mix, or rather the lack thereof, was even more noticeable at the graduate level. In a seminar of 10 students, it was rare to see more than a couple of women. And there were very few female faculty members. This was far from a gender-balanced workplace, but at least the situation seemed to be improving.

According to a statistical series on undergraduate degree conferrals collected by the Department of Education's National Center for Education Statistics (NCES), the gender ratio among CS undergraduates improved from 20% to nearly 40% from 1975 to 1984. Since then there has been a steady decline. According to the latest data in my possession, in the class of 1993 only 28% of the computer science B.S. degree recipients in the United States were female. This is a national average.

At major research universities, there are even fewer women in CS undergraduate programs than suggested by the national averages discussed above. The Massachusetts Institute of Technology Planning Office performed a detailed analysis of the NCES data for the class of 1990. The percentage of females among the CS undergraduate degree recipients that year at the top 12 schools, as ranked in the CRA Taulbee Survey, was 22% at Stanford University, 21% at MIT, 24% at Carnegie Mellon University, 31% at the University of California at Berkeley, 13% at Cornell University, 12% at the University of Illinois at Urbana-Champaign, 19% at the University of Washington, 21% at the University of Texas at Austin, 30% at the University of Wisconsin at Madison and 25% at the University of Southern California. NCES had no data for 1990 CS undergraduate degrees from the University of California at Los Angeles or the University of Toronto. Note that only Berkeley and Madison approached the 1990 national average (30%) gender ratio for undergraduate CS degree recipients.

A third data series, recently added to the annual CRA Taulbee Survey, showed that only 18% of the undergraduate CS degree recipients in 1994 were female. This 18% figure is a close match to the "top 12 schools" data quoted in the previous paragraph. I don't think the CRA Taulbee data is directly comparable to the NCES data quoted above; the percentages are too far apart.

I don't have 1994 data from NCES, nor do I have 1993 data from the CRA Taulbee Survey because none was collected for undergraduate conferrals. Still, it is worrisome to compare the 30% gender ratio for CS bachelor's degrees in the United States in 1993 (NCES data) with the 18% gender ratio among CS bachelor's degrees for CRA Taulbee reportants in 1994. My rough estimate is that only half the difference is due to a difference in survey methodology and scope, i.e., that the NCES data for 1994 will show a dramatic drop in the gender ratio for CS bachelor's degree recipients in the United States.

The recent downward trend in undergraduate female participation in computer science will almost surely result, soon, in a downward trend in female CS Ph.D. conferrals. Historically, gender ratios for master's degrees in computer science are lower than those for bachelor's degrees, and gender ratios for CS Ph.D. recipients are lower still. As we follow an age cohort through the pipeline of advancement in academic computer science, we see fewer females.

You might believe that at present no downward trend exists in undergraduate female CS ratios. Perhaps the gender ratio for CS bachelor's degrees in 1995 will be higher than 1994, and 1996 will be even higher. However, I disagree. The gender ratio at the high school level is still dropping, judging from data collected by the College Board. (I believe Nancy Griffeth of Bellcore was the first to study this data for its relevance to the CS pipeline.)

Before high school students take the graded portion of an SAT exam, they indicate their areas of highest interest among a list of "College Majors by Academic Area." The College Board publishes a yearly

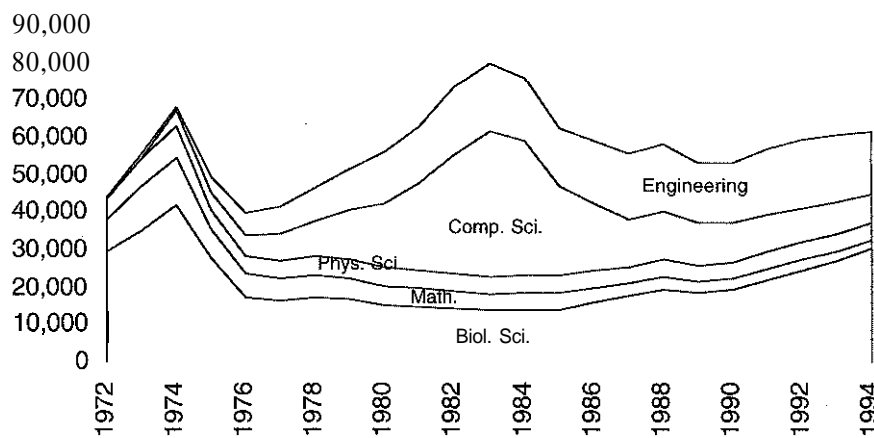**Figure 1. Intended Majors of Females in Science and Engineering**

Figure 2. Intended Majors of Males in Science and Engineering

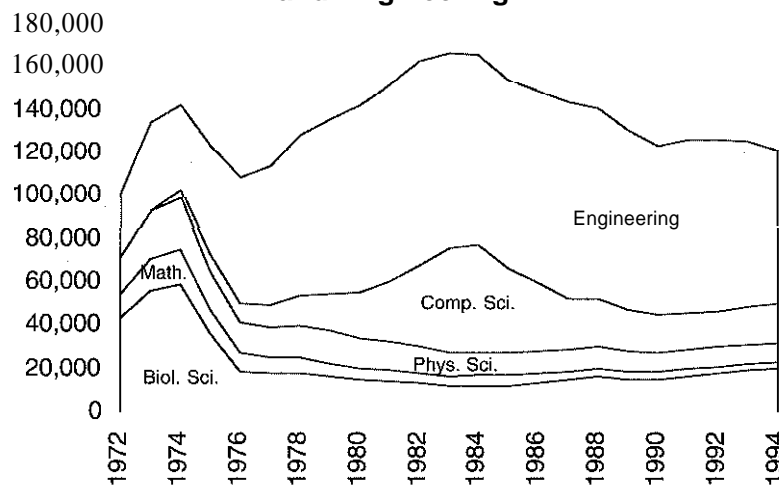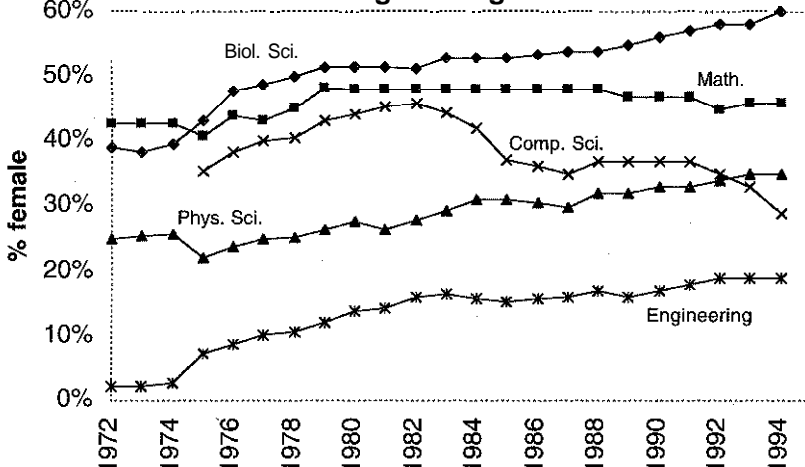
Figure 3. Intended Majors in Science and Engineering

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digest of their answers, broken down by gender and broad major field.

I've plotted the absolute numbers of high school students expressing interest in computer science separately for females and males, in Figures 1 and 2. These are area charts, so each line indicates the cumulative total of the majors mentioned below it. For example, Figure 1 shows that in 1994, about 60,000 high school females declared an intention to major in science and engineering (reading from the top line); about half of these females planned to major in the biological sciences. In Figure 2, we see that about 120,000 males intended to major in science and engineering in 1994; the majority of these males planned to major in engineering.

Among academic disciplines within science and engineering, computer science stands out as the only field with a downward trend in interest among high school females (see Figure 3). I'm particularly concerned by a sharp downward trend in 1991 through 1994, from 37% to 29%. I fear this eight-point drop in gender ratio among intended majors in 1991-94 portends an eight-point drop in the gender ratio among CS bachelor's degree recipients in 1994-98. Note that the 1982-85 drop in gender ratio among intended CS majors occurred just before the 1985-88 drop in gender ratio among CS bachelor's degree recipients.

My intent in writing this column is to spark discussion of why computer science is becoming more gender. segregated at the undergraduate level. More importantly, what can we do about it! I hope you are inspired to discuss these questions with your friends and colleagues, send me e-mail at cthombor@cs.umn.edu, write something for publication or get involved in a mentoring or outreach program.

Clark Thomborson is a visiting professor at the University of Minnesota at Twin Cities. In early 1996 he will become a chaired professor of computer science at Auckiand University in New Zealand.