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President Proposes Increases to IT R&D, Physical Sciences *Start of Budget Cycle Is Anything but Typical*

By Peter Harsha

Traditionally, the first Monday in February marks the release of the President's budget and the beginning of the process of setting federal funding levels that will occupy Congress and the Administration until fall. This year's announcement includes proposed increases to federal information technology research and development programs and a further bolstering of the physical sciences. The budget's release comes at a time when Congress still has not completed last year's work on the FY 2003 budget and the impact of the loss of the Space Shuttle *Columbia* on America's space program is still unknown. Even for seasoned veterans of the budget prognostication game, the uncertainty that surrounds the start of this year's budget process makes forecasts about its possible outcome difficult.

Congress finds itself still at work on FY 2003 funding, despite the start of FY 2003 on October 1, 2002, because its focus on creating a new

Department of Homeland Security delayed consideration of all but two annual appropriations bills until late September 2002. Then uncertainty between the White House and the House Republican leadership over a final, overall funding level for the remaining 11 appropriations bills further delayed their consideration until late October, when all involved decided to hold off until after the mid-term election. The unexpected success of Republicans in picking up control of the Senate and increasing their majority in the House further clouded the calculus. Republican leaders during the lame-duck session felt no pressure to accede to Democrat priorities in the funding bills and stalled consideration until the new, Republican-controlled 108th Congress convened in January.

As this goes to press on February 4, 2003, there is still no resolution to the appropriations situation. Federal agencies have been operating under a "continuing resolution" since October 1—allowing them to continue to run, but prohibiting new

project starts and capping funding at the FY 02 rate. At this point it is unclear whether the President's Office of Management and Budget even wants to see Congress finish the FY 03 appropriations bills, perhaps preferring to keep the continuing resolution in place until work on the FY 04 appropriations is finished. For researchers, this strategy could have a serious impact on their ability to secure funding in the coming year, especially for those scheduled to start new projects. CRA, along with our affiliates and the rest of the scientific community, will continue to urge congressional leaders to finish their work on FY 03 as soon as possible.

In late January, the Senate did pass its version of an "omnibus" FY 2003 appropriations bill—a single bill containing all 11 unfinished appropriations bills. Though across-the-board cuts were made to funding levels that were tentatively set when the individual appropriations bills were marked up in committee, the final funding figures contained in the omnibus bill should be encouraging to computing researchers and the science community in general. Perhaps most importantly, funding for the National Science Foundation would increase over 8 percent to \$5.2 billion in FY 03, including an increase to \$526 million for NSF's Computing

and Information Science and Engineering directorate. The increase to CISE represents a 15.8 percent increase over the FY 02 level, an increase of more than \$82 million.

House and Senate conferees will meet in mid-February to discuss the omnibus bill and attempt to craft a compromise bill that would pass both chambers later in February or early March. The outcome likely will not vary too significantly from the Senate-passed version, especially in funding for R&D. It should be noted that the final numbers for IT R&D overall are significantly higher than the 3 percent increase over FY 02 proposed by the President in his last budget in February 2002.

Part of the reason House and Senate appropriators may have felt comfortable proposing such large increases to IT-related research at NSF—indeed, to research all over NSF—was the overwhelming passage of the *Investing in America's Future* Act late last year. The act authorizes the doubling of NSF research over five years. Not surprisingly, the funding increase proposed for NSF in

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Cyberinfrastructure: The Critical Role of Computer Science and Engineering Research

By Peter A. Freeman and Lawrence L. Landweber, NSF

Computer science and engineering (CS&E) researchers have an opportunity to explore fundamental research questions in almost all fields of CS&E in the context of helping to create future versions of cyberinfrastructure (CI). They also have the opportunity to see how well new concepts and mechanisms work in practice by assisting with the provisioning of advanced CI in the near-term.

NSF is committed to exploiting the potential of computing, communications, and information technologies to revolutionize the conduct of science and engineering research and education in all fields. This revolution¹ promises discoveries currently unrealizable, a greatly enhanced understanding of the universe in which we live, and technological innovation in areas of great consequence to society. "Cyberinfrastructure" (CI) is the term we use for the advanced tools, technologies, resources, and services necessary to support this revolution.

Development, wide-scale deployment, and continuing renewal of ever more powerful versions of CI will require a sustained cooperative effort, including computer scientists and

engineers and domain scientists and engineers in all sectors, including universities, industry, and government agencies, both foreign and domestic. Research breakthroughs in computing, communications, and information technologies and paradigms will lead to new and transforming versions of CI. For these reasons, it is important to understand the critical role that will be played by CS&E research breakthroughs on the one hand, and the marvelous opportunity for new research in CS&E on the other.

The CI of the future will be available to science and engineering researchers and educators nationwide. Through ubiquitous, persistent communication networks, science and engineering researchers and educators

will have instantaneous access to state-of-the-art resources such as computational engines, data repositories, digital libraries, sensors, and field-specific instruments. Moreover, software-based resources and services—such as collaboration, data management, visualization, and simulation tools—will result in unique, shared, digital-knowledge environments in which researchers and educators collaborate, create, and promulgate new knowledge across distance, time, and fields of expertise.

Today's advanced computing, communications, and information technologies are a result of basic CS&E research performed over the past 40 years. With this in mind, it is

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Expanding the Pipeline Migrating Out of Computer Science

By J McGrath Cohoon and Lih-Yuan Chen

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Undergraduate enrollment in the computer science major skyrocketed through the mid- to late 1990s. Resources were strained as the number of students declaring a CS major rose year after year at rates that made it difficult for departments to find the necessary space, equipment, and faculty. Since 2000, this demand for a CS major appears to have leveled off and may even be declining. (For more information on the trends in newly declared majors, see "Survey Results Show Better Balance in Supply and Demand" by Vardi, Finin, and Henderson, elsewhere in this issue of CRN.)

However, the halting growth in numbers of new students is only half the story. There is now evidence that even before the number of students choosing a computing major started to fall, undergraduates who were already in computing majors began migrating out at higher rates than in the past. In other words, not only are fewer students going into a computing major, but more are switching out before earning their degree. This phenomenon occurs at varying rates in different types of programs.

Data from a new nationwide study of computer science programs reveal recent trends in both enrollment and migration out of the major. This study, "Departmental Factors in Gendered Attrition from Undergraduate IT Majors," focused on mid- to large-sized undergraduate programs in the contiguous United States. For this portion of the study, data came from 71 institutions. Ninety percent of these institutions were public, and 60 percent of the study institutions offered doctoral programs. We report here on the migration of all CS students. Analyses of gender differences will be discussed in other reports.

The Departmental Factors data in Table 1 show the annual rise in the study departments' total undergraduate enrollment. From 1994 to 1999, CS undergraduate enrollment at the average institution in this study grew by approximately 100 percent. These data show the recent changes in total student enrollment numbers, not new student numbers. The latter phenomenon is apparent in data from the 2000-01 and 2001-02 Taulbee Surveys of Ph.D.-granting institutions, which produced similar, but not identical, data to that produced by the Departmental Factors study. The Taulbee Survey measured newly declared majors and degrees awarded, not total enrollment.

More importantly, Figure 1 shows that while the average undergraduate enrollment was rising dramatically, students who remained at their institutions migrated out of the CS major at an average rate of 16 percent per year. (Note that the figure shows this number split into Ph.D. and non-Ph.D.-granting institutions and by upper and lower level.) During the years when enrollments increased,

In Ph.D.-Granting Institutions			In Non-Ph.D.-Granting Institutions		
Year	Undergraduate Enrollment	Annual % Increase	Year	Undergraduate Enrollment	Annual % Increase
1994-95	297		1994-95	224	
1995-96	285	-4%	1995-96	275	23%
1996-97	353	24%	1996-97	302	10%
1997-98	414	17%	1997-98	350	16%
1998-99	483	17%	1998-99	404	15%
1999-00	568	18%	1999-00	520	29%
Mean	400	14%	Mean	346	19%

the trend in overall attrition rates declined from 16 percent in 1994 to a low of 14 percent in 1996. But attrition began to grow in 1998 and reached a high of 19 percent in 1999, even before new enrollment stopped rising. This increase in attrition rates at the end of the 1990s shows that students began migrating out of the CS major even before fewer came into the major.

The migration out was not an effect of students choosing to enter the job market early. We know this because our migration rates only consider students who did not leave their institution. They continued as undergraduates, but in a different major. More likely causes are changes in the job market that led students motivated by career options to choose a different major, or growing student disaffection with conditions in departments that lacked adequate resources. Migration out is also not likely to be extreme relative to other science, mathematics, and engineering disciplines. Although no current data are available for comparison, Seymour and Hewitt (1997) showed that students leave the CS major at relatively low rates compared with these other disciplines.

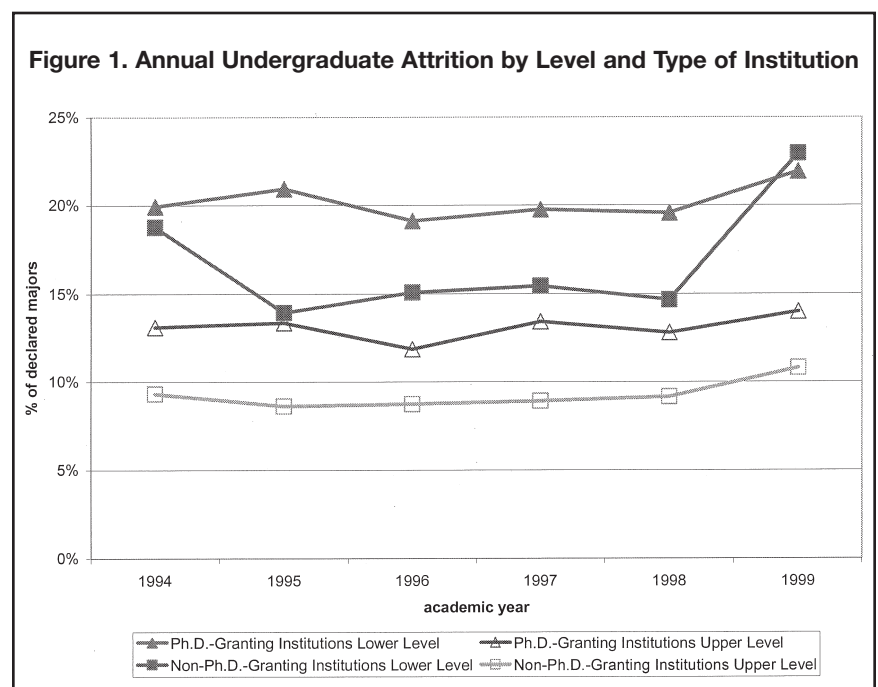
The trends shown by the Departmental Factors data were similar for both Ph.D.-granting and non-Ph.D.-granting institutions. They differed only in that the average Ph.D. institution saw more students migrate out of computer science than did the average non-Ph.D.-granting institution. This difference in CS attrition rates for the different types of institutions continued until the 1999-2000 academic

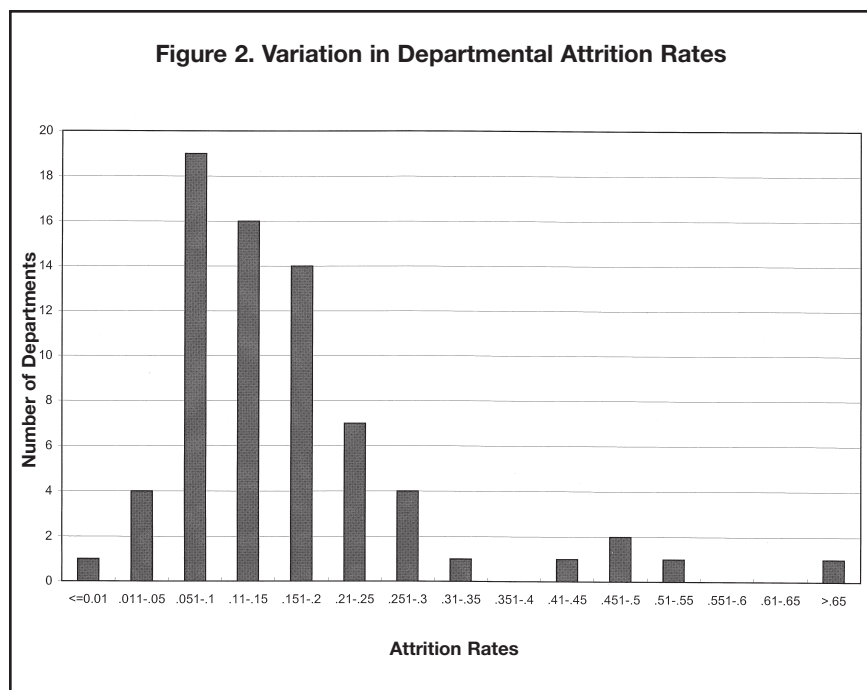
year when there was a large increase in attrition, particularly at non-Ph.D.-granting institutions (see Figure 1).

Not surprisingly, attrition was highest among first- and second-year students. Freshmen and sophomores migrated out of the computer science major each year at an average rate of 19 percent. Juniors and seniors were much less likely to leave for a different major. Their average attrition rate was only 12 percent. The rate for upper-level students was less in non-Ph.D.-granting institutions than in Ph.D.-granting institutions, and it demonstrated less of an increase in 1999 than did lower-level student attrition (see Figure 1).

Computer science departments varied considerably in their attrition rates (Figure 2), ranging from 1 to 66 percent. Departments in Ph.D.-granting institutions had rates that ranged from 1 percent to 53 percent. Departments in non-Ph.D.-granting institutions had rates that ranged from 5 to 66 percent. This variation in attrition rates suggests that some departmental characteristics might influence the rates at which students leave their programs.

Several of the characteristics that one might expect to influence departmental attrition rates were investigated for their relationship with attrition. Thus far, we have no evidence that students were any more or less likely to leave the major in public institutions than private institutions. Likewise, we found no relationship between attrition rates and student/faculty ratio. Looking at freshmen, sophomores, juniors, and seniors together, none of the





measures of academic quality we considered was significantly related to overall attrition rates.

However, it appears that upper- and lower-level students were motivated to leave by different factors, although there was a tendency for departments with high attrition among one group to also have high attrition among the other group ($r = .43$, significant at the .01 level). For juniors and seniors, we have only conducted preliminary analyses and have no results to report yet. For lower-level students, we found two factors that significantly correlated with attrition when we considered upper- and lower-level students separately.

The two significant correlations with attrition rates for lower-level students were overall grade point average (GPA) for a department's lower-level students and faculty scholarly quality at Ph.D.-granting institutions. Freshmen and sophomores were more likely to leave departments where the average overall grade point average was low ($r = -.47$, significant at the .01 level), and at Ph.D.-granting institutions,

lower-level students were also more likely to leave departments where the National Research Council rating of faculty scholarly quality was low ($r = -.62$, significant at the .01 level).

The measure of departments' faculty scholarly quality was produced by the National Research Council in 1993 by averaging the ratings of external experts. Ratings are strongly correlated with citations per faculty publication, research productivity, size of program, and production of new Ph.D.s. (Ehrenberg and Hurst, 1996). The rating scale is from zero to five with zero representing "not sufficient for doctoral education" and five representing "distinguished." In our study, the mean for rated departments was 2.44 with a standard deviation of 0.90. The minimum rating received was 1.35, and the maximum was 4.18.

The relationship between faculty scholarly quality and attrition calls to mind findings from research on attrition from science, mathematics, and engineering disciplines in general. Seymour and Hewitt (1997) found that the high rate at which students migrate out of these disciplines was

due to factors related to students' collegiate academic experiences. In particular, when they encountered the poor teaching and advising, harsh grading, and heavy demands that are not uncommon in these disciplines, many students switched to a different major.

If faculty scholarly quality and these pedagogical practices are related, it would explain why students are more likely to leave higher-rated departments. Our survey of CS faculty showed that faculty in departments rated high in scholarly quality were less likely to consider the lecture the most important element of their instruction ($r = -.58$, sig. at .01 level), and less likely to consider their responsibility as instructors satisfied by presenting information to the students ($r = -.47$, sig. at .05 level). To the extent that these opinions represent good pedagogical practices, they hint that in Ph.D.-granting institutions, departments with faculty of the highest scholarly quality may also be those with the best pedagogy. This hypothesis receives some support from our focus group data where students reported that knowledge and the ability to communicate it were very important faculty qualifications. When these qualities were lacking, undergraduates were discouraged in their CS studies.

Grading was the other factor that contributed to lower-level students leaving. Departments where the average freshman and sophomore had a low GPA were more likely to lose students than were departments where grades were higher. Partial correlations showed that the effect of grades persisted even when controlling for the median SAT score of an institution's incoming freshmen, and when controlling for the average math SAT of lower-level students in the department. Furthermore, there were no significant relationships between attrition rates and either the median SAT or the math SAT. Thus, the effect of grades on attrition does not appear to be a simple matter of students' academic quality (see Figure 3).

Focus group data suggest that low grades may lead some students to switch majors because students feel they get too little reward for a great deal of effort. For example, numerous students reported that faculty could be overly tough in their evaluation of very difficult work. At least one student argued that receiving low grades in return for extensive, good-quality work was the most obvious reason people left the department.

Conclusion

Computer science departments have been struggling for years to keep up with demand for their programs. However, the data presented here indicate that the steep upward trend in demand has changed direction. New student numbers are falling, and students increasingly are migrating out of undergraduate CS programs.

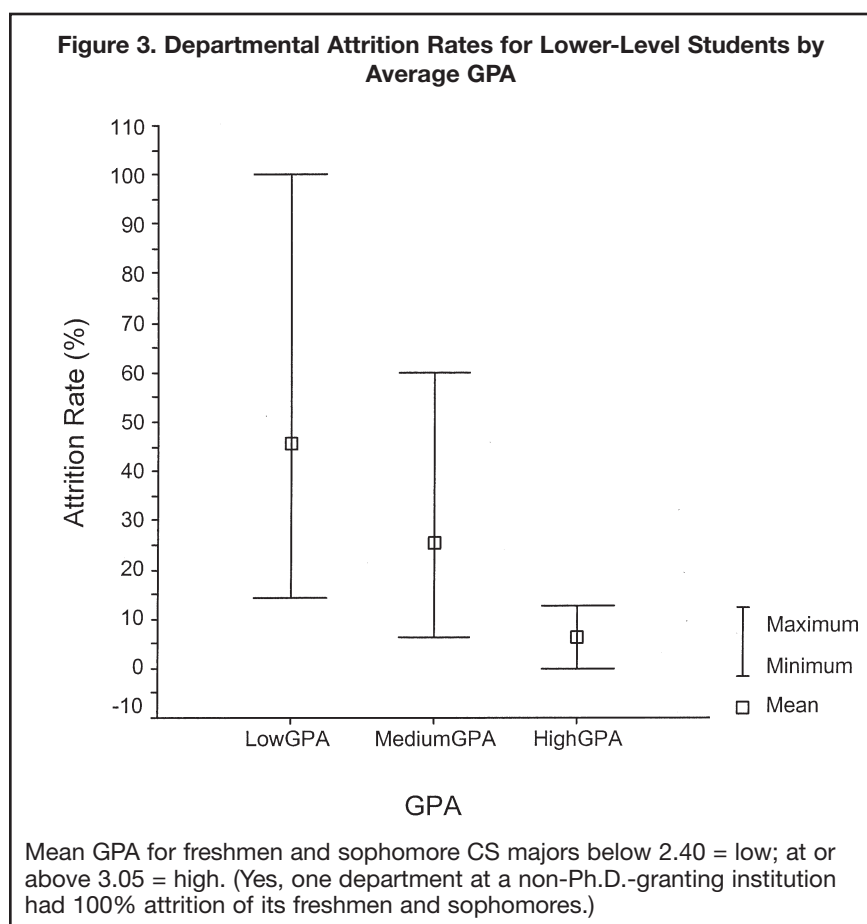
If interest in the undergraduate CS major continues to decline, departments may have to make recruiting and retaining students more of a priority. Hints at effective intervention points are provided by the departmental and institutional characteristics that vary with student attrition rates. This first look at those characteristics suggests that freshmen and sophomores are more likely to leave the CS major when grade point averages for students in their department are low, and in Ph.D.-granting institutions, when the scholarly quality of their CS faculty is low.

The results discussed here are preliminary; much further investigation is needed before we can confidently assert which factors affect departments' attrition rates. Yet despite the need for more research on predictive factors, the trends demonstrating a decline in undergraduate interest in CS now have more than one data set supporting them. As the discipline catches its collective breath from the rush to keep up with demand, it might do well for some departments to consider how to attract and retain students.

More information about this project and its results is available online at <http://curry.edschool.virginia.edu/ITattrit>

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Mean GPA for freshmen and sophomore CS majors below 2.40 = low; at or above 3.05 = high. (Yes, one department at a non-Ph.D.-granting institution had 100% attrition of its freshmen and sophomores.)

Three CRA Board Members Elected to NAE

Congratulations to all members of the CSE community who were recently elected Members of the National Academy of Engineering.

Among those honored were CRA board members Philip Bernstein (Microsoft Research), Randy Bryant (Carnegie Mellon University), and Mary Jane Irwin (Penn State University). Others elected from CSE were Daniel Bricklin (Trellix Corp.), Jeffrey Buzen (BMC Software), Hector Garcia-Molina (Stanford University), Jeff Hawkins (Handspring Inc.), Debasis Mitra (Lucent Technologies), Sanjit Mitra (UC Santa Barbara), Eugene Myers (UC Berkeley), Richard Rashid (Microsoft Corp.), Burton Smith (Cray Research Inc.), and J. Turner Whitted (Microsoft Research).

A list of the 77 new NAE members and nine foreign associates is provided on the NAE website: (<http://www4.nationalacademies.org/news.nsf/isbn/02142003?OpenDocument>) ■

CRA: 30 Years of Service to the Computing Research Community of North America

By William Aspray

The year was 1972. For about a decade, universities had been forming doctoral programs in computer science; and by this time there were about 65 of them. Students were beginning to graduate in significant numbers, but there was no obvious way for them to look for jobs. Various professional meetings were being held, but none was focused primarily on academic research. The major computing professional societies, ACM and the IEEE Computer Society, were doing many good things, but the computing research community was not their principal interest. These societies had many interests to serve, and the majority of their members were programmers and others working in non-research positions in industry who had little interest in research issues. The department chairs of these newly formed doctoral programs believed they needed more attention paid to their own managerial needs, such as information about curriculum, doctoral production, and salaries, as well as to research issues.

These department chairs had begun to take action outside of the existing professional organizations. In 1970, Earl Schweppe had convened a meeting at his home institution, the University of Kansas, to discuss research issues in computing. Many of the key researchers from North America attended. In the November 1971 issue of *Communications of the ACM*, Penn State's Preston Hammer called for a new winter meeting that could serve for both research communication and job placement of new doctorates.

The following year, a group of chairs from doctoral computer science programs—mostly from the midwestern United States, but also from Canada and other parts of the United States—met to discuss issues concerning doctoral production and research in computer science. Several meetings were held in Columbus, Ohio, convened by the Ohio State department chair, Marshall Yovits. The group included (among others whose names have not been recorded in the historical record): Bob Ashenurst (Chicago), Sam Conte (Purdue), George Dodd (General Motors Research), Preston Hammer (Penn State), Harry Hedges (Michigan State), Gerry Salton (Cornell), Jim Snyder (Illinois), Bob Stewart (Iowa State), Orrin Taulbee (Pittsburgh), Joe Traub (Carnegie Mellon), and Albert Wouk (Alberta).

These discussions led to the first Computer Science Conference. At first, the effort was encouraged by the ACM, but eventually the negotiations between the ACM officials and Yovits's group broke down over how to run the conference, and the chairs decided to organize the conference on their own. They obtained funding

from NSF in 1972 and held the first conference in Columbus, Ohio, in 1973. It was more successful than anyone had imagined possible. Yovits's group organized another conference the following year—once again successful.

Now that it was a proven entity, not just someone's idea, ACM took renewed interest. For a few years, the annual research conference was jointly organized by this group of chairs and by ACM. Eventually it was decided to let ACM, which had the organizational wherewithal to plan this annual research conference, handle it on its own. ACM continued the conference well into the 1990s, when specialization and conferences of special interest groups took their toll on the annual general-purpose research conference, and it was retired. In the early years, the meeting was always held in February, in the heart of the recruiting season for new Ph.D.s. An employment registry was organized each year by Orrin Taulbee. The meeting was also used to run panels or workshops for department chairs on effective departmental management.

The chairs had wider interests than just the research conference, so they decided to organize themselves into a free-standing organization called the Computer Science Board (CSB). Their charter called for them to organize computer science chairs, promote communication among them, and provide a forum for discussion. They set a ratio of representation on the CSB at three-quarters academic and one-quarter industrial. The Computing Research Association continues to follow that practice today, with only minor modifications. CSB held its board meetings at the annual research conference.

From the beginning, there was participation by Canadian as well as U.S. computer scientists. Albert Wouk from the University of Alberta was a member of the original board. For many years, John Brzozowski from the University of Waterloo was active on the board, and for a while served as an officer. John Tartar from the University of Alberta was board chair and a key figure in the organization throughout most of the 1980s. Maria Klawe from the University of British Columbia, Ken Sevcik from the University of Toronto, and Frank Tompa from the University of Waterloo continued this tradition in the 1990s and into the new century. In 2001, a new arrangement was made to better allow the Canadians to develop their own organization (CACS/AIC), while at the same time remaining active within CRA as an affiliate society.

In the early 1970s, the number of departments of computer science in North America was growing rapidly. As one of its first projects, the CSB decided to keep track of all the departments that grant doctorates in

computer science, and to inform them about news of interest. (Later the list was expanded to include departments awarding doctorates in computer engineering.) The list was named in honor of George Forsythe, who had founded the program at Stanford University. The Forsythe list continues to be maintained by CRA and is used to inform the community today.

The department chairs decided they needed a place to come together and meet. There were too many other things going on at the research conference (the technical papers themselves, placing one's graduate students, recruiting) to focus on the more general departmental needs and the state of the profession. Because the field was a new and thriving intellectual discipline, there were many growing pains and a need for concerted action. Tony Ahern from the University of Utah told the group of a resort that would be ideal for their meetings, nestled in the Wasatch Mountains not far from Salt Lake City. Starting in 1974, the organization has held a meeting for department chairs in the summer of every even-numbered year at the Snowbird Resort and Conference Center. Throughout the 1980s and into the 1990s, the Snowbird conference resulted in a White Paper on the state of computing. As the number of participants increased in the 1990s, it became too unwieldy to obtain the group consensus needed to prepare a White Paper, and so the practice was discontinued.

As early as the 1960s, members of the computing profession had begun to collect statistics about academic computing. Tom Keenan from the University of Rochester and John Hamblen from the Southern Regional Educational Board had compiled information about computers in use on campuses nationwide. In 1970, Orrin Taulbee from the University of Pittsburgh began collecting information about national production of computer science doctorates. Taulbee's work became an activity of CSB when the organization was formed in 1972. In the early years the results were published in *Communications of the ACM*, in the

1980s in both *CACM* and *Computer*, and in *Computing Research News* since its first publication in 1989.

CSB addressed a number of issues in the 1970s and 1980s of concern to the computer science departments. The prominent issues from this era included the mismatch between growth and research funding in computer science, the ways in which computer time was being charged for in academic departments, and the shortage of good journal referees. As one can see in Table 1 of topics discussed at the 1984 Snowbird meeting, many are not all that different from those being addressed today.

There had been talk throughout the 1980s that the computer science community did not have adequate representation in Washington. The biologists, chemists, and especially the physicists had this kind of representation and used it effectively, for example, in increasing the level of funding for research in their disciplines. This issue was of interest not only to the academic computer scientists, but also to people in the National Science Foundation and the National Academies who were interested in computing. It was in this same time period that the National Science Foundation formed a directorate for Computer and Information Science and Engineering, and that the National Research Council restarted its Computer Science and Telecommunications Board.

A lengthy discussion of this issue was held at the 1986 Snowbird meeting. As a result, changes were made to CSB that same year. CSB began to position itself to act as the representative for all of computing research, not just for doctoral computer science departments. It incorporated itself as a not-for-profit organization. It changed its name to the Computing Research Board so it would include computer engineering as well as computer science. It changed its election procedures so that board members were elected by the chairs of doctoral-granting departments, instead of by the board itself, so the board would better represent the computing research community.

CRA: 30 Years of Service
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Table 1: Topics Discussed at the 1984 CSB Meeting at Snowbird

Inadequate national output of CS doctorates
Rising starting salaries for CS faculty
Faculty/student immigration problems
Recruitment and retention of doctoral students and faculty
Role of masters programs in doctoral departments
Common core doctoral curriculum
Computing infrastructure for research and instruction—equipment maintenance, programming support personnel, etc.
Accreditation of academic programs
Placement of CS programs in faculties of arts and science versus colleges of engineering

The State of CRA – An Update

By Jim Foley, CRA
Chairman

In September 2001, I provided our members an update on CRA activities. Even then we were concerned about how the economic slowdown might affect CRA. I can report that the effect has, in fact, been fairly modest.

On the one hand, academic membership has continued to climb, from 182 then to 224 now. We have lost a few industrial labs, but several government labs have joined, so our lab membership is remaining steady at around 25. We have six affiliate members—ACM, AAAI, CACS/AIC (Canadian Association of Computer Science/Association Informatique Canadienne), IEEE Computer Society, SIAM, and USENIX. We appreciate the support of all our members.

On the other hand, total revenues have decreased. Job advertising in CRN is down. Fewer corporate labs are renewing at the sponsoring (\$50K), sustaining (\$30K), or supporting (\$12K) levels. As a consequence, we are cutting some costs, dipping into reserves, and requesting labs that are financially able to increase their levels of support.

At Snowbird in July we bid farewell to Bill Aspray as our Executive Director, and welcomed Andrew Bernat. Bill and Andy worked very well together to ensure a smooth transition, and Andy has already launched new initiatives to continue moving the organization forward.

On the programmatic front, we are moving ahead at full speed. Recall that the mission of CRA is to strengthen research and advanced education in computing and allied fields. We do this by working to influence **policy** that impacts computing research, encouraging the development of **human resources**, contributing to the cohesiveness of the professional **community**, and collecting and disseminating **information** about the importance and the state of computing research. Please browse <http://www.cra.org> to learn about our many programs in these areas—I think you'll be quite impressed!

One activity I would like to highlight is our Grand Challenges conference series. The first conference, on

Computer Systems, was conceived by Anita Jones and Bill Wulf as a way to define and articulate major new research challenges (see CRN, September 2002, p. 3). A summary of their findings will be published shortly, even as plans are being made for a second conference on information privacy and computer security.

Two years ago we decided to place increased emphasis on three key areas: human resources, research funding, and communications. Here's what is happening in each of these areas.

1. Human Resources

Let there be no mistake—while the temporary economic slowdown may be giving a bit of breathing room to the demand for Ph.D. computing professionals, our output is still low. In fact, our most recent Taulbee Survey (see "Survey Results Show Better Balance in Supply and Demand" elsewhere in this issue) found that Ph.D. production actually decreased this past year. The good news is that the pipeline is filling up, with an increase of 11% over last year in students passing their qualifying exams.

CRA's report, "The Recruitment and Retention of Faculty in Computer Science and Engineering" is in press and should be published in March. An NSF-funded study, its goal was to collect data and information on the perceived difficulties that departments are facing in the recruitment and retention of both graduate students and faculty. This report was initiated because of concern about the effect that departures of faculty to industry might have on the ability of universities to carry out their research and teaching missions. The report identifies significant problems in the faculty recruitment process and makes several key recommendations. A group of 13 experts was convened to conduct the study, chaired by CRA's Treasurer, Jack Stankovic.

A CRA-W study funded by NSF is currently examining the recruitment and retention policies, practices, and programs at institutions with graduate computer science and computer engineering programs, particularly with regard to female graduate students. The seven-person committee is led by CRA's Vice Chair, Jan Cuny.

The first Tapia Celebration of Diversity in Computing, an activity of the Coalition to Diversify Computing (a joint committee of ACM, CRA, and IEEE-CS) was held in Houston, under ACM sponsorship and with partial financial support from CRA. The second conference in Atlanta later this year will be co-sponsored by CRA and ACM, and we hope that IEEE-CS as well will join in sponsoring future conferences.

2. Funding for Computing Research

Our major activity is providing information to the legislative and executive branches of our government. We have been called on by federal policymakers for advice on structuring the federal IT R&D portfolio, what a new initiative for cyber security research and development should look like, and the shape of a new research agency within the newly created Department of Homeland Security. We like to think that we helped (along with many other groups) to increase federal funding for computing research by more than 15 percent for this current fiscal year. CRA was one of only six groups asked to participate in the press conference announcing the introduction of the NSF doubling bill that was subsequently signed into law by President Bush. This authorization bill, when followed by yearly appropriations, will double NSF funding over the next five years. The Senate version of the FY 03 Omnibus Appropriations includes an \$81 million addition to NSF CISE in FY 03, or 15.8 percent over FY 02, increasing the directorate's budget to \$596 million for the year.

CRA was also asked for input on legislation that would authorize a large increase in cyber security R&D at NSF and the National Institute of Standards and Technology. CRA Board Member Eugene Spafford joined Bill Wulf in testifying before the House Science Committee and providing advice as the bill moved through the legislative process. At the press conference celebrating final passage, CRA was one of only two groups recognized by Science Committee Chairman Sherwood Boehlert as having been critical to the bill's success. The bill, authorizing

\$900 million in new research opportunities over the next five years, was signed by the President in December.

Jeff Vitter, co-chair of the government affairs committee, has re-energized CRAN (the Computing Research Advocacy Network) and used it to help move the NSF doubling bill forward and to mitigate proposed cuts to IT research at DARPA. Thanks to all of you who participated by writing your senators and representatives.

We are looking to develop ways to further engage the computing community with the very important computer-intensive research activities at NIH. Your suggestions and initiatives are most welcome!

3. Communications

CRA's ability to have an impact depends in part on the overall awareness of CRA among those whom we seek to influence and serve. We intend to help the newly revitalized communications committee to increase CRA's visibility and make it better known.

The communications committee, chaired by CRA's Vice Chair, Jan Cuny, is developing new ways to build CRA's visibility among our constituencies, starting with advanced Ph.D. students. This year CRA will institute a program that will offer welcome packages to students who have passed their thesis exams (or the equivalent). These packages will include a CRA tee shirt, a bookmark with information for graduate students, a copy of CRN, and other materials explaining CRA's mission. Also, go to <http://www.cra.org> and select "CRA For ..." for pages designed to inform specific CRA constituencies.

Peter Harsha, our Director of Government Affairs, is stepping up his already active communications program to include several industry groups and the government relations offices of major corporations.

Please let us hear from you with thoughts on how CRA can continue to best serve the computing research community.

Jim Foley (foley@cc.gatech.edu) is Professor and Stephen Fleming Chair in Telecommunications at Georgia Tech. ■

CRA Elects Officers to Two-Year Terms

The CRA board has recently elected its officers who will serve two-year terms (July 1, 2003 to June 30, 2005). Re-elected to second terms were James D. Foley (Georgia Institute of Technology), Board Chair; Janice Cuny (University of Oregon), Vice Chair; and Kathleen McKeown (Columbia University), Secretary. Phil Bernstein (Microsoft Research) was elected CRA's Treasurer. CRA is grateful to Jack Stankovic, whose term as Treasurer ends June 30, and other members of the current executive committee for their dedicated service.

James D. Foley is a Professor in the College of Computing at Georgia Tech, where he holds the Stephen Fleming Chair in Telecommunications. He also holds an appointment in the School of Electrical and Computer Engineering. A CRA board member since 1996 and

Treasurer from 1998 to 2000, he was elected Board Chair in 2000. Dr. Foley has also served on the elections, industry, and government affairs committees. He co-chaired the 1998 Snowbird Conference, and served on the program committee for Snowbird 2000.

Janice Cuny, Professor of Computer and Information Science at the University of Oregon, joined the CRA board in 2000. She currently chairs both the Communications Committee and a study on the Recruitment and Retention of Women in CS&E Graduate Programs. She has chaired the Selection Committees for the Outstanding Undergraduate Awards and for the A. Nico Habermann Award. A CRA-W member since 1993, Professor Cuny served a term as co-chair of the committee. She has been actively involved in CRA-W's

Faculty Mentoring Workshops, she has mentored a number of their DMP students, and she currently works on increasing CRA-W's funding.

Kathleen R. McKeown, Professor of Computer Science at Columbia University, has been a CRA board member since 1999. She currently co-chairs the External Awards Committee, and co-chaired the New Chairs Workshop at Snowbird 2000 and 2002. Professor McKeown is a Fellow of the American Association of Artificial Intelligence. She was named Outstanding Woman Scientist, Association for Women in Science, New York 2000. Professor McKeown received the NSF Faculty Award for Women and the NSF Presidential Young Investigator Award. She also was an invited speaker at the International Joint Conference on Artificial Intelligence in Japan in 1997.

Philip Bernstein, a board member since 2001, is a Senior Researcher at Microsoft Research and an Affiliate Professor at the University of Washington. He has worked as an industrial researcher, executive manager, executive technical consultant, and product architect at both hardware and software companies, and as a professor in large and small computer science departments. Bernstein was appointed a member of CRA's Executive Committee last year, and also served as co-chair of the 2002 Conference at Snowbird. Dr. Bernstein was recently elected a Member of NAE. He is an ACM Fellow and a winner of the ACM SIGMOD Innovations Award (1994). ■

2001-2002 Taulbee Survey

Survey Results Show Better Balance in Supply and Demand

By Moshe Y. Vardi, Tim Finin, and Tom Henderson

This article and the accompanying figures and tables present the results of the 32nd annual CRA Taulbee Survey¹ of Ph.D.-granting departments of computer science (CS) and computer engineering (CE) in the United States and Canada. This survey is conducted annually by the Computing Research Association to document trends in student enrollment, employment of graduates, and faculty salaries.

Information is gathered during the fall and early winter. The period the data cover varies from table to table. Degree production (Ph.D., Master's, and Bachelor's) and total Ph.D. enrollments refer to the previous academic year (2001-2002). Data for new students in all categories and total enrollments for Master's and Bachelor's degrees refer to the current academic year (2002-2003). Projected student production and information on faculty salaries and demographics also refer to the current academic year. Faculty salaries are those effective January 1, 2003. Responses received by January 3, 2003 are included in the analysis.

The data were collected from Ph.D.-granting departments only. A total of 225 departments were surveyed, compared with 215 departments last year. As shown in Figure 1, 182 departments returned their survey forms, for a response rate of 80 percent (the same as last year). The return rate of 10 out of 28 (36%) for Computer Engineering (CE) programs is very low, as has been the case for several years (see below). We attribute this low response to two factors: 1) many CE programs are part of an ECE department, and they do not keep separate statistics for CE vs. EE; and 2) many of these departments are not aware of the Taulbee Survey or its importance. The response rate for US CS departments (150 of 170, or 88%) was very good, as was the 82% response rate for Canadian programs. We thank all respondents who completed this year's questionnaire. Departments that participated are listed at the end of this article.

The set of departments responding is somewhat different each year (10 more departments responded this year); thus, we must approach any trend analysis with caution. Due to the low return rate for CE departments, the same caveat applies to the CE data. In our discussion, we will focus on the combined numbers for CS and CE. Because of the low

Figure 1. Number of Respondents to Faculty Salary Questions

Year	US CS Depts.	US CE Depts.	Canadian	Total
1995	110/133 (83%)	9/13 (69%)	11/16 (69%)	130/162 (80%)
1996	98/131 (75%)	8/13 (62%)	9/16 (56%)	115/160 (72%)
1997	111/133 (83%)	6/13 (46%)	13/17 (76%)	130/163 (80%)
1998	122/145 (84%)	7/19 (37%)	12/18 (67%)	141/182 (77%)
1999	132/156 (85%)	5/24 (21%)	19/23 (83%)	156/203 (77%)
2000	148/163 (91%)	6/28 (21%)	19/23 (83%)	173/214 (81%)
2001	142/164 (87%)	8/28 (29%)	23/23 (100%)	173/215 (80%)
2002	150/170 (88%)	10/28 (36%)	22/27 (82%)	182/225 (80%)

return rate for CE, the CRA board has decided to combine the CS and CE data in future Taulbee Surveys and not offer separate data for CE.

For more details on how the faculty salary information (Tables 27-34) is to be interpreted, see the article in the January 2003 CRN on Preliminary Taulbee Faculty Salary Data (<http://www.cra.org/CRN/articles/jan03/vardi.finin.henderson.html>).

The survey form itself is modified slightly each year to ensure a high rate of return (e.g., by simplifying and clarifying), while continuing to capture the data necessary to understand trends in the discipline and also reflect changing concerns of the computing research community. In previous years, Tables 27-34 have only reported the mean salaries. We believe, however, that for aggregating data the median is more meaningful than the mean, since it is less skewed by outlying data points. This year we have included both mean and median salaries to facilitate comparison with previous Taulbee Surveys. In future surveys, however, we intend to report only median salaries. Departments will be asked to provide only the minimum, median, and maximum salaries.

Ph.D. Degree Production and Enrollments (Tables 1-8)

As shown in Table 1, a total of 849 Ph.D. degrees were awarded in 2002 by the 182 responding departments. As Figure 2 indicates, this is the lowest number since 1989. Most likely this number is still reflecting the high-tech boom of the late 1990s, when start-up companies presented an extremely attractive employment option for computer scientists.

The prediction from last year's survey that 1,205 Ph.D. degrees would be awarded in 2002 was, as usual, overly optimistic, with an "optimism" ratio, defined as the actual over the

predicted, being 0.70. Given next year's prediction of 1,224 graduates (Table 1), we predict the actual number will be between 850 and 950.

All other numbers indicate a strong growth in the Ph.D. supply in the next few years. The number entering Ph.D. programs (Table 5) increased from 2,702 to 3,286 (22%). The number who passed qualifiers (Table 1) increased from 1,244 to 1,375 (11%), but the number who passed thesis proposal exams (Table 1) decreased slightly from 917 to 884 (-4.0%). Total Ph.D. enrollment (Table 6) increased from 8,810 to 10,021 (14%). Looking beyond our survey results, some CS programs are reporting record numbers of applicants to their Ph.D. programs this year. It seems that the failure of the dot-com boom has convinced many recent Bachelor's and Master's degree recipients to return to graduate school.

Table 4 shows area of specialization versus types of first appointments for Ph.D. recipients in 2002. The

table shows a marked shift from industrial to academic employment. More than 52% of fresh Ph.D.s found academic employment (43% last year) and only 38.2% found industrial employment (49% last year). There has also been a non-negligible increase in the number of postdoctoral positions (from 56 to 83).

Most statistics on gender and ethnicity for Ph.D. students (Tables 2, 3, 7, 8) show remarkably little change from last year. White and nonresident-alien men continue to account for a very large fraction of our Ph.D. production and enrollments. Women constitute a significant minority (19% of enrollments, 18% of graduates.) All other underrepresented groups are very small minorities. As Figure 3 illustrates, we see a slight decrease in the proportion of enrolled Ph.D. students who are nonresident aliens, probably reflecting an increased interest in Ph.D. programs by U.S. students.

Taulbee Continued on Page 7

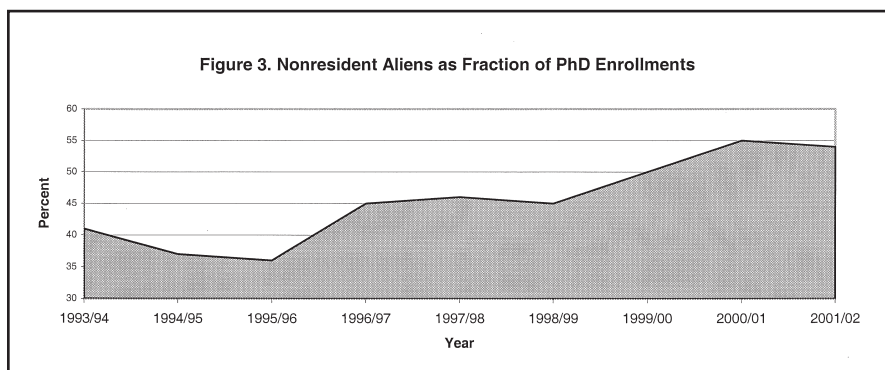
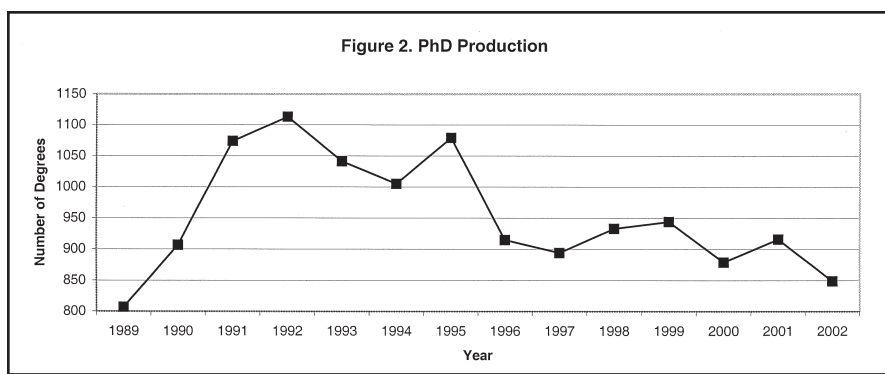


Table 1. Ph.D. Production by Type of Department and Rank

Department, Rank	Ph.D.s Produced	Avg. per Dept.	Ph.D.s Next Year	Avg. per Dept.	Passed Qualifier	Avg. per Dept.	Passed Thesis Exam	Avg. per Dept.
US CS 1-12	197	16.4	213	17.8	267	22.3	153	12.8
US CS 13-24	135	11.3	154	12.8	150	12.05	117	9.8
US CS 25-36	69	6.3	117	10.6	159	14.5	75	6.8
US CS Other	340	3.0	503	4.5	633	5.7	368	3.3
Canadian	72	3.3	110	5.0	111	5.1	57	2.6
US CE	36	3.6	127	12.7	55	5.5	114	11.4
Total	849	4.7	1,224	6.8	1,375	7.7	884	4.9

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Master's and Bachelor's Degree Production and Enrollments (Tables 9-16)

The statistics on Master's and Bachelor's programs show mixed trends. Master's degrees were awarded to 7,918 students, a decrease of 4 percent from last year. Bachelor's degrees numbered 20,677, an increase of 21 percent. This year's Master's production exceeded the projection from last year's survey by 8 percent, while Bachelor's production exceeded projections by 11 percent.

The number of new undergraduates actually dropped slightly from 23,090 to 23,033 (0%) (see Figure 5), in contrast with significant increases in recent years. As yet, we cannot determine whether this was simply an artifact of the changes in the departments reporting, or the start of a new trend. Perhaps the decline in the technology industry is making computer science and engineering less alluring to new undergraduates. In addition, some programs may be operating in "saturation" mode, where they simply cannot accept more undergraduate majors, given their teaching resources. It is quite clear that the period of explosive growth in enrollments in Bachelor's

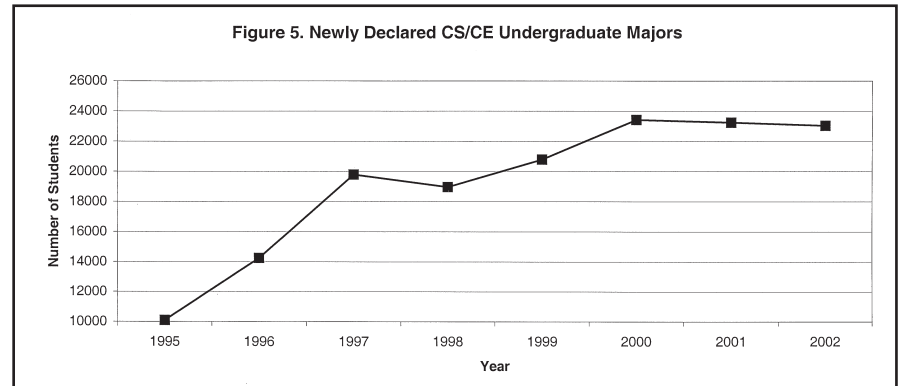
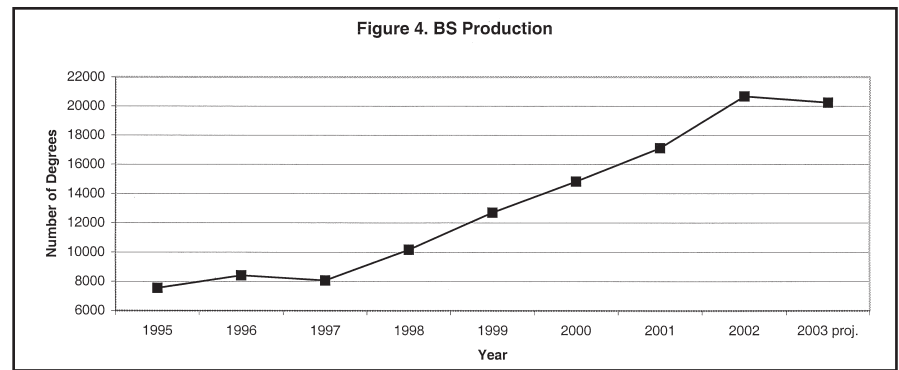


Table 2. Gender of Ph.D. Recipients by Type of Degree

	CS		CE		CS&CE	
Male	610	82.2%	70	84.3%	680	82.4%
Female	132	17.8%	13	15.7%	145	17.6%
Total have Gender Data for	742		83		825	
Unknown	24		0		24	
Total	766		83		849	

Table 3. Ethnicity of Ph.D. Recipients by Type of Degree

	CS		CE		CS&CE	
Nonresident Alien	316	44.8%	54	68.4%	370	47.2%
African-American, Non-Hispanic	9	1.3%	1	1.3%	10	1.3%
Native American/Alaskan Native	2	0.3%	4	5.1%	6	0.8%
Asian/Pacific Islander	81	11.5%	3	3.8%	84	10.7%
Hispanic	11	1.6%	0	0.0%	11	1.4%
White, Non-Hispanic	275	39.0%	16	20.3%	291	37.1%
Other/Not Listed	11	1.6%	1	1.3%	12	1.5%
Total have Ethnicity Data for	705		79		784	
Ethnicity/Residency Unknown	61		4		65	
Total	766		83		849	

programs is over. Anecdotal evidence suggests that the trend of increasing enrollments is near its peak, and is perhaps headed towards a decline.

In all other numbers, we again see mixed trends in both Bachelor's and Master's programs. New Master's students (Table 13) decreased by 3 percent; total enrollments in Bachelor's programs (Table 16) increased by 11% and enrollments in Master's programs (Table 15) increased by 21%. We seem to be in a period of changing patterns in all degree programs; it may take a while before the new trends are clear.

Most demographics regarding gender and ethnicity for Bachelor's and Master's students show remarkable stability when compared with last year's results. As with Ph.D. recipients (whose numbers actually decreased this year), the proportion of Master's degree recipients who are nonresident aliens decreased slightly, from 57 percent last year to 56 percent this year (Table 10).

Faculty Demographics (Tables 17-23)

Over the past year, the total number of faculty increased by 3 percent to a total of 5,520. This increase was present in all faculty categories (but not for researchers or postdocs). Considering that 229 faculty are reported to have left their current positions in academia (Table 23), the survey indicates 405 new faculty positions this year. Our Ph.D. production shows only 351 graduates taking faculty positions (Table 4.) Some of the new teaching faculty may not have Ph.D. degrees, and some new faculty may have come from nonacademic sources. There is some influx of existing Ph.D.-holders into academia as industrial labs are being downsized and reorganized.

This year's faculty growth to 5,520 was less than the prediction of 5,955 from last year's survey. The planned two-year growth rate of 14 percent is significantly less than last year's

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Table 4. Employment of New Ph.D. Recipients by Specialty

New Ph.D.s in Ph.D.-Granting Depts.	Artificial Intelligence/Robotics	Hardware/Architecture	Numerical Analysis/Scientific Computing	Programming Languages/Compilers	OS/Networks	Software Engineering	Theory/Algorithms	Graphics/Human Interfaces	Databases/Information Systems	Other/Unknown	Total		
Tenure-track	35	16	7	9	36	9	28	12	23	12	187	27.1%	50.8%
Researcher	12	3	3	2	5	2	3	11	2	5	48	6.9%	
Postdoc	27	5	4	5	7	5	13	5	5	7	83	12.0%	
Teaching Faculty	3	0	1	5	4	3	6	3	2	6	33	4.8%	
New Ph.D.s, Other Categories													
Other CS/CE Dept.	1	2	0	1	2	0	1	1	0	1	9	1.3%	49.2%
Non-CS/CE Dept.	0	0	0	0	0	2	0	1	0	1	4	0.6%	
Industry	39	38	11	17	30	20	18	26	39	26	264	38.2%	
Government	7	0	5	0	0	1	0	0	1	4	18	2.6%	
Self-Employed	0	0	1	0	1	1	0	0	0	0	3	0.4%	
Employed Abroad	3	0	2	1	9	1	2	3	5	5	31	4.5%	
Unemployed	2	1	0	0	1	0	2	3	0	2	11	1.6%	
Total have Employment Data for	129	65	34	40	95	44	73	65	77	69	691	100.0%	100.0%
Unknown	18	6	1	6	2	0	6	9	8	100	156		
Total	147	71	35	46	97	44	79	74	85	169	847		

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Table 5. New Ph.D. Students in Fall 2002 by Department Type and Rank

Department, Rank	CS				CE				CS & CE	
	New Admit	MS to Ph.D.	Total	Avg. per Dept.	New Admit	MS to Ph.D.	Total	Avg. per Dept.	Total	Avg. per Dept.
US CS 1-12	388	89	477	39.8	0	0	0	0	477	39.8
US CS 13-24	304	40	344	28.7	6	0	6	0.5	350	29.2
US CS 25-36	298	34	332	30.2	0	0	0	0	332	30.2
US CS Other	1,157	368	1,525	13.6	94	28	122	1.1	1,647	14.7
Canadian	178	64	242	11.0	11	11	22	1.0	264	12.0
US CE	0	0	0	0	120	96	216	21.6	216	21.6
Total	2,325	595	2,920	16.3	231	135	366	2.0	3,286	18.4

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21 percent. The projected target of 5,881 positions for 2003-04 reflects growth of less than 7 percent. Last year we observed that the planned growth targets were unrealistically aggressive, compared with the predicted supply of new Ph.D.s. This year, the combination of increasing supply (because of the increased attractiveness of academia) and decreasing targets makes the recruiting objectives seem more feasible, although the tough economic

environment suggests that even 7% growth is perhaps too optimistic.

Table 23 on faculty "losses" shows that a large number took academic positions elsewhere. Only 89 (1.6% of total faculty) actually left academia through death, retirement, or taking nonacademic positions. This compares with 140 (2.6% of total faculty) last year. Overall, the rate of departures over the past few years has remained within the very stable range of between 1.6 percent and 2.6 percent. The faculty "retention problem" that was so much discussed over the

past few years seems to have solved itself.

The demographic data for faculty (Tables 19-22) are very similar to those from last year. We see that the gender split of new faculty (82% male, 18% female) is very close to the split for new Ph.D. recipients (Table 2). There is some skew in the distribution, with somewhat more men in tenure-track (83%) and research (89%) positions, and somewhat more women in teaching (26%) and other (60%) positions, but these numbers are actually more balanced than in previous years.

It is interesting to compare the ethnicity data for new faculty (Table 20) with that of Ph.D. recipients (Table 3). Fully 55 percent of the new faculty are white, non-Hispanic, even though only 37 percent of the Ph.D. recipients are in this category. By contrast, only 23 percent of the new faculty are nonresident aliens, whereas fully 47 percent of the degree recipients are in that category. Some new faculty could have become residents after receiving their Ph.D. degrees, but it seems clear that proportionately fewer foreign students take positions at U.S. universities.

The second question asked departments to "provide the number of graduate students supported as full-time students as of fall 2002," further categorized as teaching assistants, research assistants, fellows, or computer systems' supporters, and split between those on institutional vs. external funds. The results are shown in Table 25. Overall, we can see that the higher-ranked schools are able to support more students with research positions through research assistantships and fellowships, while the other schools rely more on teaching assistantships to support their students. Canadian schools also have a high proportion (52%) of students supported via teaching assistantships. The number supported for computer systems support is very small.

The third question asked respondents to "provide the net amount (as of fall 2002) of an academic-year stipend for a graduate student (not including tuition or fees)." The results are shown in Table 26. Canadian stipends are shown in Canadian dollars. The numbers suggest a gap between departments in the top two ranking bands and departments in lower bands in all categories of graduate-student support.

Table 6. Ph.D. Degree Total Enrollment by Department Type and Rank

Department, Rank	CS		CE		CS & CE	
US CS 1-12	1,824	20.5%	0	0.0%	1,824	18.2%
US CS 13-24	1,380	15.5%	9	0.8%	1,389	13.9%
US CS 25-36	1,086	12.2%	0	0.0%	1,086	10.8%
US CS Other	3,929	44.2%	314	27.7%	4,243	42.3%
Canadian	667	7.5%	51	4.5%	718	7.2%
US CE	1	0.0%	760	67.0%	761	7.6%
Total	8,887		1,134		10,021	

Table 7. Ph.D. Program Total Enrollment by Gender

	CS		CE		CS & CE	
Male	7,019	80.5%	970	85.6%	7,989	81.1%
Female	1,701	19.5%	163	14.4%	1,864	18.9%
Total have Gender Data for	8,720		1,133		9,853	
Unknown	167		1		168	
Total	8,887		1,134		10,021	

Table 8. Ph.D. Program Total Enrollment by Ethnicity

	CS		CE		CS&CE	
Nonresident Alien	4,217	53.6%	721	67.2%	4,938	55.2%
African-American, Non-Hispanic	124	1.6%	29	2.7%	153	1.7%
Native American/Alaskan Native	13	0.2%	1	0.1%	14	0.2%
Asian/Pacific Islander	750	9.5%	63	5.9%	813	9.1%
Hispanic	99	1.3%	9	0.8%	108	1.2%
White, Non-Hispanic	2,568	32.6%	224	20.9%	2,792	31.2%
Other/Not Listed	103	1.3%	26	2.4%	129	1.4%
Total have Ethnicity Data for	7,874		1,073		8,947	
Ethnicity/Residency Unknown	1,013		61		1,074	
Total	8,887		1,134		10,021	

Research Expenditures and Graduate Student Support (Tables 24-26)

The first question asked: "For the most recently completed fiscal year, what was the department's total expenditure (including indirect costs or "overhead" as stated on project budgets) from external sources of support for Computer Science/Engineering research?" The results are reported in Table 24, showing both absolute and per-capita numbers, where capitation is computed relative to the number of tenured and tenure-track faculty members. Canadian levels are shown in Canadian dollars. The data show a clear correlation between ranking and per-capita expenditures, although this correlation holds only between ranking bands (1-12, 13-24, etc.) and per-capita expenditures. As expected, Canadian departments show a lower level of expenditures from external sources, stemming, no doubt, from the different way that research is funded in Canada. Computer engineering departments also show a lower level of expenditures from external sources, but no conclusion can be drawn due to the low response rate of computer engineering departments.

Faculty Salaries (Tables 27-34)

U.S. average salaries increased by just over 3 percent for different categories, less than last year's increases (average salaries for non-teaching faculty actually declined slightly). Canadian salaries (shown as 12-month salaries in Canadian dollars) increased by 3.8% to 5.2% for different categories, less than for last year (again with a slight decrease for non-teaching faculty).

Concluding Observations

Overall, signs indicate a continued growth in graduate (both Master's and Ph.D.) programs in computer science and engineering. Although Ph.D. output declined slightly this year, it appears there will be a significant increase over the next few years. The growth at the Bachelor's level has diminished compared with recent years, with even a slight decrease in the number of newly declared majors. It is still too early to tell whether this is the start of a trend toward declining undergraduate enrollments (as has happened at other times during downturns in the technology

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2001-2002 Taulbee Survey

Table 9. Gender of Bachelor's and Master's Recipients

	Bachelor's						Master's					
	CS		CE		CS & CE		CS		CE		CS & CE	
Male	12,497	81.2%	3,201	88.0%	15,698	82.5%	4,696	74.1%	732	82.6%	5,428	75.1%
Female	2,891	18.8%	435	12.0%	3,326	17.5%	1,643	25.9%	154	17.4%	1,797	24.9%
Total have Gender Data for	15,388		3,636		19,024		6,339		886		7,225	
Unknown	1,519		134		1,653		692		1		693	
Total	16,907		3,770		20,677		7,031		887		7,918	

Table 10. Ethnicity of Bachelor's and Master's Recipients

	Bachelor's						Master's					
	CS		CE		CS & CE		CS		CE		CS & CE	
Nonresident Alien	921	8.5%	216	8.4%	1,137	8.5%	3,218	55.7%	476	60.8%	3,694	56.3%
African-American, Non-Hispanic	368	3.4%	115	4.5%	483	3.6%	65	1.1%	18	2.3%	83	1.3%
Native American/Alaskan Native	44	0.4%	6	0.2%	50	0.4%	9	0.2%	0	0.0%	9	0.1%
Asian/Pacific Islander	2,346	21.7%	437	17.1%	2,783	20.1%	909	15.7%	49	6.3%	958	14.6%
Hispanic	390	3.6%	90	3.5%	480	3.6%	68	1.2%	9	1.1%	77	1.2%
White, Non-Hispanic	6,261	57.8%	1,484	57.9%	7,745	57.8%	1,420	24.5%	230	29.4%	1,650	25.1%
Other/Not Listed	506	4.7%	213	8.3%	719	5.4%	93	1.6%	1	0.1%	94	1.4%
Total have Ethnicity Data for	10,836		2,561		13,397		5,782		783		6,565	
Ethnicity/Residency Unknown	6,071		1,209		7,280		1,249		104		1,353	
Total	16,907		3,770		20,677		7,031		887		7,918	

Table 11. Bachelor's Degree Candidates for 2002-2003 by Department Type and Rank

Department, Rank	CS		CE		CS & CE	
US CS 1-12	2,093	12.4%	233	6.9%	2,326	11.5%
US CS 13-24	1,515	9.0%	466	13.8%	1,981	9.8%
US CS 25-36	1,623	9.6%	73	2.2%	1,696	8.4%
US CS Other	8,186	48.5%	1,580	46.6%	9,766	48.2%
Canadian	3,445	20.4%	277	8.2%	3,722	18.4%
US CE	0	0.0%	758	22.4%	758	3.7%
Total	16,862		3,387		20,249	

Table 12. Master's Degree Candidates for 2002-2003 by Department Type and Rank

Department, Rank	CS		CE		CS & CE	
US CS 1-12	809	11.8%	65	6.7%	874	11.2%
US CS 13-24	688	10.1%	0	0.0%	688	8.8%
US CS 25-36	479	7.0%	0	0.0%	479	6.1%
US CS Other	4,335	63.3%	405	41.8%	4,740	60.7%
Canadian	534	7.8%	76	7.8%	610	7.8%
US CE	0	0.0%	423	43.7%	423	5.4%
Total	6,845		969		7,814	

Table 13. New Master's Students in Fall 2002 by Department Type and Rank

Department, Rank	CS		CE		CS & CE	
	Total	Avg. per Dept.	Total	Avg. per Dept.	Total	Avg. per Dept.
US CS 1-12	539	49.0	60	5.5	599	54.5
US CS 13-24	749	62.4	2	0.2	751	62.6
US CS 25-36	330	30.0	0	0.0	330	30.0
US CS Other	4,348	38.5	342	3.0	4,690	41.5
Canadian	832	37.8	44	2.0	876	39.8
US CE	0	0.0	283	28.3	283	28.3
Total	6,798	38.0	731	4.1	7,529	42.1

Table 14. New Undergraduate Students in Fall 2002 by Department Type and Rank

Department, Rank	CS			CE			CS & CE Majors	
	Pre-Major	Major	Average Major per Dept.	Pre-Major	Major	Average Major per Dept.	Major	Average Major per Dept.
US CS 1-12	720	940	85.5	0	206	18.7	1,146	104.2
US CS 13-24	192	1,100	91.7	0	446	37.2	1,546	128.8
US CS 25-36	408	2,595	216.3	0	0	0.0	2,595	216.3
US CS Other	3,637	9,348	83.5	795	2,219	19.8	11,567	103.3
Canadian	1,536	5,089	231.3	0	378	17.2	5,467	248.5
US CE	0	0	0.0	302	712	71.2	712	71.2
Total	6,493	19,072	106.6	1,097	3,961	22.1	23,033	128.7

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economy), whether it simply indicates that many programs are operating at full capacity and cannot expand further, or whether it is just an artifact of the shifting departments responding to our survey. We suspect, however, that this is the start of a trend toward declining enrollments.

Rankings

For tables that group computer science departments by rank, the rankings are based on information collected in the 1995 assessment of research and doctorate programs in the United States conducted by the National Research Council.

The top twelve schools in this ranking are: Stanford, Massachusetts

Institute of Technology, University of California (Berkeley), Carnegie Mellon, Cornell, Princeton, University of Texas (Austin), University of Illinois (Urbana-Champaign), University of Washington, University of Wisconsin (Madison), Harvard, and California Institute of Technology. All schools in this ranking participated in the survey this year.

CS departments ranked 13-24 are: Brown, Yale, University of California (Los Angeles), University of Maryland (College Park), New York University, University of Massachusetts (Amherst), Rice, University of Southern California, University of Michigan, University of California (San Diego), Columbia, and University of Pennsylvania.² All

schools in this ranking participated in the survey this year.

CS departments ranked 25-36 are: University of Chicago, Purdue, Rutgers, Duke, University of North Carolina (Chapel Hill), University of Rochester, State University of New York (Stony Brook), Georgia Institute of Technology, University of Arizona, University of California (Irvine), University of Virginia, and Indiana. All schools in this ranking participated in the survey this year.

CS departments that are ranked above 36 or that are unranked that responded to the survey include: Arizona State University, Auburn, Boston, Brandeis, Case Western Reserve, Clemson, College of William and Mary, Colorado School of Mines, Colorado State, Dartmouth, DePaul, Florida Institute of Technology, Florida International, Florida State, George Mason, George Washington, Georgia State, Illinois Institute of Technology, Iowa State, Johns Hopkins, Kansas State, Kent State, Lehigh, Louisiana State, Michigan State, Michigan Technological, Mississippi State, Montana State, New Jersey Institute of Technology, New Mexico State, North Carolina State, North Dakota State, Northeastern, Northwestern, Oakland, Ohio State, Oklahoma State, Old Dominion, Oregon Health

& Science, Oregon State, Pennsylvania State, Polytechnic, Portland State, Rensselaer Polytechnic, Southern Methodist, State University of New York (Albany and Buffalo), Stevens Institute, Syracuse, Texas A&M, Texas Tech, Tufts, Utah State, Vanderbilt, Virginia Commonwealth, Virginia Polytechnic, Washington State, Washington (St. Louis), Wayne State, West Virginia, Western Michigan, Worcester Polytechnic, and Wright State.

University of: Alabama (Birmingham, Huntsville, and Tuscaloosa), Arkansas, California (at Davis, Riverside, Santa Barbara, and Santa Cruz), Central Florida, Cincinnati, Colorado (at Boulder, Colorado Springs, and Denver), Connecticut, Delaware, Denver, Florida, Georgia, Hawaii, Illinois (Chicago), Iowa, Kansas, Kentucky, Louisiana (Lafayette), Maine, Maryland (Baltimore Co.), Massachusetts (at Boston and Lowell), Minnesota, Missouri (at Rolla and Columbia), Nebraska (Lincoln), Nevada (Las Vegas), New Mexico, North Texas, Notre Dame, Oklahoma, Oregon, Pittsburgh, South Carolina, South Florida, Tennessee (Knoxville),

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Table 15. Master's Degree Total Enrollment by Department Type and Rank

Department, Rank	CS		CE		CS & CE	
US CS 1-12	1,323	6.6%	65	3.0%	1,388	6.2%
US CS 13-24	1,654	8.2%	4	0.2%	1,658	7.4%
US CS 25-36	781	3.9%	0	0.0%	781	3.5%
US CS Other	14,583	72.2%	1,083	50.3%	15,666	70.1%
Canadian	1,856	9.2%	279	13.0%	2,135	9.6%
US CE	0	0.0%	721	33.5%	721	3.2%
Total	20,197		2,152		22,349	

Table 16. Bachelor's Degree Program Total Enrollment by Department Type and Rank

Department, Rank	CS			CE			CS & CE Majors	
	Pre-Major	Major	Average Major per Dept.	Pre-Major	Major	Average Major per Dept.	Total	Average Major per Dept.
US CS 1-12	644	5,860	532.7	0	634	57.6	6,494	590.4
US CS 13-24	191	4,636	386.3	0	1,756	146.3	6,392	532.7
US CS 25-36	1,510	6,618	551.5	0	0	0.0	6,618	551.5
US CS Other	8,422	40,423	360.9	1,551	7,730	69.0	48,153	429.9
Canadian	4,067	21,566	980.3	0	1,886	85.7	23,452	1,066.0
US CE	0	0	0	697	3,352	335.2	3,352	335.2
Total	14,834	79,103	441.9	2,248	15,358	85.8	94,461	527.7

Table 17. Actual and Anticipated Faculty Size by Position

	Actual		Projected		Expected Two-Year Growth	
	2002-2003	2003-2004	2003-2004	2004-2005		
Tenure-Track	4,047	4,337	4,337	4,618	571	14.1%
Researcher	374	415	415	459	85	22.7%
Postdoc	278	302	302	351	73	26.3%
Teaching Faculty	708	708	708	737	29	4.1%
Other/Not Listed	113	119	119	125	12	10.6%
Total	5,520	5,881	5,881	6,290	770	13.9%

Table 18. Actual and Anticipated Faculty Size by Department Type and Rank

	Actual		Projected		Expected Two-Year Growth	
	2002-2003	2003-2004	2003-2004	2004-2005		
US CS 1-12	692	732	732	781	89	12.9%
US CS 13-24	494	537	537	570	76	15.4%
US CS 25-36	480	530	530	580	100	20.8%
US CS Other	2,807	2,985	2,985	3,194	387	13.8%
Canadian	883	953	953	1,011	128	14.5%
US CE	164	144	144	154	-10	-6.1%
Total	5,520	5,881	5,881	6,290	770	13.9%

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Table 19. Gender of Newly Hired Faculty

	Tenure-Track		Researcher		Postdoc		Teaching		Other		Total	
Male	331	82.8%	74	89.2%	86	84.3%	84	74.3%	2	40.0%	577	82.1%
Female	69	17.3%	9	10.8%	16	15.7%	29	25.7%	3	60.0%	126	17.9%
Total	400	56.9%	83	11.8%	102	14.5%	113	16.1%	5	0.7%	703	
Unknown	0		0		0		0		0		0	

Table 20. Ethnicity of Newly Hired Faculty

	Tenure-Track		Researcher		Postdoc		Teaching Faculty		Other		Total	
Nonresident Alien	79	21.7%	15	20.8%	42	43.3%	10	10.0%	0	0.0%	146	22.9%
African-American, Non-Hispanic	4	1.1%	0	0.0%	1	1.0%	2	2.0%	0	0.0%	7	1.1%
Native American/Alaskan Native	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Asian/Pacific Islander	61	16.8%	10	13.9%	24	24.7%	10	10.0%	1	20.0%	106	16.6%
Hispanic	4	1.1%	3	4.2%	1	1.0%	3	3.0%	0	0.0%	11	1.7%
White, Non-Hispanic	204	56.0%	44	61.1%	29	29.9%	71	71.0%	4	80.0%	352	55.2%
Other/Not Listed	12	3.3%	0	0.0%	0	0.0%	4	4.0%	0	0.0%	16	2.5%
Total have Ethnicity Data for	364		72		97		100		5		638	
Ethnicity/Residency Unknown	36		11		5		13		0		65	
Total	400		83		102		113		5		703	

Table 21. Gender of Current Faculty

	Full		Associate		Assistant		Teaching Faculty		Total	
Male	1,630	92.2%	1,029	86.9%	1,054	84.6%	579	73.8%	4,292	86.2%
Female	137	7.8%	155	13.1%	192	15.4%	206	26.2%	690	13.8%
Total have Gender Data for	1,767	35.5%	1,184	23.8%	1,246	25.0%	785	15.8%	4,982	

Table 22. Ethnicity of Current Faculty

	Full		Associate		Assistant		Teaching Faculty		Total	
Nonresident Alien	7	0.4%	22	2.0%	214	19.2%	32	4.2%	275	6.0%
African-American, Non-Hispanic	4	0.2%	8	0.7%	16	1.4%	18	2.4%	46	1.0%
Native American/Alaskan Native	6	0.4%	2	0.2%	3	0.3%	3	0.4%	14	0.3%
Asian/Pacific Islander	287	17.9%	231	20.9%	191	17.2%	49	6.5%	758	16.6%
Hispanic	18	1.1%	18	1.6%	24	2.2%	16	2.1%	76	1.7%
White, Non-Hispanic	1,242	77.4%	784	71.1%	645	58.0%	626	83.0%	3,297	72.1%
Other/Not Listed	41	2.6%	38	3.4%	20	1.8%	10	1.3%	109	2.4%
Total have Ethnicity Data for	1,605		1,103		1,113		754		4,575	
Ethnicity/Residency Unknown	162		81		133		31		407	
Total	1,767		1,184		1,246		785		4,982	

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Texas (at Arlington, Dallas, El Paso, and San Antonio), Tulsa, Utah, and Wyoming.

Computer Engineering departments participating in the survey this year include: Cornell, Georgia Institute of Technology, Johns Hopkins, North Carolina State, Northwestern, Oregon State, Purdue, Rensselaer Polytechnic, University of California (Santa Cruz), University of Illinois (Urbana-Champaign), and the University of New Mexico.

Canadian departments participating in the survey include: Carleton, Dalhousie, McGill, Memorial, Queen's, Simon Fraser, and York universities. **University of:** Alberta, British Columbia, Calgary, Laval, Manitoba, Montreal, New Brunswick, Quebec (Montreal), Regina, Saskatchewan, Toronto (CS and ECE), Victoria, Waterloo, and Western Ontario.

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Endnotes

¹The title of the survey honors the late Orrin E. Taulbee of the University of Pittsburgh, who conducted these surveys for the Computer Science Board until 1984, with retrospective annual data going back to 1970.

²Although the University of Pennsylvania and the University of Chicago were tied in the National Research Council rankings, CRA made the arbitrary decision to place Pennsylvania in the second tier of schools.

Table 23. Faculty Losses

	Total
Died	4
Retired	59
Took Academic Position Elsewhere	108
Took Nonacademic Position	26
Remained, but Changed to Part-Time	11
Other	18
Unknown	3
Total	229

All tables with rankings: Statistics sometimes are given according to departmental rank. Schools are ranked only if they offer a CS degree and according to the quality of their CS program as determined by reputation. Those that only offer CE degrees are not ranked, and statistics are given on a separate line, apart from the rankings.

All ethnicity tables: Ethnic breakdowns are drawn from guidelines set forth by the U.S. Department of Education.

All faculty tables: The survey makes no distinction between faculty specializing in CS vs. CE programs. Every effort is made to minimize the inclusion of faculty in electrical engineering who are not computer engineers. ■

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Table 24. Total Expenditure from External Sources for CS/CE Research by Department Rank and Type

Department, Rank	Minimum	Total Expenditure			Minimum	Per Capita Expenditure		
		Average	Median	Maximum		Average	Median	Maximum
US CS 1-12	\$1,450,000	\$16,950,260	\$9,904,050	\$61,902,887	\$87,879	\$376,583	\$307,130	\$952,352
US CS 13-24	\$4,686,549	\$8,661,334	\$7,500,000	\$14,543,024	\$144,168	\$323,123	\$279,252	\$618,853
US CS 25-36	\$545,118	\$4,778,106	\$5,000,000	\$12,324,811	\$29,307	\$173,590	\$170,549	\$318,308
US CS Other	\$125,000	\$2,065,788	\$1,368,755	\$14,319,441	\$12,454	\$108,516	\$90,129	\$572,778
Canadian	\$171,445	\$1,958,063	\$1,267,918	\$8,659,771	\$8,572	\$54,278	\$36,781	\$199,075
US CE	\$155,595	\$2,308,094	\$1,000,000	\$9,007,293	\$33,687	\$114,863	\$108,475	\$281,478

Table 25. Graduate Students Supported as Full-Time Students by Department Type and Rank

Department/ Rank	Number on Institutional Funds					Number on External Funds				
	Teaching Assistants	Research Assistants	Full-Support Fellows	Graduate Assistants for Computer Systems Support	Other	Teaching Assistants	Research Assistants	Full-Support Fellows	Graduate Assistants for Computer Systems Support	Other
US CS 1-12	377 22.0%	243 14.0%	115 6.6%	0 0.0%	1 0.1%	0 0.0%	807 46.5%	175 10.1%	0 0.0%	17 1.0%
US CS 13-24	331 20.3%	24 1.5%	66 4.1%	1 0.1%	0 0.0%	0 0.0%	1,012 62.2%	194 12.0%	0 0.0%	0 0.0%
US CS 25-36	418 33.8%	160 13.0%	48 3.9%	0 0.0%	5 0.4%	8 0.6%	540 43.7%	49 4.0%	0 0.0%	7 0.6%
US CS Other	1,900 40.8%	388 8.3%	147 3.2%	87 1.9%	38 0.8%	6 0.1%	1,887 40.5%	177 3.8%	1 0.0%	23 0.5%
Canadian	354 37.0%	188 19.6%	21 2.2%	0 0.0%	10 1.0%	29 3.0%	225 23.5%	121 12.6%	0 0.0%	10 1.0%
US CE	198 21.9%	106 11.7%	20 2.2%	10 1.1%	1 0.1%	0 0.0%	559 61.8%	11 1.2%	0 0.0%	0 0.0%
Total	3,578 32.2%	1,109 10.0%	417 3.8%	98 0.9%	55 0.5%	43 0.4%	5,030 45.3%	727 6.5%	1 0.0%	57 0.5%

Table 26-1. Fall 2002 Academic-Year Graduate Stipends by Department Type and Rank

Department, Rank	Minimum	Total Assistantships			Minimum	Research Assistantships		
		Mean	Median	Maximum		Mean	Median	Maximum
US CS 1-12	\$9,587	\$15,378	\$16,268	\$18,276	\$13,419	\$16,905	\$17,005	\$19,632
US CS 13-24	\$3,490	\$14,247	\$14,522	\$19,000	\$8,736	\$15,969	\$15,639	\$20,808
US CS 25-36	\$11,260	\$13,787	\$13,701	\$15,510	\$12,336	\$14,197	\$14,079	\$15,510
US CS Other	\$3,000	\$12,543	\$12,500	\$20,800	\$3,000	\$13,286	\$12,833	\$20,800
Canadian	\$1,305	\$9,564	\$10,000	\$18,000	\$4,000	\$12,434	\$13,000	\$19,700
US CE	\$1,519	\$12,820	\$13,559	\$19,464	\$1,409	\$12,100	\$13,606	\$19,464

Table 26-2. Fall 2002 Academic-Year Graduate Stipends by Department Type and Rank

Department, Rank	Minimum	Full-Support Fellows			Assistantships for Computer Systems Support			
		Mean	Median	Maximum	Minimum	Mean	Median	Maximum
US CS 1-12	\$16,812	\$18,132	\$18,000	\$20,000	*	*	*	*
US CS 13-24	\$12,000	\$17,747	\$16,518	\$28,500	*	*	*	*
US CS 25-36	\$12,000	\$15,206	\$15,459	\$19,000	*	*	*	*
US CS Other	\$4,200	\$15,521	\$15,200	\$25,000	\$7,500	\$11,984	\$12,150	\$18,000
Canadian	\$15,000	\$19,504	\$18,850	\$25,000	*	*	*	*
US CE	\$1,625	\$13,826	\$15,000	\$19,464	*	*	*	*

*Numbers not reported due to low number of respondents

Table 26-3. Fall 2002 Academic-Year Graduate Stipends by Department Type and Rank

Department, Rank	Minimum	Mean	Median	Maximum
US CS 1-12	*	*	*	*
US CS 13-24	*	*	*	*
US CS 25-36	*	*	*	*
US CS Other	\$3,450	\$11,401	\$11,939	\$15,832
Canadian	\$2,250	\$10,270	\$5,100	\$30,000
US CE	*	*	*	*

*Numbers not reported due to low number of respondents

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Table 27. Nine-month Salaries, 146 Responses of 170 US CS Computer Science Departments

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Non-Tenure Teaching Faculty	629	\$20,000	\$47,023	\$81,840	\$55,044	\$54,269	\$24,000	\$64,192	\$132,400
Assistant Professor	953	\$46,800	\$70,764	\$90,500	\$75,114	\$75,138	\$61,308	\$79,402	\$120,000
Associate Professor	920	\$53,772	\$75,497	\$110,000	\$83,502	\$83,051	\$63,648	\$92,468	\$175,000
Full Professor	1,340	\$39,873	\$86,960	\$146,000	\$109,030	\$105,294	\$80,760	\$142,408	\$280,786

Table 28. Nine-month Salaries, 11 Responses of 12 US CS Computer Science Departments Ranked 1-12

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Non-Tenure Teaching Faculty	75	\$37,296	\$53,956	\$76,136	\$71,672	\$71,719	\$66,150	\$88,114	\$110,000
Assistant Professor	118	\$50,000	\$74,711	\$82,000	\$80,891	\$81,357	\$83,200	\$86,483	\$96,000
Associate Professor	86	\$62,995	\$84,148	\$103,000	\$91,412	\$90,847	\$79,300	\$97,949	\$120,000
Full Professor	218	\$51,600	\$88,632	\$109,800	\$122,732	\$116,825	\$139,518	\$168,860	\$198,646

Table 29. Nine-month Salaries, 12 Responses of 12 US CS Computer Science Departments Ranked 13-24

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Non-Tenure Teaching Faculty	56	\$46,542	\$60,096	\$81,840	\$69,208	\$66,993	\$62,200	\$80,631	\$100,000
Assistant Professor	94	\$74,000	\$78,070	\$82,000	\$83,673	\$82,239	\$82,500	\$90,538	\$117,000
Associate Professor	64	\$67,915	\$85,663	\$97,520	\$92,985	\$92,069	\$85,900	\$98,827	\$127,000
Full Professor	200	\$76,596	\$93,962	\$111,300	\$127,845	\$121,462	\$153,422	\$185,306	\$280,786

Table 30. Nine-month Salaries, 12 Responses of 12 US CS Computer Science Departments Ranked 25-36

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Non-Tenure Teaching Faculty	51	\$39,634	\$53,998	\$75,408	\$62,620	\$61,198	\$59,223	\$75,352	\$132,400
Assistant Professor	100	\$46,800	\$71,228	\$80,000	\$77,535	\$77,485	\$73,380	\$82,390	\$88,134
Associate Professor	96	\$63,907	\$78,592	\$92,277	\$89,354	\$89,588	\$87,100	\$99,811	\$120,000
Full Professor	153	\$68,199	\$89,345	\$109,000	\$115,998	\$114,630	\$110,650	\$160,350	\$195,550

Table 31. Nine-month Salaries, 111 Responses of 134 US CS Computer Science Departments Ranked Higher than 36 or Unranked

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Non-Tenure Teaching Faculty	448	\$20,000	\$44,182	\$81,500	\$51,100	\$50,474	\$24,000	\$58,903	\$109,000
Assistant Professor	641	\$48,269	\$69,521	\$90,500	\$73,338	\$73,486	\$61,308	\$77,153	\$120,000
Associate Professor	674	\$53,772	\$73,284	\$110,000	\$81,131	\$80,667	\$63,648	\$90,493	\$175,000
Full Professor	769	\$39,873	\$85,747	\$146,000	\$104,770	\$101,286	\$80,760	\$132,954	\$275,000

Table 32. Nine-month Salaries, 8 Responses of 29 US Computer Engineering Departments

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Non-Tenure Teaching Faculty	17	\$44,112	\$59,798	\$89,611	\$66,766	\$66,425	\$54,468	\$73,027	\$89,611
Assistant Professor	57	\$55,000	\$70,110	\$80,020	\$75,165	\$73,805	\$70,002	\$79,455	\$94,500
Associate Professor	39	\$69,000	\$77,036	\$87,000	\$84,283	\$81,446	\$69,786	\$91,021	\$110,000
Full Professor	87	\$76,398	\$87,501	\$95,000	\$114,659	\$102,720	\$80,220	\$148,338	\$200,000

Table 33. Twelve-month Salaries, 21 Responses of 27 Canadian Computer Science Departments (Canadian Dollars)

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Non-Tenure Teaching Faculty	80	\$38,411	\$56,510	\$94,000	\$63,252	\$62,360	\$47,283	\$72,363	\$100,000
Assistant Professor	219	\$43,582	\$70,619	\$95,119	\$78,268	\$77,823	\$59,568	\$86,788	\$127,000
Associate Professor	195	\$62,298	\$81,692	\$111,000	\$90,450	\$89,799	\$62,947	\$101,079	\$153,000
Full Professor	291	\$71,853	\$93,314	\$111,912	\$110,505	\$109,668	\$94,000	\$136,275	\$188,133

Table 34. Nine-month Salaries for New Ph.D.s, Responding US CS and CE Departments

Position	Number of People	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Tenure-Track Faculty	163	\$58,055	\$75,902	\$102,000	\$76,595	\$76,453	\$58,055	\$77,225	\$105,000
Researcher	5	\$42,000	\$61,750	\$72,000	\$63,250	\$63,250	\$42,000	\$64,750	\$75,000
Postdoc	40	\$26,000	\$47,360	\$60,000	\$50,663	\$51,201	\$40,512	\$53,083	\$65,000
Non-Tenure Teaching Faculty	12	\$36,000	\$55,297	\$70,772	\$55,297	\$55,297	\$36,000	\$55,297	\$70,772

Cyberinfrastructure from Page 1

clear that future generations of CI will be realized only if significant long-term, as well as near-term, investments in CI-related CS&E research and education are made on a continuing basis. This is important because of benefits to science and engineering research broadly; these benefits, in turn, become primary drivers for many of the efforts to strengthen and improve our society. In addition, today's CI will become tomorrow's commonplace computing, communications, and information environment.

Basic, or long-term, research on the Internet's underlying technology was done in the 1960s and 1970s. Basic research on Hypertext, the foundation for the WWW, was done in the 1960s. Relational database systems, the principal type of database system used today, were first described by researchers in the 1970s. There are many other such examples in fields relevant to CI.

The above examples illustrate something most of us already know—that it may take 10 to 20 years or more to move basic research results from the laboratory to commercial systems. Along the way, and prior to commercialization, prototypes will be built whose successors will be available for use by early adopters; in this case, the country's science and engineering research and education

communities. This is what happened with the NSFNET, which, in 1986, became the world's first large-scale Internet.

In addition to the basic, long-term research described above, there is a second, nearer-term (2 to 5 years) category of CS&E research that is critical to the success of current and future generations of CI. This research often involves significant complexity and, more often than not, requires collaboration among CS&E researchers and those in other fields of science and engineering who wish to use the resulting CI.

Both of these types of research are essential to realizing the CI vision, and they are indeed complementary. Both long-term and near-term CI-related research is likely to be conducted at universities. Partnerships with industry are a traditional component of experimental CS&E projects, but industry, with ever fewer exceptions, generally does not participate in such projects until the last stages—for example, the last 12 to 18 months of short-term research efforts prior to product development.

Following are a few representative examples of relevant short-term research areas: Middleware, Resource Management and Scheduling, Visualization and Interpretation, End-End Performance, and Software Engineering.

One could argue that *all* areas of long-term, CS&E research are relevant to future CIs, but the following

are a few representative examples of relevant long-term research areas: Human Computer Interfaces, Information Management Systems, Integrated Sensing and Signal Processing, Computer Networks, Architectures for High Performance Computing, Secure and Reliable Software, Distributed Computing, Algorithms.

The figure below describes the relationship we see between key components in the CI lifecycle. This lifecycle is critical to ensuring that the future offers new breakthrough opportunities for science and engineering. The process begins with basic CS&E research, carried out by computer scientists and engineers for the most part and informed by a vision of scientific opportunities and challenges that cannot be solved with existing CI. This is followed by the building of prototypes/experimental systems and associated near-term research. Industrial partners may enter at this stage. This leads to the development of new CI, which provides the vehicle for solving new classes of science and engineering problems. And during this process there will be continuing input to CS&E researchers from the science and engineering research communities as to their fanciful hopes for future capabilities.

It is not possible to predict the results of future basic research. Hence we cannot today describe the CI of 2010 or 2020. We can only say with some assurance that the future CI

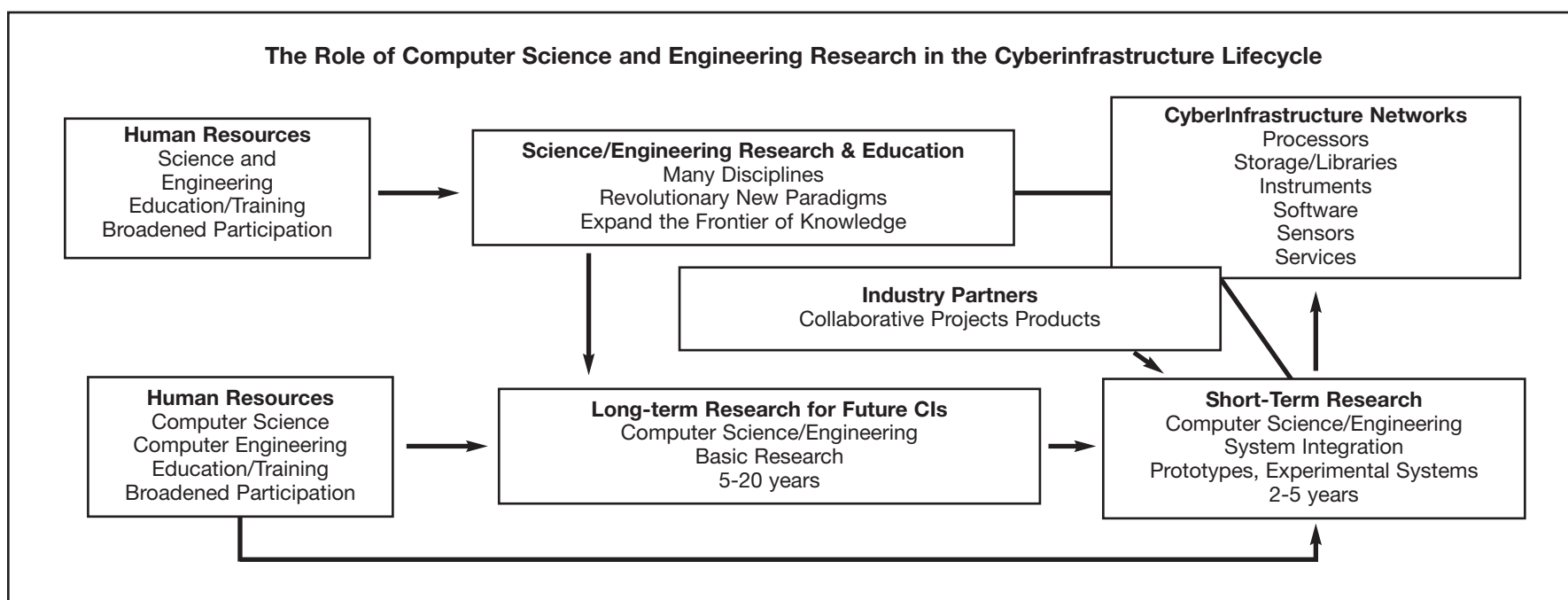
will be very different from today's CI. The development of these future CIs will rest on the research that we in CS&E do.

In a future column, we will address more fully the converse proposition—that the research that is needed to create future CIs is a great driver for many areas of CS&E research. For the moment, we will close with the assertion that we do not see any other single driver for CS&E research in the next decade that is more comprehensive, deep, and compelling than that directed toward creating CIs that are ever more powerful.

Endnotes:

¹A recent report of a "Blue Ribbon" Advisory Panel to NSF/CISE headed by Prof. Dan Atkins, "Revolutionizing Science and Engineering Through Cyberinfrastructure," outlines the tremendous opportunity for all areas of S&E (including CS&E) to revolutionize their activities via use of advanced computing, communications, and information technologies—cyberinfrastructure—and the absolutely critical research role that CS&E can play. This report can be found at www.cise.nsf.gov.

Peter A. Freeman is Assistant Director and Lawrence L. Landweber is a Senior Advisor in the Computer and Information Science and Engineering directorate at the National Science Foundation. ■



President Proposes Increases from Page 1

both House and Senate versions of the VA-HUD-Independent Agencies appropriations bill is at least 15 percent, the rate of increase required to double funding in five years.

The President's plan for FY 04 is a little less generous. Under the President's proposal, the Networking and Information Technology R&D program would grow 6 percent—twice the rate of increase he proposed for FY 03, but a far cry from the large increases included in the omnibus legislation.

The President's budget calls for \$2.2 billion in federal support for IT R&D at seven different federal agencies: NSF would remain the lead agency at \$724 million; the Department of Defense, \$461 million; Health and Human Services/NIH, \$441 million; Department of Energy, \$317 million; NASA, \$195 million; Commerce, \$39 million; and the Environmental Protection Agency, \$2 million.

What is not yet known is how the Administration will address funding issues at NASA, post-Columbia. The incident, which killed seven astronauts, leaves the U.S. space program perilously short of space shuttles

(three left) to service the International Space Station. It seems likely that the President and many members of Congress will push for additional funding for NASA to build whatever vehicle is needed to keep the ISS serviced. However, what is not clear is where the extra funding would come from or what programs might face cuts in order to make the difference.

These details, as well as an in-depth analysis of the President's budget proposal, will be posted on the CRA Government Affairs (<http://www.cra.org/govaffairs>) website as soon as they are available. ■

CRA-W Career Mentoring Workshop at FCRC 2003

Saturday, June 7 and Sunday, June 8

Details at:

http://www.cra.org/Activities/craw/projects/mentoring/mentorWrkshp/fcrc_2003.html

Professional Opportunities

CRN Advertising Policy

See <http://www.cra.org/main/cra.jobshow.html>

Arizona State University Center for Interdisciplinary Research in Media, Arts, and Engineering (CIRMAE) Director Research & Development

The Center for Interdisciplinary Research in Media, Arts and Engineering (CIRMAE) at Arizona State University announces an opening for Director of Research and Development.

CIRMAE was co-created by the College of Engineering and Applied Sciences (CEAS) (<http://www.eas.asu.edu/CEAS/>) and the Herberger College of Fine Arts (HCFA) (<http://herbergercollege.asu.edu>). It is housed at the internationally known Institute for Studies in the Arts (<http://isa.asu.edu>). The goal of CIRMAE is to facilitate the parallel, integrated development of media hardware, software, content and theory.

Duties for this position are as follows:

Responsible for development and coordination of CIRMAE collaborative research projects of major scope and related grants.

- Identifies emerging areas of research in industry and government. Collaborate with CIRMAE faculty and staff in research and grant development.
- Head development of CIRMAE industry consortium.
- Assists in collaboration with the HCFA & CIRMAE communication teams in the dissemination, outreach, and public relations of CIRMAE research projects through lab demonstrations, the web site, performances and participation in conferences.
- Coordinates grants to public and private agencies and other activities to interact or partner with industry.
- Attracts distinguished collaborators from academia and industry in the areas of Media, Arts & Engineering to work with CIRMAE faculty, staff and other involved departments.
- Represents CIRMAE to interested faculty, artists and other guests.

Minimum Qualifications:

Ph.D. in Engineering; experience in obtaining research/grant funding and/or partnering with industry appropriate to rank; and experience in research development in media, arts and engineering appropriate to rank.

Desired Qualifications:

Evidence of successful collaboration and fundraising with industry. Evidence of interdisciplinary research as principal investigator in media, arts and engineering. Please send letter of interest, CV, evidence of research and development activities appropriate to job description, and names/contact information for three references to:

Sheilah Britton, Chair
Director, Research & Development
Ref. Job #7383 CIRMAE/ISA
PO Box 8733302
Tempe, AZ 85287-3302

Applications deadline is April 1, 2003; if not filled, 1st of the month thereafter until search is closed. The anticipated start date is August 15, 2003.

ASU is an Equal Opportunity/Affirmative Action Employer.

Auburn University Department of Computer Science and Software Engineering Assistant, Associate, and Full Professor

The Department of Computer Science and Software Engineering (CSSE) invites applications for multiple tenure-track faculty positions at the Assistant, Associate, or Full Professor level to begin Fall 2003. Salary will be commensurate with the candidate's qualifications. Women and ethnic minorities are encouraged to apply. Responsibilities include research, graduate student supervision, and graduate and undergraduate teaching. In addition, successful applicants will be expected to participate in departmental, college, and university service activities.

Applicants should have a Ph.D. in computer science, software engineering, or a closely related field; however, applicants that are ABD may apply if they reasonably expect to complete the terminal degree prior to January 2004. The following are preferred

research areas: simulation, computer and communication networks, wireless engineering, information assurance and security, real-time and embedded systems, operating systems, human-computer interaction, database systems, programming languages, and software engineering; however, all areas of computer science and software engineering will be considered. The candidate selected for this position must be able to meet the eligibility requirements for work in the United States.

CSSE has recently created a center for Innovations in Mobile, Pervasive, and Agile Computing Technologies (IMPACT). The University will invest over \$1M over five years in new positions with an objective of gaining national prominence in the IMPACT research areas and other areas of information technology.

The CSSE Department currently has 17 full-time faculty members and supports strong graduate (M.S., M.Sw.E., Ph.D.) and undergraduate programs (B.S., B.Sw.E.) in computer science and software engineering. Beginning in Fall 2002, CSSE, jointly with Electrical and Computer Engineering, began offering a new undergraduate degree program in wireless engineering (B.W.E). CSSE enrollment for Fall 2002 is approximately 600 undergraduate and 100 graduate students. Faculty research areas include software engineering, computer and communication networks, human-computer interaction, pervasive computing, artificial intelligence, and database systems. Additional information about the Department and faculty research interests can be found at the Department's home page (<http://www.eng.auburn.edu/csse>).

Auburn University was chartered in 1856, and is the largest university in the State of Alabama, with a student enrollment of over 22,000 and 1,125 faculty. Auburn is located 100 miles southwest of Atlanta and 50 miles northeast of Montgomery, the State Capitol. Auburn offers nearly 150 baccalaureate degree programs in 64 academic departments. The Graduate School provides master's level programs in 130 areas and doctoral programs in 96 fields. The College of Engineering has an enrollment of 3,100 undergraduates and 500 graduate students in eight departments. The picturesque main campus covers 1,875 acres, and includes the entire southwest quadrant of the city of Auburn. The Auburn-Opelika community has a population of about 70,000, an excellent public school system, and has been nationally ranked as one of the "best small towns in America".

Applicants should submit a current curriculum vita, research vision, teaching philosophy, and the names and addresses of three references to:

James H. Cross II, Professor and Chair
Computer Science and Software
Engineering
107 Dunstan Hall
Auburn University, AL 36849-5347
cross@eng.auburn.edu (with copy to
sheriev@eng.auburn.edu)
334-844-6300 (Voice)
334-844-6329 (Fax)
<http://www.eng.auburn.edu/csse/>

The applicant review process will begin in January 2003 and continue until successful candidates have been identified.

Auburn University is an Affirmative Action/Equal Opportunity Employer.

Bowdoin College Department of Computer Science Assistant Professor of Computer Science

The Computer Science Department at Bowdoin College invites applications for a tenure track position at the rank of Assistant Professor to begin in Fall 2003. A Ph.D. in computer science or a comparable field is required (ABD will be considered), and the area of specialization is open. A four-course annual teaching load and generous research support, including opportunities to guide undergraduate research, distinguish this position from many others. Applicants should expect excellent teaching and research experiences in this setting.

Bowdoin is a highly selective, coeducational liberal arts college with 1650 students, located in a vibrant community on the Maine coast, two hours from Boston. The Computer Science Department shares a modern science building with the Mathematics and Physics Departments. Departmental lab facilities include Mac OSX machines for the introductory courses, Linux machines for the intermediate and advanced courses, and a nascent robotics laboratory.

Further information about Bowdoin and the Department is available at <http://www.bowdoin.edu> and <http://academic.bowdoin.edu/computerscience>. Applicants should send a letter, curriculum vitae, and statements of teaching philosophy and research interests; and arrange for three letters of reference to be sent to:

Allen B. Tucker, Chair
Department of Computer Science
8650 College Station
Brunswick, ME 04011

Questions can be e-mailed to allen@bowdoin.edu at any time. Review of applications will begin February 15 and will continue until the position is filled.

Bowdoin is an affirmative action/equal opportunity employer. Women and members of all minority groups are strongly encouraged to apply.

California Institute of Technology Computer Science Department Faculty Search

We are seeking applications from exceptional candidates for a tenure-track position at the rank of assistant, associate, or full professor in the field of computer science. Particular emphasis is on researchers in the following areas:

- novel computational substrates and architectures
- distributed systems and networking; and
- foundations of computing

The principal requirements include demonstrated excellence in innovative research and the potential for high-quality teaching and mentoring. Completion of a PhD in Computer Science or a related field is required. The initial appointment term for tenure-track positions is four years.

Interested candidates are asked to complete an on-line application summary, and should electronically submit a complete CV with a list of publications, a one-page statement of research and teaching plans, copies of 3 - 5 scientific publications, and a list of suggested references. Please visit <http://www.cs.caltech.edu/search> for complete instructions on the application procedure.

Caltech is an Equal-Opportunity/Affirmative-Action Employer. Women, minorities, veterans, and disabled persons are encouraged to apply.

The City College of the City University of New York Computer Sciences Department Two tenure-track faculty positions in Computer Engineering at the Assistant, Associate, or Full Professor level in Computer Engineering

City College invites applications for two tenure-track faculty positions in Computer Engineering at the Assistant, Associate, or Full Professor level starting with the Fall semester of 2003. Applicants must have a Ph.D. in computer engineering, computer science or a closely related field. Junior appointments require teaching experience and clear evidence of research potential; a senior appointment requires demonstrated excellence in research and teaching. Our need is in computer-aided software/hardware engineering, secure systems and cryptography. Areas of interest include, but are not limited to, real-time systems, data-driven architectures, data-driven programming, high-assurance systems, and key-management. A track record of research funding is expected for a senior position.

City College is the oldest college of the City University system; Computer Sciences resides within the School of Engineering. The department offers the BS in Computer Engineering jointly with the Department of Electrical Engineering. It offers as well BS and MS degrees in Computer Science, and the Ph.D. in collaboration with the Graduate School of the City University of New York.

The department's active research reflects its position in the School of Engineering, and encompasses diverse areas of Computer Science and Engineering. Our primary research concentrations are in computational geometry and vision, information security and assurance, data systems and information retrieval, distributed computing systems and algorithms, combinatorial mathematics and optimization, web-based human-computer interaction, information management and E-commerce, multimedia networks and digital libraries, computational methods for image and speech processing, remote sensing, and programming systems and language paradigms. Further information can be obtained from the department's web site at <http://www-cs.engr.cuny.cuny.edu>.

Rank and salary are commensurate with experience and qualifications. Applications, with vitae and names of three references, and clearly marked PVN# FY1615, should be sent by April 15, 2003 to:

Professor Douglas Troeger, Chair
Computer Sciences Department
R8/206
City College of New York
Convent Avenue at 138th Street
New York, New York 10031

Cornell University Peace Studies Program

*Faculty and Postdoctoral Positions in
Technology and Security*

Cornell University Peace Studies Program announces 1 faculty position and 2 postdoctoral positions in technology and security. See website <http://www.einaudi.cornell.edu/PeaceProgram/news/index.asp?id=408>

Florida Tech

Computer Science Faculty Positions

The Department of Computer Sciences at Florida Tech invites applications for open faculty positions. Qualifications include an earned Ph.D. in computer science or a related field, evidence of the ability to develop and sustain an active research program, and a sincere interest in quality teaching at the undergraduate and graduate level. All areas of research specialization will be considered, but expertise in information assurance, software testing, parallel processing, operating systems and networks will be given preference. New faculty will be expected to assist the department in improving undergraduate and graduate education, developing quality research programs, and strengthening our collaborations with industry, government, and other academic institutions.

The department is housed in the new Olin Engineering Complex with modern laboratories and classrooms. The department has over \$6 million in active research funding from multiple government agencies and commercial companies.

Florida Tech is located in Melbourne on Florida's Space Coast, one of the nation's most prosperous and growing high-tech areas. The campus occupies 130 tropical acres, including a picturesque, 30-acre botanical garden. The campus is 5 minutes from the Indian River estuary, 10 minutes from the Atlantic Ocean and 50 minutes from Kennedy Space Center and Orlando.

Qualified applicants send a letter of intent, curriculum vitae, research and teaching summary, and full contact information for at least three references to faculty-search@cs.fit.edu, or to:

Faculty Search Committee
Department of Computer Sciences
Florida Institute of Technology
Office of Human Resources
150 W. University Blvd.
Melbourne, FL 32901
<http://www.cs.fit.edu>

Florida Tech is an Equal Opportunity Employer Committed to Excellence through Diversity.

Franklin W. Olin College of Engineering, Needham, MA Computer Science Faculty Position

Olin College is a brand-new, highly selective residential engineering college in the Boston area. We invite applications from computer scientists interested in reinventing undergraduate engineering education, with particular interest in multidisciplinary candidates, software engineering, or theoretical computer science.

continued

Professional Opportunities

A complete description of this position may be found at <http://www.olin.edu>.

Olin College is an Equal Opportunity Employer.

Indiana University Computer Science Department Department Chair Position

The Indiana University Computer Science Department seeks nominations and applications for the position of department chair. Candidates should possess an international reputation in the computer science research community, should have strong leadership and administrative skills, and should understand the importance of promoting excellence in education. It is expected the chair will expand on existing research programs or initiate new ones. She or he will have the opportunity to fill faculty positions immediately.

The Computer Science Department, part of the College of Arts and Sciences, has 20 FTE faculty members and approximately 200 undergraduate majors, 100 masters students and 100 doctoral students. The department has substantial research interactions with the privately supported Indiana Pervasive Technology Laboratories. Other research interactions include the Cognitive Science Program and the nation's first School of Informatics, which offers degrees focusing on the application of information technology.

The department occupies a gracious limestone building with extensive state-of-the-art computing facilities. The attractive wooded campus of Indiana University is located in Bloomington, one of the most cultural and livable small cities in the US and located less than an hour from the Indianapolis airport. To learn more about the department please visit our web site at www.cs.indiana.edu.

Applicants should send a detailed CV and a list of references to:

Prof. Edward Robertson
Computer Science Department
Indiana University
Lindley Hall 215
Bloomington, IN 47405-7104
email: search@cs.indiana.edu

Indiana University is an Equal Opportunity/Affirmative Action Employer. The Computer Science Department especially seeks applications from women and minorities.

Indiana University Computer Science Department Faculty Positions

The Indiana University Computer Science Department anticipates filling several tenure-track faculty positions beginning 2003-2004. Areas of interest are databases, embedded systems, networking and programming languages. In addition our new, privately endowed, pervasive technology labs will be hiring several senior positions in the areas of graphics, human computer interaction, embedded systems, data mining and security.

The CS department, which is part of the College of Arts and Sciences, is working cooperatively with our new School of Informatics, which offers a B.S. degree focusing on the application of information technology to various disciplines and has M.S. programs in Human Computer Interaction, and Bio and Chemical Informatics. Cross-appointments with Informatics are possible in computer science related areas such as data mining and search technologies.

A Ph.D. in Computer Science is required for all CS faculty positions. Applicants must have demonstrated potential for excellence and productivity in research. In addition, a strong contribution to the educational mission of the department is expected.

The department occupies a spacious limestone building with extensive state-of-the-art computing facilities. The attractive wooded campus of Indiana University is located in Bloomington, chosen as one of the most cultural and livable small cities in the US, and only one hour from the Indianapolis airport. To learn more about the department please visit our web site at www.cs.indiana.edu.

Please send a detailed CV and a list of references to:

Faculty Search
Computer Science Department
Indiana University
Lindley Hall 215
Bloomington, IN 47405-7104
email: search@cs.indiana.edu

Indiana University is an Equal Opportunity/Affirmative Action Employer. The Computer Science Department strongly encourages applications from women and minorities.

Massachusetts Institute of Technology Electrical Engineering and Computer Science – Engineering Systems Division Dual Faculty Search In Engineering Systems Theory

Candidates are sought who have experience and research interests in Engineering Systems Theory for a position starting in September 2003.

We are seeking a Ph.D. with excellent academic credentials and a strong interest in the development of theoretical approaches to large-scale engineering systems, such as software or telecommunication systems. Issues of interest include system complexity, uncertainty, robustness, flexibility and architecture, especially the relationships among them. Candidates with expertise in areas such as systems and control, optimization, and distributed systems theory are encouraged to apply.

ESD-EECS Dual Faculty

This will be a dual faculty appointment in the Engineering Systems Division (ESD) and the Electrical Engineering & Computer Science (EECS) Department at MIT. Faculty duties include teaching, research, and supervision of theses in both within ESD and in the EECS Department. This appointment will be as a tenure-track faculty member.

The Department

The Electrical Engineering and Computer Science Department (EECS) has ongoing research in the areas listed above.

The Division

The Engineering Systems Division is an interdisciplinary unit, which brings together educational and research programs with an integrative approach to large complex systems.

Applications

MIT is especially encouraging minorities and women to apply, because of its strong commitment to diversity in engineering education, research and practice.

Applications should be sent to the address below by May 1, 2003, including a statement of professional interests and goals. Each application should include a curriculum vitae, up to three papers, and the names and addresses of three or more individuals who will provide letters of recommendation. Please arrange to have such letters sent directly to:

Professor Joel Moses
MIT
77 Massachusetts Avenue
Room NE43-407
Cambridge, MA 02139
or by electronic mail to esd-eeecs03@mit.edu (MS Word or plain text).

MIT is an Affirmative Action/Equal Employment Opportunity employer.

Michigan Technological University Department of Computer Science Tenure-Track Faculty Position(s)

Applications are invited for one or more tenure-track faculty positions beginning August 2003. Candidates are expected to have a Ph.D. in computer science, computational science and engineering, or a closely related field. Candidates are expected to demonstrate potential for excellence in teaching and research. Applications from exceptional candidates for more senior positions will be considered. Of particular interest are candidates with research in areas of software engineering, security, and systems. Individuals with ongoing research support may be considered for research faculty positions.

Michigan Technological University, designated as one of four Michigan research universities, has over 6,200 students and 400 faculty. The Department has 16 faculty members and B.S., M.S. and Ph.D. programs with excellent students. Enrollment in the undergraduate program exceeds 400 students. Approximately 50 students are enrolled in the graduate program. In addition, the Department has a central role in the interdisciplinary Computational Science and Engineering Ph.D. Program. This program fosters research and teaching in the application of computer science to problems in engineering and the sciences.

Computing facilities in the Department include a heterogeneous Unix network of over

100 workstations and servers. The main platforms are Sun Solaris and Linux. Research equipment includes SGI workstations, a Myrinet cluster consisting of 16 2GHz dual-processor PCs, a 60-processor Cray T3E, a 128-processor Beowulf cluster, a 12-node Sun E4500, and Internet-2 access.

Michigan Technological University is located in Michigan's scenic Upper Peninsula. Surrounded by Lake Superior and nearby forests, the community offers year-round recreational opportunities. This environment, combined with a competitive compensation package and a low cost of living, results in an excellent quality of life. Review of applications will continue until the position is filled. Women and minorities are particularly encouraged to apply. Applicants should send a resume, email address, and a list of at least three references to:

Linda M. Ott, Chair
Department of Computer Science
Michigan Technological University
Houghton, Michigan 49931
linda@mtu.edu
(906) 487-2209

For more information see our web page <http://cs.mtu.edu/>.

Michigan Technological University is an equal opportunity educational institution/equal opportunity employer.

North Dakota State University Computer Science Department (2) Assistant/Associate Professors

Computer Science Department seeks to fill two tenure-track Assistant/Associate Professor positions starting Fall, 2003. The department offers degrees in Software Engineering as well as Computer Science. Preference will be given to Software Engineering candidates for at least one of the positions. Research and teaching excellence is expected, normal teaching loads are 3 courses/year. Successful candidates will be awarded a significant startup package. The department has 13 Faculty in diverse areas; 3 Lecturers; about 100 Master's and PhD students and 400 BS/BA students.

Fargo is a clean, growing city that consistently ranks near the top in national quality-of-life surveys. We have low levels of crime and pollution, excellent schools, short commutes, and proximity to the Minnesota lake country. The community has a symphony, an opera, a domed stadium, a community theater, three colleges, and many other amenities. See www.cs.ndsu.nodak.edu/position for more information. NDSU is an equal opportunity institution.

The Ohio State University Department of Computer & Information Science Assistant, Associate and Full Professors

The Department of Computer and Information Science invites applications for several tenure-track/tenured positions. The department's focus areas are in artificial intelligence, graphics, networking, software engineering, and systems. Outstanding applicants in any of these areas will be considered, with priority given to the artificial intelligence (speech, vision, and machine learning in particular) and networking (security in particular) areas.

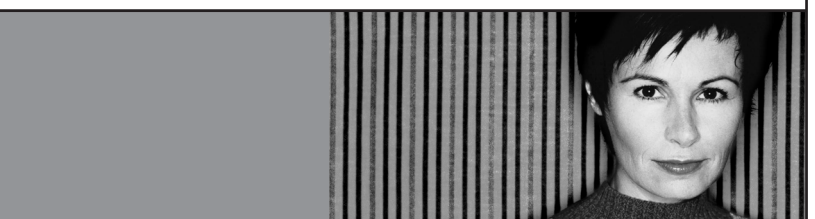
Appointments at all ranks will be considered. Applicants for an assistant professor position should hold or be completing a Ph.D. in computer science and engineering or a closely related field, and have a commitment to excellent research and quality teaching. Applicants for a senior position should also demonstrate a strong record of external funding and impact on their field.

The department maintains and encourages active collaborations With Ohio Supercomputer Center, Advanced Computing Center for the Arts and Design, Center for Cognitive Science, Department of Biomedical Informatics, and many other units in the university.

To apply, send a curriculum vita (including names and addresses of at least three references) and a statement of research and teaching interests, by e-mail to:

continued

Always thinking... about tomorrow



We live in a world of exponential change, both in technology and scientific research. The National Center for Supercomputing Applications (NCSA) deploys hardware and creates software and tools to enable breakthrough scientific research and enhance national competitiveness. As a leader in defining the future's high-performance computing infrastructure for scientists and society, we seek sophisticated, sharp, and agile individuals interested in collaborating with some of the world's leading scientific researchers.

NCSA seeks computer science and engineering researchers and developers to expand our staff and meet new challenges in building and deploying leading edge computing infrastructure. Experts in high-performance computing and networking, cybersecurity, commodity computing, visualization, and collaborative technologies, as well as researchers in disciplines like computational chemistry, computational biology and computational fluid dynamics are needed.

We encourage interested parties to visit our web site for job opportunities. A PhD is required for most positions. Bridging diverse fields, working with fellow staff members, and transferring your knowledge to academic and industrial communities are critical skills for all positions. NCSA is dedicated to building a more diverse community, so women and minorities are strongly encouraged to apply.

Please visit our web site to view current position openings with NCSA
<http://www.ncsa.uiuc.edu/About/NCSA/Employ/index.html>



The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

Professional Opportunities

fsearch@cis.ohio-state.edu
or by mail to:
Chair, Faculty Search Committee
Department of Computer and Information Science
The Ohio State University
2015 Neil Avenue, DL395
Columbus, OH 43210-1277

Review of applications will begin immediately and will continue until the positions are filled. For additional information please see <http://www.cis.ohio-state.edu>.

The Ohio State University is an Equal Opportunity/Affirmative Action Employer. Qualified women, minorities, or individuals with disabilities are encouraged to apply.

Panasonic Information and Network Technologies Laboratory (PINTL)

The Panasonic Information and Network Technologies Laboratory (PINTL), located in Princeton, NJ, is a research and development laboratory specializing in computer and communication sciences. PINTL is interested in exceptional employment candidates with a Ph.D. in Computer Science or Electrical Engineering and a track record of creating Intellectual Property in the areas of:

- Mobile Communications
- Interactive Digital Television
- Networking

It is expected that research will lead to patents as well as conference and journal publications. These positions also require domestic and international travel. A minimum of three years post doctoral experience and a Ph.D. in either Computer Science or Electrical Engineering is required.

Mobile Networking Scientist

The Mobile Communications group conducts research and development on the evolution of 4G communications networks. We are particularly interested in the convergence of wireless LAN and mobile communications technologies. Researchers are expected to lead the design and development of prototypes that demonstrate the practical feasibility of their ideas. Desirable technical scope: primarily above physical layer, e.g., VoIP, SIP, wireless IP, ad-hoc networks, etc.

Networking Scientist

The Networking Protocols group conducts research on protocols suitable for home networking and mobility. Researchers are expected to lead in the design and development of prototypes as well as participate in relevant standardization activities. Desirable technical scope: UPnP, HaVi, ZeroConf.

Distributed Computing Systems Scientist

The Communications Middleware group conducts research and development on distributed computing techniques for multimedia appliance architectures. This group focuses on the middleware layer for mobile communication devices and interactive digital television platforms. Researchers are expected to lead the design and development of prototypes that demonstrate the practical feasibility of their ideas. Researchers are also expected to participate in national and international standardization activities (e.g., JCP, OMA, IETF, W3C, etc.). Experience in Java, XML, and research in distributed computing is required. Desirable technical scope: Background in research and exploratory development in the area of consumer applications as well as enabling technologies and middleware for embedded systems and networked appliances, such as Jini, UPnP, MHP, OSGI and HAVI.

Please send your resume and salary requirement by either e-mail:

bast@research.panasonic.com
mail:
Panasonic/PINTL
2 Research Way, 3rd Floor
Princeton, NJ 08540
fax: (609) 987-8827

We are committed to creating a diverse work environment and proud to be an equal opportunity employer (m/f/d/v). Pre-employment drug testing is required. Due to the high volume of responses, we will only be able to respond to candidates of interest. All candidates must have valid authorization to work in the U.S.

Purdue University Department of Computer Sciences Tenure-Track Positions

The Department of Computer Sciences at Purdue University invites applications for tenure-track positions beginning August 2003. Positions are available at the assistant professor level; senior positions will be considered for highly qualified applicants. Applications from outstanding candidates in all areas of computer science will be considered. Areas of particular interest include security, mobile and wireless systems, scientific computing and computational biology, and software engineering.

The Department of Computer Sciences offers a stimulating and nurturing academic environment. Thirty-six faculty members have research programs in analysis of algorithms, bioinformatics, compilers, databases, distributed and parallel computing, geometric modeling and scientific visualization, graphics, information security, networking and operating systems, programming languages, scientific computing, and software engineering. The department implements a strategic plan for future growth which is strongly supported by the higher administration. This plan includes a new building expected to be operational in 2005 to accommodate the significant growth in faculty size. Further information about the department is available at <http://www.cs.purdue.edu>.

Applicants should hold a Ph.D. in Computer Science, or a closely related discipline, and should be committed to excellence in teaching and have demonstrated strong potential for excellence in research. Salary and benefits are highly competitive. Special departmental and university initiatives are available for junior faculty. Applicants can apply electronically by sending a curriculum vitae, a statement of career objectives, and names and contact information of at least three references as a postscript or .pdf file to fac-search@cs.purdue.edu. Alternatively, applicants can send hard copies of their application to:

Chair, Faculty Search Committee
Department of Computer Sciences
Purdue University
West Lafayette, IN 47907-1398

Applications are being accepted now and will be considered until the positions are filled. Any inquiries should be sent to fac-search@cs.purdue.edu.

Purdue University is an Equal Opportunity/Affirmative Action employer. Women and minorities are especially encouraged to apply.

Quantum Leap Innovations AI Technical Leads

Seeking Ph.D.(s) with expertise in Optimization, AI Scheduling, AI Planning, Data Mining, Human Computer Interaction, Knowledge Representation, or Probabilistic AI.

For additional qualifications, responsibilities and application instructions, visit www.quantumleap.us/OurPeople/FullTime.html#Technical

Rensselaer Polytechnic Institute Assistant Professor School of Science

The Department of Computer Science at Rensselaer Polytechnic Institute invites applications for one or more expected tenure-track positions at the Assistant Professor level in bioinformatics, data mining, networking and security, scientific computation, and software engineering, starting in the fall of 2003.

Applicants should hold a Ph.D. in Computer Science or a closely allied field, have substantial research accomplishments, and demonstrate a strong commitment to teaching. Additionally, strong candidates in all areas of computer science will be considered.

Under the direction of its president, Rensselaer plans to double its research program in the next five years. Major research initiatives in information technology and biotechnology are integral components of this plan. The Department of Computer Science faculty is participating in collaborative research at the forefront of both of these initiatives. The department currently consisting of 22 full-time faculty members, offers BS, MS and Ph.D. degrees, and has multi-million dollar research programs with excellent computing facilities. It has hired 9 junior faculty over the past 5 years, 5 of whom, have won NSF Career Awards. Substantial growth over the next several years

is anticipated.

We offer an excellent benefits package including health, dental, life insurance, retirement, tuition, etc. Visit our Web site at: www.rpi.edu/dept/hr

Interested individuals should submit a curriculum vitae with a list of publications, a statement describing current and planned research, and a statement describing teaching philosophy to:

Department of Computer Science
Attn: Jacqueline Carley
Rensselaer Polytechnic Institute
110 8th Street
Troy, NY 12180-3590
E-mail: carlej@cs.rpi.edu
Rensselaer Why not Change the World?
Rensselaer is an Equal

Opportunity/Affirmative Action Employer. Women and Minorities are strongly encouraged to apply.

Rockefeller University Center for Studies in Physics and Biology Independent Fellow Positions

The CSPB is looking for individuals with doctoral training who wish to apply ideas and techniques from computer science to biological problems. A more complete statement of interests and contact information can be found at <http://uqbar.rockefeller.edu>.

Faculty associated with the center include Albert Libchaber, Stan Leibler, Marcelo Magnasco, Eric Siggia and Mitchell Feigenbaum (Director). Their individual research programs can be accessed through the university web pages.

Texas Tech University

The Department of Computer Science invites applications in all areas of Computer Science for one or more tenure track positions at all levels for the academic year 2002-03. We anticipate having faculty openings at both the main campus in Lubbock, and a satellite graduate campus in Abilene, Texas. Specific areas of need include software engineering, intelligent systems, and theory. Applicants must have a Ph.D. degree in computer science or a closely related field. Faculty are expected to teach existing graduate and undergraduate courses, develop new courses, and contribute to the research mission of the university.

Texas Tech University offers a Ph.D. and an M.S. in Computer Science and an M.S. in Software Engineering. We offer competitive salaries, a friendly and cooperative environment, and excellent research facilities. State-of-the-art two-way video instructional facilities allow the Lubbock and Abilene sites to exchange course offerings and to conduct collaborative faculty and committee meetings. More information on the department is available at <http://www.cs.ttu.edu/>.

Applicants should send curriculum vitae, including a two-page research and teaching statement, and the names of at least three references. Electronic submission of application materials in the form of postscript or PDF is preferred. Electronic submission should be sent to sobol@cs.ttu.edu or hardcopy can be mailed to:

Dr. Michael Sobolewski
Chair of Faculty Search Committee
Department of Computer Science
Texas Tech University
Box 43104
Lubbock, TX 79409-3104

Review of applications will begin as soon as they are received. Applications will be accepted until the positions are filled. Candidates must be currently eligible to work in the United States.

Texas Tech University is an equal opportunity/affirmative action employer and actively seeks the candidacy of women and minorities.

Toyota Technological Institute at Chicago Computer Science at TTI-Chicago Tenure-Track and Tenured Faculty Positions

Toyota Technological Institute (TTI-Japan) is founding a new Department of Computer Science (TTI-Chicago) adjacent to the University of Chicago campus. Applications are invited for tenure-track and tenured faculty positions at all ranks.

TTI-Chicago will have exclusive use of the interest on a fund of \$100 million being set aside by TTI-Japan for this purpose.

TTI-Chicago will be dedicated to basic research, education of doctoral students, and a small masters program. Faculty members will receive continuing research grants and will have a teaching load of at most one course per year. TTI-Chicago will have close ties with the Computer Science Department of the University of Chicago.

Initial faculty appointments will commence in autumn 2003, though some appointments may begin earlier by mutual agreement. The Department is projected to grow to a steady-state of thirty faculty by 2007.

Faculty are particularly sought with research programs in:

- Computational geometry
- Databases and data mining
- Human-computer interaction
- Large-scale scientific simulation
- Machine learning
- Networking and distributed computing
- Software and programming systems
- Theoretical computer science

An advisory committee from the University of Chicago and Argonne National Laboratory will recruit the founding faculty, who will then assume leadership to determine the character of the department.

For more information, contact:

Mr. Frank Inagaki
Treasurer and Secretary to the Board
Toyota Technological Institute at Chicago
e-mail: finagaki@uchicago.edu

Tulane University Faculty Positions In Electrical Engineering and Computer Science

The Department of Electrical Engineering and Computer Science invites applications for at least two tenure-track faculty positions in Electrical Engineering, Computer Engineering, or Computer Science starting in Fall 2003. Candidates should have a Ph.D. in Electrical Engineering, Computer Engineering, or Computer Science, a strong commitment to both research and teaching, a publication record in their area, and demonstrate potential for obtaining external research funding. Outstanding candidates at all levels and from all areas of expertise especially with research interests in nanotechnology and bioinformatics will be considered.

Applicants should send a letter of intent, a statement of research and teaching interests, a resume, and the names of at least three references including the reference's address, e-mail, telephone, and fax number to:

Dr. Paul F. Duvoisin
Search Committee Chair
Department of Electrical Engineering and Computer Science
Tulane University
New Orleans, LA 70118

Applications will be accepted until the positions are filled. Tulane University is an equal opportunity/affirmative action employer.

The University of Alabama Department of Computer Science

The University of Alabama, Department of Computer Science, invites applications for a tenure-track faculty position at the Assistant Professor level to begin August 16, 2003.

Candidates must have an earned Ph.D. in computer science or a related field, with an evidence of research potential, commitment to teaching, and willingness to participate in the Department's graduate and undergraduate programs. Applicants from all areas of computer science will be considered. Those who specialize in software engineering, database systems, operating systems, or networking are particularly encouraged to apply.

The Department of Computer Science currently has 20 faculty (14 tenured/tenure-track), over 350 undergraduates in a CSAB-accredited B.S. degree, and over 50 M.S. and Ph.D. students. Areas of current research emphasis include algorithms, artificial intelligence, database systems, human-computer interface, networking, operating systems, programming languages, and software engineering. The University of Alabama is a charter member of Internet2.

Outstanding applicants should send a curriculum vitae and the names and addresses of at least three references to:

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Professional Opportunities

Dr. Richard Borie, Chair
Computer Science Search Committee
Department of Computer Science
Box 870290
The University of Alabama
Tuscaloosa, AL 35487-0290

For additional information, please visit <http://cs.ua.edu>, or contact Richard Borie at borie@cs.ua.edu.

Review of applications will begin January 1, 2003 and will continue until the position is filled. The University of Alabama is an equal opportunity/affirmative action employer. Women and minorities are particularly encouraged to apply.

University of California, Davis Department of Computer Science Faculty Positions

The Department of Computer Science, at the University of California, Davis, invites applications for a tenure-track faculty position in areas related to Computational Science, and the interface between Computer Science and Computational Science. We particularly encourage applicants working on Complex Systems, and on computational science issues in Nanocomputing.

We welcome applications from candidates who use the interaction of science and computation to produce novel research in computer science. This new search is in addition to ongoing searches (previously advertised) in the areas of Information Systems, Networks, and Computer Systems. The department is seeking candidates at the Assistant level for the Computational Science position.

These positions require a Ph.D. or equivalent. The positions are open until filled. For complete application instructions, please consult our webpage at

<http://www.cs.ucdavis.edu/department/employ/>

UC Davis is responsive to the concerns of dual career couples and offers a Partner Opportunity Program. UC Davis is an affirmative action/equal opportunity employer.

University of Kentucky Computer Science Department Assistant Professor

The Department of Computer Science invites applications for two tenure-track positions at the Assistant Professor level. New faculty will play an important role as members of the new Visualization and Vision Science Facility, a new research unit with over 8,000 sq. ft., and over 5M in funding from state and federal agencies. The goal of the facility is to advance state-of-the-art visualization technologies through basic and applied research programs. To that end, we are particularly interested in candidates with specialization in computer vision, computer graphics, distributed multimedia, scientific computation, or human computer interaction. Applicants with credentials in other fields that will support the goals of the facility will also be considered.

The Department of Computer Science offers BS, MS, and PhD degrees. Our faculty are actively involved in research in artificial intelligence, computer vision, networking, cryptography, numerical analysis, operating systems and theory. The department is funded by a number of external grants including DARPA projects, several NSF ITR awards, and an NSF Research Infrastructure award.

The Department is experiencing a period of dynamic growth, particularly in the areas of multimedia, computer networking, and distributed systems. In the previous five years, the department has hired six new faculty members, three of which are NSF CAREER awardees. New members of the Computer Science faculty will have access to significant new laboratory space, generous start-up research funds, and will actively participate in the research activities of the Visualization and Vision Science Facility.

The University of Kentucky is an equal opportunity employer and especially encourages applications from women and minority candidates.

Completed applications consisting of a curriculum vita, statements of teaching and research interests, and the names of at least three references should be submitted to:

Chair, CS Search Committee
c/o Ms. Diane Mier
773 Anderson Hall
University of Kentucky
Lexington, KY 40506-0046

Application review will begin on March 1, 2003 and continue until the positions are filled.

University of Maryland, College Park Institute For Advanced Computer Studies Director

The University of Maryland, College Park, invites applications for the position of Director of the University of Maryland Institute for Advanced Computer Studies (UMIACS). The Institute is the locus of interdisciplinary research in computing across the College Park campus, with 75 affiliated faculty members and a total research budget of approximately \$20M/year. The Director will play a leadership role in developing and implementing a vision for the Institute, in close collaboration with other units on campus. The Institute's faculty currently lead major research programs in scientific computing, computer vision and graphics, parallel and distributed computing, computational linguistics, information visualization, multimedia and internet computing, human computer interaction, data bases, and software engineering.

Candidates for this position must have an established international reputation in computer science with a broad outlook concerning the interaction of computer science with other academic disciplines. The Director will be an outstanding scientist who will play a leadership role in continuing to develop and implement a vision for the Institute as a premier interdisciplinary research unit on campus with high national visibility, and in fostering partnerships with the private sector. The campus is already pre-eminent in computer science and candidates are expected to build on this expertise through new faculty appointments and innovative leadership to enhance the campus reputation in computer science and aligned fields. The appointment will be made at the Full Professor level and carries academic tenure.

Applicants and nominees should submit a letter of interest, curriculum vitae and a list of potential references who could be contacted by the search committee. Nominations are encouraged and will be received at any time at the address below. However for best consideration, nominations and applications should be received by March 1, 2003. All materials should be sent to:

Prof. Antonio J. Busalacchi, Chair
UMIACS Director Search Committee
c/o ESSIC
2207 Computer and Space Sciences
Building
#224 University of Maryland
College Park, MD 20742

For more information, please contact Dr. Antonio Busalacchi, Professor of Meteorology and Director of the Earth System Science Interdisciplinary Center (ESSIC) at (301) 405-5599 or tonyb@essic.umd.edu

The University of Maryland is an affirmative action, equal opportunity employer. Women and minorities are encouraged to apply. Applications will be accepted until the position is filled.

University of Nebraska – Lincoln Computer Science and Engineering Department

The UNL CSE Department is embarking on dynamic growth and seeks applications for a tenure track faculty position in simulation and modeling beginning August 2003. All ranks will be considered based on the qualifications of the candidate. The University has identified Simulation & Computing Engineering and Information Technology & Telecommunications as a priority area. The selected person is expected to enhance research productivity (including publications and external funding) and teaching effectiveness in the priority area. The person is also expected to facilitate collaborations with other engineering and science disciplines to make significant advances in the disciplines utilizing advanced simulation, high-performance computing, and visualization.

The successful candidate must have a Ph.D. in computer science or a closely related discipline, outstanding potential as a research scholar who will complement the department's research faculty and their engineering collaborators, and a commitment to teaching excellence. Preference will be given to candidates with expertise in simulation and modeling of engineering problems.

UNL is a comprehensive research university with Carnegie I standing and membership in the elite Association of American Universities. The CSE Department offers BS, MS, and PhD degree programs in both computer science and computer engineering. Lincoln, the capital of Nebraska, is a prosperous, medium-sized city that ranks high in quality-of-life.

Applicants should send a letter of application, a CV, research and teaching statements, and contact information for three references to:

Simulation and Modeling Search Committee
Department of Computer Science and Engineering
115 Ferguson Hall
University of Nebraska-Lincoln
Lincoln, NE 68588-0115

For complete position advertisements, visit: <http://cse.unl.edu/search>, email: search@cse.unl.edu, or phone (402) 472-2401.

The University of Nebraska is committed to a pluralistic campus community through affirmative action and equal opportunity and is responsive to the needs of dual career couples. We assure reasonable accommodation under the Americans with Disabilities Act; contact Richard Sincovec at (402) 472-2401 for assistance.

University of North Carolina at Charlotte Department of Computer Science Bank of American Distinguished Professor of Computer Science

The Department of Computer Science (Department (www.cs.uncc.edu)) at the University of North Carolina at Charlotte invites applicants for the Bank of American Distinguished Professor of Computer Science. Applicants should have a strong record of externally funded research and impact on their field, and a commitment to teaching as an essential component of scholarship. We are looking for an exceptional scholar with the ability to provide intellectual leadership in the Department of Computer Science, the College of Information Technology, and the University. Applications should present evidence of an interest in working closely with students and faculty in a collaborative research environment, and an ability to develop and support a vigorous research agenda. We are particularly interested in applicants whose primary research area is relevant to the financial services industry.

Charlotte, NC has a metro-area population of over one million people and is the second largest financial center in the U.S. UNC-Charlotte has a student enrollment of approximately 19,000 with plans to grow to 25,000 and is poised to move from Doctoral Research Intensive to Doctoral Research Extensive Carnegie Classification. The University has seven colleges (Information Technology, Engineering, Arts and Science, Health and Human Services, Architecture, Education, and Business Administration) offering a variety of Ph.D., Master, and baccalaureate programs. The Department of Computer Science, located within the College of Information Technology, has approximately 600 undergraduate computer science majors and 150 graduate students in computer science and information technology. Construction has begun on a new building to house the entire College of Information Technology with anticipated completion date of fall 2004.

Applicants should send a letter of application together with their curriculum vitae, and the names and contact information of at least five references to BoASearch@cs.uncc.edu or by postal mail to:

Chair, BoA Distinguished Professor Search Committee
Department of Computer Science
University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

Electronic submission of PDF files is preferred. Review of applications will begin in February 2003 and continue until the position is filled.

The University of North Texas Department of Computer Science Tenured and Tenure-Track Faculty Positions

The Department of Computer Science at the University of North Texas invites applications and nominations for multiple faculty

positions, primarily at Assistant Professor Level. Although all areas of Computer Science will be considered, we are particularly interested in databases, data mining, computer networks, computer architecture, operating systems, compilers, software engineering, computer security. The positions require an earned doctoral degree in Computer Science or a related field and a potential for research and teaching. The positions are for Fall 2003. The University of North Texas is making substantial commitments to the growth of the Computer Science Department. The department is strongly committed to research and teaching excellence, and continued growth and increasing national visibility. Visit our website for more information, <http://www.cs.unt.edu/>

Interested persons should send an application including a detailed curriculum vitae and have at least three letters of reference sent to:

Faculty Search Committee
Department of Computer Science
P.O. Box 311366
Denton, Texas 76203
or electronically to:
faculty_search@cs.unt.edu.

The University of North Texas is an Equal Opportunity/Affirmative Action/ADA employer, committed to diversity in its faculty and educational programs.

University Of Notre Dame Department of Computer Science and Engineering Faculty Position

The Department of Computer Science and Engineering at the University of Notre Dame (<http://www.cse.nd.edu>) invites faculty applications. Rank and area of specialty are open.

Our faculty are actively engaged in high-quality research in a variety of areas, supported by NSF, DARPA, SRC, Air Force, HP/Compaq, and other organizations. The blend of small class size, low teaching load, and a "PhD only" graduate program allows us to emphasize true excellence in both research and teaching. Faculty must be committed to both quality teaching and a strong externally-funded research program.

Notre Dame is ranked 18th among national universities in the 2002 US News and World Report survey. Notre Dame's heritage and values are unique among top-ranked national universities, resulting in a distinctive character of campus life.

Screening of applications will begin December 1, 2002 and continue until positions are filled. Applicants should send cover letter, cv, statement of research interests, statement of teaching interests, and names and addresses of at least three references either to faculty_search@cse.nd.edu, or to:

Chair, Faculty Search Committee
Department of Computer Science and Engineering
384 Fitzpatrick Hall
University of Notre Dame
Notre Dame, IN 46556

University of Pennsylvania Department of Computer and Information Science Lecturer Positions

The University of Pennsylvania invites applicants for the position of Lecturer in Computer Science to start July 1, 2003. Lecturer duties include undergraduate and graduate level teaching. The position is for one year and is renewable annually up to three years.

Successful applicants will find Penn to be a stimulating environment conducive to professional growth. The Department of Computer and Information Science is undergoing a major expansion, including new faculty positions and a new building, Levine Hall, with completion this academic year. In fall 2001 we started a new Master of Computer and Information Technology (MCIT). The MCIT is designed for candidates who have a strong academic background in areas other than computer science but who have a need for graduate education in computer science or a closely related discipline. Completion of the MCIT program will give the graduate a solid foundation in computer science, providing the advanced expertise needed to meet the demands of the rapidly growing field of information technology. MCIT graduates will be ready to enter the IT workforce, or will find new opportunities in

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Professional Opportunities

continuing their education. The MCIT program will also prepare students for further graduate education in computer science.

The University of Pennsylvania is an Ivy League University located near the center of Philadelphia – the 5th largest city in the US. Within walking distance of each other are its Schools of Arts and Sciences, Engineering, Medicine, Nursing, Law, Business and Fine Arts. The University campus and its surroundings in Philadelphia benefit from a rich diversity of cultural opportunities as well as attractive urban and suburban residential neighborhoods.

To apply, please complete the form located on the Faculty Recruitment Web Site at: http://www.cis.upenn.edu/positions/faculty_application.html

Electronic applications are strongly preferred, but hard-copy applications (including the names of at least four references) may alternatively be sent to:

Chair, Lecturer Search Committee
Department of Computer and Information Science
School of Engineering and Applied Science
University of Pennsylvania
Philadelphia, PA 19104-6389

Applications should be received by March 1, 2003 to be assured full consideration. Applications will be accepted until positions are filled. Questions can be addressed to faculty-search@central.cis.upenn.edu.

The University of Pennsylvania is an Equal Opportunity/Affirmative Action Employer. The Penn CIS Faculty is sensitive to "two-body problems" and would be pleased to assist with opportunities in the Philadelphia region.

University of Puerto Rico at Mayagüez

College of Engineering
Electrical and Computer Engineering Department

The Department of Electrical and Computer Engineering of the University of Puerto Rico at Mayagüez invites applications for a tenure-track position in Computer Science or Computer Engineering. The

Department plans to increase its overall strength in computing, and has particular interest in attracting faculty in the areas of networks, databases, computer architecture, and distributed systems. But candidates from all areas of computing are encouraged to apply. Applicants must possess a PhD degree in Computer Science, Computer Engineering or related fields, and demonstrate strong potential for excellence in research. Appointments will be made by July 1, 2003.

Currently, a significant number of faculty members of ECE Department are engaged in research in Computer Science and Engineering areas including image processing, signal processing, parallel and distributed computing, information systems, net-centric computing, human-computer interaction, and databases, among others.

The department offers an undergraduate degree in Computer Engineering, a Master degree in Computer Engineering, and a PhD degree in Computing and Information Sciences and Engineering (CISE).

For further information concerning the ECE department, and the PhD in CISE program, please visit www.ece.uprm.edu, and www.phd.ece.uprm.edu. Applications, with curriculum vitae, three reference letters and MS and PhD transcripts should be sent to:

Prof. Hector Monroy, Chairman
Department of Electrical and Computer Engineering
University of Puerto Rico-Mayagüez
P. O. Box 9042
Mayagüez, Puerto Rico 00681

UPRM is an equal opportunity affirmative action employer.

University of Wyoming Computer Science Academic Professional Lecturer

The Computer Science Department of the University of Wyoming is accepting applications for an academic professional lecturer position, to begin August 2003. Minimum qualifications include an M.S. in Computer Science or closely related field, completed before August 2003. Preferred qualifications

include a Ph.D. and prior teaching experience. Responsibilities for the position include teaching, advising, and service to the University.

The Computer Science Department has strong programs in both Computer Science and Management Information Science. We offer B.S., M.S., and Ph.D. degrees in Computer Science, as well as a B.S. degree in Management Information Systems. We also offer a 1-year Professional Master's program in Computer Science. In addition, we support the College of Business in offering an M.S. degree in E-Business. Currently we have 10 tenured or tenure-track faculty. Current areas of research emphasis include formal methods, databases, computational algebraic geometry, medical informatics, and robotics.

The University of Wyoming is one of the nation's premier research universities. Yet its enrollment is small enough to encourage close ties and collaborations between faculty and students, resulting in high-quality research and teaching experiences. The College of Engineering is committed to the long-term growth of the Computer Science Department.

The university is located in Laramie, Wyoming (pop. 28,000), 130 miles northwest of Denver. Laramie is a friendly town offering a reasonable cost of living; we have clean air, 300 days of sunshine per year, no traffic jams, and easy access to wilderness activities in the Rockies with the 12,000 ft. Snowy Range 35 miles west of town.

To apply, send a curriculum vitae, a statement of teaching interests and philosophy, a research plan, and three letters of reference to the following address:

Faculty Search Committee
Dept. of Computer Science
University of Wyoming
PO Box 3315
Laramie, WY 82071-3315
Email: search@cs.uwyo.edu
WWW: <http://www.cs.uwyo.edu>

The search committee will begin reviewing files on February 3, 2003, and the search will continue until the positions are filled. Persons seeking admission, employment or access to programs of the University of

Wyoming shall be considered without regard to race, color, national origin, sex, age, religion, political belief, disability, veteran status or sexual orientation.

University of Wyoming Computer Science Assistant Professor

The Computer Science Department of the University of Wyoming is accepting applications for a tenure-track track faculty position at the assistant professor rank, to begin in August 2003. Minimum qualifications include a Ph.D. in Computer Science or a closely related field, completed before August, 2003. Preferred qualifications include research interest in formal methods and their application to computer science and other disciplines, and prior teaching experience. However, we will consider outstanding candidates in all areas of specialization in Computer Science.

Responsibilities for the position will include teaching, advising, service and the development of a vigorous research program.

The Computer Science Department has strong programs in both Computer Science and Management Information Science. We offer B.S., M.S., and Ph.D. degrees in Computer Science, as well as a B.S. degree in Management Information Systems. We also offer a 1-year Professional Master's program in Computer Science. In addition, we support the College of Business in offering an M.S. degree in E-Business. Currently we have 10 tenured or tenure-track faculty. Current areas of research emphasis include formal methods, databases, computational algebraic geometry, medical informatics, and robotics.

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The university is located in Laramie, Wyoming (pop. 28,000), 130 miles northwest of Denver. Laramie is a friendly town offering

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UNIVERSITY OF
ALBERTA
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www.careers.ualberta.ca

Computing Science

Do you have a commitment to push the frontiers of computing research in one of the most supportive environments in Canada? We are seeking outstanding candidates who are driven by curiosity and interested in collaborative research for the following tenured faculty chair positions:

Tier II Canada Research Chair (www.chairs.gc.ca)

Position in software engineering and/or software systems. Candidates should have demonstrated ability to provide research leadership in some of the following areas: software architecture, software reuse, re-engineering, software system development, parallel and distributed computation, and compiler design and optimization. The CRC award is for a five-year period, renewable for another five-year period.

Tier I Canada Research Chair (www.chairs.gc.ca)

Position associated with the Alberta Ingenuity Centre for Machine Learning (www.aicml.ca) targeted at exceptional individuals who have demonstrated research accomplishments in areas that combine machine learning and bioinformatics, possibly molecular biological modeling, and related areas in nanoscience and nanotechnology. The CRC award is for a seven-year period, and is renewable.

iCore Chair (www.icore.ca)

Targeted at exceptional individuals who have demonstrated research accomplishments in Machine Learning. The iCore award is for a minimum of five years.

About Us

Join us in a dynamic Computing Science department, known for its collegial atmosphere and collaborative research environment. Our department is in the Faculty of Science at the University of Alberta, in Edmonton, the capital of Alberta.

We have established research laboratories, including Advanced Man-Machine Interfaces, Algorithmics, Bioinformatics, Artificial Intelligence, Computer Vision and Multimedia Communications, Database Management, Graphics, Networks and Communications, Robotics, Software Engineering, and Software Systems. We have abundant computing facilities, and our department leads broadly-based multidisciplinary research within the Multimedia and Advanced Computational Infrastructure (www.maci.ca) project. We have standard, state of the art, computational research

facilities, as well as extensive computational infrastructure for high performance parallel computing and computer graphics. In 2001 we moved into a new research laboratory building adjoined to a renovated historical building. This combined space provides us with consolidated office and research space in the middle of our campus of more than 30,000 students.

Computing Science research is well-funded in Alberta. Several provincial programs provide research opportunities that are the envy of every one in the world, including our multi-university collaborations (e.g., www.westgrid.ca, www.maci.ca, www.peoria.cs.ualberta.ca/aserc), research chair programs (e.g., www.icore.ca), and the Alberta Ingenuity Fund (www.albertaingenuity.ca). This fund established The Alberta Ingenuity Centre for Machine Learning (www.aicml.ca) in 2002.

Our current complement of 47 regular faculty work within a department of about 32 support staff. There are over 200 graduate students and over 500 undergraduate students in our Computing Science degree programs. We also offer joint degrees with Engineering, Business, and other Science departments. Our performance in ACM World Programming Contests is evidence of our claim to be one of the best undergraduate programs in the country, and our graduate students are successful in industrial and academic research labs around the world.

Our department is part of a full-service university, in a province that has the fastest economic growth in the country, and we enjoy strong collaborative ties with local industry.

Competition will remain open until suitable candidates are found. Find further details about us at www.cs.ualberta.ca. To apply send your curriculum vita and the names and addresses of three referees to:

Iris Everitt
Administrative Assistant
Department of Computing Science
University of Alberta
Edmonton, Alberta
Canada T6G 2E8
E-mail: everitt@cs.ualberta.ca

These positions will remain open until a suitable candidate is found.

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. If suitable Canadian citizens and permanent residents cannot be found, other individuals will be considered. The University of Alberta hires on the basis of merit. We are committed to the principle of equity in employment. We welcome diversity and encourage applications from all qualified women and men, including persons with disabilities, members of visible minorities, and Aboriginal persons.

Professional Opportunities

a reasonable cost of living; we have clean air, 300 days of sunshine per year, no traffic jams, and easy access to wilderness activities in the Rockies with the 12,000 ft. Snowy Range 35 miles west of town.

To apply, send a curriculum vitae, a statement of teaching interests and philosophy, a research plan, and three letters of reference to the following address:

Faculty Search Committee
Dept. of Computer Science
University of Wyoming
PO Box 3315
Laramie, WY 82071-3315
Email: search@cs.uwyo.edu
WWW: <http://www.cs.uwyo.edu>

The search committee will begin reviewing files on February 3, 2003, and the search will continue until the positions are filled. Persons seeking admission, employment or access to programs of the University of Wyoming shall be considered without regard to race, color, national origin, sex, age, religion, political belief, disability, veteran status or sexual orientation.

Virginia Tech

Department of Computer Science
Virginia Bioinformatics Institute

The Department of Computer Science and the Virginia Bioinformatics Institute (VBI) seek applications for several tenure-track positions in the Department of Computer Science

from individuals desiring to make fundamental contributions to both computer science and the life sciences in bioinformatics. Applicants for a senior position must have a significant track record of grant funding. All applicants must have a PhD in Computer Science or an allied area, a demonstrated record of publications in computer science or computational science, and a commitment to addressing significant life science problems. Full information about the positions and the department is available at <http://www.cs.vt.edu>.

The university has a strong commitment to bioinformatics. VBI (<http://www.vbi.vt.edu>) serves as a flagship bioinformatics research institute wedding cutting-edge biological research with state-of-the-art computer science. The Department of Computer Science has an outstanding record of multidisciplinary research, and has projects in human-computer interaction, high performance computing, problem solving environments, digital libraries, and bioinformatics.

Applicants should send a curriculum vitae, a 1-2 page statement of research goals in both computer science and life science, and at least three letters of reference to

Bioinformatics Faculty Search
Dept. of Computer Science
660 McBryde Hall (0106)
Virginia Tech
Blacksburg, VA 24061

Review of candidates will begin November

15, 2002, and continue until the positions are filled. Virginia Tech is deeply committed to recruiting, selecting, promoting, and retaining women, persons of color, and persons with disabilities. We strongly value diversity in the university community, and seek to assure equality in education and employment. Individuals with disabilities desiring accommodations in the application process should notify Dr. Lenwood Heath, 540/231-4352, TTY: 800/828-1120.

Virginia Tech

Department of Computer Science
Bioinformatics Postdoctoral Associate

The Department of Computer Science seeks applications for a postdoctoral associate to contribute to existing bioinformatics projects and to assist in teaching graduate-level courses in computation for life scientists. Applicants for the postdoctoral position must have a PhD in Computer Science or allied field and must demonstrate a genuine interest in participating in bioinformatics research. Full information about the position can be accessed through <http://www.cs.vt.edu>.

Applicants should send a curriculum vitae, a 1-2 page statement of research goals in both computer science and life science, and at least three letters of reference to:

Bioinformatics Faculty Search
Dept. of Computer Science
660 McBryde Hall (0106)

Virginia Tech
Blacksburg, VA 24061

Review of candidates will begin November 15, 2002, and continue until the position is filled. Virginia Tech is deeply committed to recruiting, selecting, promoting, and retaining women, persons of color, and persons with disabilities. We strongly value diversity in the university community, and seek to assure equality in education and employment. Individuals with disabilities desiring accommodations in the application process should notify Dr. Lenwood Heath, 540/231-4352, TTY: 800/828-1120.

Yeshiva University (New York)

Yeshiva University (New York) Computer Science program invites applications for a possible tenure-track faculty position at the Assistant Professor level. Applicants must hope to have an earned doctoral degree in Computer Science by August 2003.

The successful candidate is expected to carry out a research program in her/his area of interest and to do undergraduate teaching. Applications should include the names, telephone numbers and email addresses of at least three references.

Please apply by email to:
Bhaskar Sengupta
Chair of Computer Science
sengupta@ymail.yu.edu

CRA: 30 Years of Service from Page 4

At the 1988 Snowbird meeting, the problem of national representation for the computing research disciplines was again considered at length. There was still no organization representing the computing research community in a serious and sustained way. CRB recommended that the doctoral departments of computer science and computer engineering be assessed membership dues in order to hire a permanent staff. The departments were overwhelmingly supportive. A dues schedule was established that enabled the office to operate on a reasonable basis, with dues ranging up to \$5,000 per year, depending on the size of the school's faculty and research budget. Start-up funds were raised from ACM and a number of companies (AT&T, Digital Equipment, Hewlett Packard, IBM). Apple supplied office computers. The IEEE Computer Society provided the original office space and furnishings. The name was changed to Computing Research Association.

The office opened in 1989. Terry Walker, a professor at Louisiana State University and a member of the board of directors, served as interim executive director. Walker began publishing the association's newsletter, *Computing Research News*, and provided staff support for some of the continuing activities: the Forsythe List, the Taulbee Survey, and the Snowbird Conference.

In 1990, CRA hired Frederick Weingarten as executive director. Trained as a computer scientist, he had several decades of experience in Washington as a program officer at the National Science Foundation and as head of the computing and telecommunications program at the Office of Technology Assessment. In his six years as executive director, he built up the office, leasing office space, hiring a staff, and building up the membership.

There were three major program areas initiated during Weingarten's tenure. Drawing on his knowledge and contacts in the policy area, Weingarten built up the organization's policy program—providing the computing research community with its first permanent advocate in Washington. Weingarten was influential, for example, in the passage of the High Performance Computing Act that served as the authorizing legislation for more than a decade in support of federal funding of computing research. Weingarten also succeeded in finding external support to run a number of conferences and workshops of interest to the computing research community and the Washington policy community. Examples include the National Information Infrastructure Workshop in 1993, at which 400 industrial and academic researchers drafted a computing research agenda for the Clinton Administration, and the Next Generation Internet Workshop in 1997 that resulted in a report identifying a research agenda for national networking initiatives.

Started in 1990 and supported by Weingarten, the CRA's Committee on the Status of Women in Computing Research (CRA-W) was formed to "maintain and increase the number and status of women participating in computer science research and education at all levels." CRA-W developed many programs and became one of the most active and effective groups addressing participation of women in the scientific and engineering disciplines. Programs included the Grace Murray Hopper Conference, career guidance literature and workshops, programs for undergraduate women to gain research experience during the school year and the summers, a series of publications, and many others.

During the first half of the 1990s, CRA and its programs grew rapidly. A 1995 planning effort led the board to create a mission statement, with

four major areas of concentration: community-building (such as the Snowbird Conference and the Federated Computing Research Conference, of which CRA was a cofounder); human resources (such as the programs of CRA-W and the Coalition to Diversify Computing, of which CRA was a cofounder, to improve the status for underrepresented minorities in the computing profession); information gathering and dissemination (such as the Taulbee Survey and the Forsythe List), and policy.

As CRA's programs grew and membership and staffing increased, it became increasingly difficult for one person to serve as both executive director and director of government affairs. In 1996, Weingarten decided to focus on government affairs and a new executive director, William Aspray, was hired. Weingarten remained with CRA for another two years before leaving CRA for a full-time policy position with the American Library Association.

Aspray, trained as a mathematical logician and historian of computing, joined CRA after an early teaching career at Williams and Harvard and with management experience in several university-based research centers. CRA was a growing organization, and part of Aspray's work involved formalizing the organizational processes and structures and rebuilding and growing the staff. Academic and industrial membership was increased, a financial reserve fund was built, and the number of committees was expanded. The four mission areas identified by the board in 1995 continued to define CRA's focus, but a number of programs were added or expanded. These included an Executive Fellowship Program, a Digital Government Fellows program, an Industrial Salary Survey, regional meetings of industrial lab managers, an IT Deans Group, an Academic Profiles Survey, several workforce studies, an annual Leadership

Summit for the various professional computing societies, career workshops, an electronic news bulletin, and the Richard Tapia Conference for underrepresented minorities in computer science.

Aspray announced his departure from CRA in summer 2002 to join the faculty of the recently formed School of Informatics at Indiana University. He was succeeded by Andrew Bernat, who was the founding chair of the computer science department at the University of Texas-El Paso. Bernat brings NSF experience, a proven track record of working to increase minority participation in the computing research community, and many other skills to his new job.

Meanwhile, the organization continues to attract board members and officers of very high quality, many of whom choose to serve for many years. The original members of the board were predominantly department chairs from midwestern U.S. computer science departments. Today the board is a more diverse and representative group. There are leading research scientists as well as department chairs and deans from universities across the United States and Canada, senior research scientists and research managers from industrial computing laboratories, and representatives—often former presidents—from CRA's six affiliate societies (AAAI, ACM, CACS/AIC, IEEE Computer Society, SIAM, and Usenix). We do not have records that allow us to compile the complete list of people who have served on the board since the founding days, but the complete set of officers and many of the board members from 1990-2003 are available online at: <http://www.cra.org/CRN/articles/march03/aspray/html>.

William Aspray, CRA's Executive Director from 1996 to 2002, is a Professor in the School of Informatics at Indiana University (waspray@indiana.edu). ■