COMPUTING RESEARCH NEWS

The News Journal of the Computing Research Association

September 1996 *Vol. 8/No. 4*

NSF division slightly changes portfolio of research priorities

By Richard B. Kieburtz

The National Science Foundation's research sponsorship programs in the Division of Computer and Computation Research (CCR) have undergone a facelift, making room for a new program in experimental software systems in fiscal 1997. The portfolio of research areas supported by the division will not change radically, although there are some shifts in priorities. The new program is intended to enable researchers to conduct significant experimental investigations, supporting projects of larger size than have been typical in the past.

The impetus for change has come from a review of research in the Computer and Information Science and Engineering Directorate, conducted by its external advisory committee last fall. The review team observed that as programs tried to stretch their budgets to support a rapidly increasing number of outstanding younger investigators, the average award had atrophied, losing about one-third of its spending power over a 10-year period. A consequence has been a subtle shift in the kind of research that NSF grants have enabled, a shift away from experimental investigations toward less costly theoretical studies. The committee recommended that NSF should provide ways to support top-quality experimental projects requiring more than average resources. It further recommended that team-oriented approaches, in which multiple investigators can bring complementary expertise to a complex research activity, should be encouraged and supported.

The new program will address this need. It is intended to support teams of investigators planning to undertake important investigations that cannot easily be done in small fragments and to improve the quality of experimental research in software systems and software engineering. A word of caution is in order, however. No new funds are available in the

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HPC Act about to expire; renewal is not expected

By Fred W. Weingarten
CRA Staff

On December 9 the High-Performance Computing Act will quietly expire. No ceremony, no wake, no memorial service will mark the occasion. Evidently no tears will be shed in the administration, either, even though the bill was closely identified with Al Gore while he was in the Senate.

So close was this identity, President Bush was reluctant to sign the legislation, despite its being passed by heavy bipartisan majorities in both houses. Bush was concerned Gore would run against him for president and the issue might be raised in the campaign.

Bush was close to correct on the first concern and very correct on the second. For the first time ever, computing research was at least tangentially the subject of a presidential campaign, sneaking into debates under the guise of the National Information Infrastructure. Now, four years later, much has changed. Those curious about the candidates' stands on science policy will have to use an electron microscope to find science and technology, much less computing research, mentioned in the campaign.

One has to suspect that the acronym, HPCC, is about to sink without a trace. (The Office of the National Coordinator for HPCC, headed by John Toole, is changing its name to National Coordinator for Computing, Information and Communication.) At hearings held earlier this year by the House Science Committee on a possible renewal of HPCC, the administration argued against reauthorization.

There are several reasons offered for these changes, none of them inherently bad for computing research. Some even find reasons for optimism from the last few years.

First, the administration argues that these changes, rather than reflecting decreasing enthusiasm for computing research, instead reflect the continued broadening and maturing of the program. Second, any special initiative of this sort has a natural trajectory of support. The public and politicians become bored with the same old thing, and political interest in HPCC actually goes back more than a decade.

Finally, this presidential campaign is different from the last one (they all are, of course). Four years ago the Clinton/Gore campaign was trying to

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Contrary to myth, CS&E doing well

By David Patterson
CRA Board Chair

The following is an edited excerpt of a talk David Patterson gave at the CRA Conference at Snowbird in July.

Myth #1: Compared to other fields, computer science and engineering (CS&E) is disadvantaged in attracting the best and brightest. (AKA: We need a TV show titled *LA Computer Engineer*.) The reality is very different; our field is one of the most popular and attractive.

Surely the pervasiveness of PCs and the World Wide Web will inspire the curious to learn about the underlying technology.

We have two popular magazines dedicated to computing that include articles explaining CS&E research; for more than 25 years *Byte* magazine has popularized computing research, and now we have the cool and award-winning *Wired* magazine. How many other fields have such magazines?

The *New York Times*, the closest we come to having a North American newspaper, dedicates every Monday's Business section to information technology. How many other fields have one-seventh of the mind share of such a newspaper?

Our society now includes many signals that suggest the public should learn about computing technology:

- Print advertisements, cartoons, movie trailers and even news shows include e-mail addresses and URLs.
- We are starting to see sympathetic characters who are in CS&E: the hit movie of 1996 is "Independence Day," starring Jeff Goldblum as an ecologically sensitive computer genius who uses his computing skills to literally save the planet.

It can't hurt that CS&E is the field of one of the wealthiest people in the world (Bill Gates), or that the Feb. 19, 1996, cover of *Time* magazine featured 24-year-old Netscape multimillionaire Marc Andreessen.

I'm sure that colleagues in science and engineering fields are jealous of our visibility and popularity.

Myth #2: CS&E is shrinking, and we will never match the mid-1980s enrollments. (AKA: The academic sky is falling.) In contrast, I have noticed several small recent counter-examples.

The College of Engineering at Berkeley has seen a shrinkage in classical engineering at the undergraduate level; the three most popular majors are electrical engineering and computer science, bioengineering and undeclared. These are followed by mechanical, civil and industrial engineering. Moreover, I have been told many B.A.s in mechanical engineering or computer engineering end up getting programming jobs that have nothing to do with ME or CE.

EECS departments at Berkeley, the University of Michigan and the Massachusetts Institute of Technology historically have had many more EE majors than CS majors. Starting in 1995-96, more than half of the freshman who declared majors at each school declared computer science as their major. These excellent public and private schools are geographically distributed, so it seems plausible that this is a nationwide trend. Freshman majors in 1996 would seem to be the leading indicator for the senior majors in 2000. This sampling suggests to me that by that time we will have many CSEE departments.

My conclusion is that I expect undergraduate CS&E majors to increase in popularity, provided our curriculum can leverage the excitement of the brave new world.

Myth #3: CS&E is seen as a lesser field by our peers in engineering and science. (AKA: Any field with the word "science" in the title is not one.)

This inferiority complex tends to be associated with the more senior members of CS&E, but I'd like to "cure" the complex in case it is

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Opinions

Electronic publishing plan a must

By Peter J. Denning

In the May issue of *CRN* (Page 2) Jeff Ullman wrote that the Internet is changing the role of printed journals because the Web—not the journals—is becoming the medium of research communication. He suggested that home page hits (HPHs) become a measure of research impact, replacing publications in prestigious journals (PPJs). He also suggested that there is no excuse for a publisher to ask for copyright and that publishers who do so inhibit dissemination of research.

In the same issue (Page 2), Franco Preparata and John Savage urged caution on a headlong rush toward eliminating printed journals. They want to retain the good parts (peer review) and make new distinctions that facilitate Web journals (disclosure versus publication, conference versus journal review and focusing copyright rules on cases where actual monetary value is at stake). They cited the Association for Computing Machinery copyright policy as a good model for other publishers to follow.

This is a good opportunity to discuss the electronic publishing plan and new copyright policies being developed and implemented by the ACM Publications Board, which I chair. The principles of our plan fulfill most, if not all, of Ullman's wish and preserve most, if not all, of what Preparata and Savage want to preserve.

ACM has, over the past 40 years, developed a reputation as a leading publisher of research journals in computing. This has been accomplished with your volunteer help—as editors and reviewers you have insisted on high scientific standards. Despite this fine reputation, subscriptions to ACM journals have been declining by an average of 6% for each of the past five years. (ACM has fared much better than most scientific publishers—10% or more annual loss in other societies is not unusual.) From surveys and focus groups we learned everyone has a reason for finding the print journals less valuable.

Researchers are finding less value in them because of the long delay to publication, often 18-24 months—most of which is spent in the review and revision process. They see conferences as more responsive and, in many cases, of equal quality. Many authors do not subscribe to the journals in which their papers appear, a fact that has led to the famous quip about "write-only journals."

Nonresearchers (who make up 80% of the ACM membership) are finding the journals increasingly specialized and difficult to relate to their everyday concerns. We are operating in a market of researchers who think increasingly that printed journal publication is slow and redundant compared with Web publication, of developers with many demands on their time, of educators and students who want easy access to materials and of end-users who want rapid insights into changing technology. ACM is repositioning its journals to produce new value for these clients.

The electronic publishing plan is the vehicle that will transport us to this destination. To generate value for the researchers, the following steps will be taken:

- Printed research journals will be replaced with dissemination from a database, which we are calling the ACM digital library. The ACMDL is the centerpiece of the ACM strategy. It will contain documents and their components, cross references, links, citation records, commentary, reviews, criticisms and the like. It will support alert, brokerage and repackaging services.
- ACMDL will accommodate a method of early disclosure (the preprint practice) and a method for readers to attach comments to disclosed documents (community review).
- The existing editorial and review structures of journals will be preserved, but they will lead to publication in the database rather than in paper. Thus, a subset of the research documents in ACMDL will be marked as "published," as certification that they have passed a peer review.
- ACM will guarantee the authenticity, integrity and indefinite preservation of all documents in ACMDL. ACM will protect its authors from copyright infringements.

In short, ACM will extend its research publications with ACMDL, providing new services for research dissemination. ACM will offer print and CD-ROM versions of journals as long as there is a market for them. To generate new value for the remaining ACM members (developers, analysts and technicians), we will:

- Offer every ACM member low-cost access to ACMDL and the ability to download individual items for personal use without an additional fee. ACMDL will notify each member when a new item is added that matches a profile created by the member.
- Develop more magazines, print and electronic, that are attuned to working professionals. These magazines will do two things: assist in technology transfer from the research literature; and promulgate case studies and best practices, analyze trends and offer tutorials on technologies.
- Develop a line of self-study reading programs, drawn from ACMDL, that will lead to certificates.
- Develop brokerage services so that individuals can obtain customized packages of items from ACMDL pertaining to a given subject area or interest.

This plan accomplishes the objectives Ullman, Preparata and Savage discuss by moving toward all-electronic research publication and dissemination without losing the features of the current system that produce value for researchers.

In this context we developed a set of new copyright policies for cyberspace. We designed these policies to promote and facilitate dissemination and recognize emerging practices on the Web. The policy permits people using ACM materials to make copies for personal and classroom use without additional permissions from ACM. It gives authors liberal retained rights, including rights to post all versions except the definitive (ACM-published) version on their personal Web pages. It offers guidelines for linking all the versions of a research paper together. It also encourages unlimited browsing and dissemination of pointers (URLs) to ACM documents.

Other scientific societies are imitating the ACM policy. We are pleased others find it so useful.

Some authors ask, "What value is generated for me in transferring copyright to a publisher?" We have sought to design the ACM copyright policy so that there is value for authors; ACM works for their interests in fast, maximum and continuing dissemination and technology transfer and in protecting them from Internet plagiarism and piracy. At the same time, the policy does not inhibit authors from their standard Internet practices.

Some authors have asked, "Why not make all the research publications free?" They claim this would maximize dissemination. We are experimenting with electronic journals that have very low operating costs by relying completely on volunteer editing and reviewing services and by accepting and disseminating in very limited formats. But even these costs are not zero. Moreover, given the glut of mediocre material on the Internet, it is not clear to us that making the cost zero would maximize readership; more readers may be willing to pay a small fee to guarantee the quality of the material they receive.

A full-service ACMDL—with full text searching, user profiles, alert services, brokerage services, editing to ensure readability of documents from non-English-speaking authors and technology transfer services—is not going to be significantly less expensive than the current print-based publication operation. It will, however, be significantly more valuable.

The ACM Electronic Publishing Plan and Copyright Policy can be found at http://www.acm.org/pubs.

Denning is chair of the ACM Publications Board. He is associate dean for computing at the School of Information Technology and Engineering at George Mason University.

Expanding the Pipeline

CRA-W advancing the status of women in CS&E

BY Mary Jane Irwin and Francine Berman

The myriad of problems facing women in CS&E education and research is significant. And the situation is expected to get worse.

The CRA Committee on the Status of Women in Computer Science and Engineering Research (CRA-W) was formed in the spring of 1991 under the very able direction of the first co-chairs Nancy Leveson of the University of Washington in Seattle and Maria Klawe of the University of British Columbia. We assumed the co-chair duties in the summer of 1993 and thereby established a three-year rotation schedule for CRA-W co-chairs. Thus, we are delighted to report that in July the leadership of CRA-W was turned over to the capable hands of Janice Cuny of the University of Oregon and Leah Jamieson of Purdue University. The goal of this article is to give you an overview of what CRA-W has accomplished over the last three years and to provide a snapshot of potential future activities. Resources and funding for the committee have been provided by the National Science Foundation and by CRA.

CRA-W is an action-based committee that has initiated numerous projects that seek to improve the participation and status of women students, professors and researchers in computer science and engineering. Members of the committee represent academic and industrial research, Ph.D.- and non-Ph.D.-granting departments, and a cross section of the major research areas in the CS&E field. Each committee member takes responsibility for guiding a project from its inception to its completion and evaluation. Thus, committee membership rotates depending on active projects; membership has ranged from 10 to 17 members.

Why is such a committee necessary? According to data from the Education Department's National Center for Education Statistics, the percentage of females in undergraduate computer science has been dropping steadily since 1984. In the early 1980s there was a steady upward trend in the ratio of female recipients to total B.S. computer science degree recipients, from 28% in 1979 to 37% in 1984. This trend reversed itself in 1984, and in 1990 the ratio had fallen to 30%. In 1995 it decreased to only 18% in computer science and computer engineering combined. Why is this trend particularly disturbing? Because these women are at the front end of a CS&E pipeline that narrows dangerously.

There are numerous arguments and explanations for the decline in interest in the undergraduate CS&E major by women. In the pre-college pipeline there are serious problems in attracting girls to science in general, in encouraging them to take enough math and science courses to remain in the pipeline and in helping them to recognize that a career in science is both possible and rewarding. The drop in the CS&E major seems to parallel the increase in computing courses taught in the high schools and some hypotheses are focusing on problems in the teaching of these courses.

During the period 1981-86 when women undergraduate CS&E majors were doubling, the percentage of women getting doctorates in computer science did not increase. This percentage has remained within the range of 10% to 14% from 1983 to 1992. It now stands at 17%. In comparison, the percentage of women receiving doctorates in the physical sciences during the same period increased from about 9% to 17%, and the biological sciences increased from 25% to 36%. Only engineering is below CS&E with about 8%, although it too has shown a continual upward trend from 2% in 1978.

At the graduate level, female CS&E students suffer from isolation, powerlessness, invisibility, exclusion and a lack of role models. The 1995 CRA Taulbee Survey found that only 10.2% of the faculty in Ph.D.-granting computer science and computer engineering departments are female and only 58 full professors were women (out of a total of 1,144 full professors). Without guidance, women students tend to turn their problems inward, resulting in lowered self-confidence and lowered career objectives. The shortage of women in CS&E faculty positions, especially at the higher ranks, means there are few role models for women who might be interested in getting a Ph.D. in CS&E.

The myriad of problems facing women in CS&E education and research is significant. The recent shrinking of the pipeline with respect to undergraduate majors forebodes even more serious problems in the near future. CRA-W's goal is to take positive action to increase the number of women participating in CS&E education research and education at all levels. In addition to increasing the number of women, the committee also seeks to increase the degree of success they experience and provide a forum for addressing problems that often fall disproportionately within women's domain (e.g., career-family conflicts, maternity, child care, two-body problems, discrimination and harassment). The dozen or so CRA-W projects are described in more detail below. Links to most activities and more information can be found on the CRA-W Web page at http://www.cra.org/womencom.html.

CRA-W activities

• *Women in CS&E careers booklet* (Dian Ray Lopez, University of Minnesota at Morris; Ann Redelfs, San Diego Supercomputer Center): Unlike the more established disciplines such as physics, chemistry and biology, the newness of CS&E means there is almost no material available for K-12 that truly gives the students a taste of the excitement, challenges and opportunities of a career in CS&E. Published in March 1996, this booklet features women in various academic and industry positions in CS&E, and is targeted to appeal to junior high and high school girls. Out of the initial print run of 15,000 copies, only 800 copies remain undistributed.

• *CRA Distributed Mentor Project* (Joseph O'Rourke, Smith College; Anne Condon, University of Wisconsin at Madison): This project has received two NSF awards, which are used to support female undergraduate students in CS&E doing research under the direction of a female faculty mentor at another institution. Almost 75 students have been supported over the past three summers.

Because of its distributed nature, it is reaching previously untapped students at institutions where undergraduates have little contact with research activity or female faculty. The program has been very effective in exposing these students to research and university environments, in many cases altering their career plans and establishing contacts that will help them realize these plans.

• *Graduate Information Kit for Women in CS&E* (Sandra Johnson Baylor, IBM T.J. Watson Research Center): A serious problem for women students is a lack of informa-

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Microsoft and Sun Microsystems donate software, hardware to CRA

The Computing Research Association would like to acknowledge the generous support of Microsoft Corp. and Sun Microsystems Inc. in their recent donations. Microsoft and Sun also have provided ongoing support to CRA: both are industrial members and both send attendees to the CRA Conference at Snowbird.

Microsoft Corp. donated more than $28,000 worth of software, including file, Web and SQL servers; HTML authoring tools; and developer tools. The donation was authorized by Dan Ling, Microsoft's director of research. Dennis Adler and Todd Needham, manager of University Research Programs at Microsoft, organized the shipment of the software.

Sun Microsystems Inc. donated more than $25,000 worth of hardware and software, including a SPARCserver 20 with hard disk, monitor, tape backup and operating system. CRA would like to thank Bert Sutherland, head of Sun Microsystems Laboratories, who made the donation with the help of Emil Sarpa, manager of external research at Sun Microsystems. Chris Spina at Sun's Chesapeake Regional Office organized delivery of the SPARCserver.

Please contact William Aspray, CRA's executive director (e-mail: aspray@cra.org; tel. 202-234-2111), if your organization is interested in making a donation to the association.

Expanding the Pipeline

Wardle helps open doors for women in CS&E

"NSF provides an excellent environment for scientists and engineers and has been very supportive of my being a spokeswoman for the funding of activities for women in computer science and engineering," said Caroline E. Wardle, the 1996 recipient of the Computing Research Association's A. Nico Habermann Award.

CRA cited her enthusiasm for spreading the word that the National Science Foundation cares about women's concerns in the computing disciplines. She also was praised by members of CRA's Committee on the Status of Women in Computer Science and Engineering Research (CRA-W). "Her guidance, encouragement and willingness to consider proposals has helped CRA-W in its efforts to recruit, retain and advance women in computer science and engineering," CRA-W committee co-chair Leah Jamieson said. "She has also been a strong advocate for greater representation of women in higher positions at NSF and in other organizations."

CRN interviewed Wardle to learn more about her life history.

"Being able to contribute to increasing opportunities for women has been personally satisfying to me," Wardle said. "The situation certainly differs from my experience growing up in England in the 1960s. When I was 18, I had a summer job with an engineering company. I supervised two male engineers, both a year younger than I. Their salaries were higher than mine because it was the norm then for men to be paid more than women for the same job. While it didn't occur to me to protest at the time, the incident certainly influenced my career decisions. Several years later I remember thinking that if I earned a Ph.D., I'd be less likely to be treated this way."

Surviving the summer job, Wardle went on to earn a B.S. in mathematics from the University of London. She came to the United States in 1967, accompanying her thesis supervisor to the University of Nebraska. "Three of his four doctoral students from England were women—the first ever in the Nebraska Physics Department," she said.

In 1970 she was awarded a doctorate in atomic physics from London University. She had already joined Hunter College of the City University of New York in 1969 as the first computer science faculty member in the math department. While at Hunter, she assumed the first of many academic leadership roles by becoming the prime architect of a bachelor's degree program in computer science.

"Before Hunter became part of CUNY," Wardle said, "it had been a top-ranked women's school. Although it was now coeducational, many students and faculty were women, and the atmosphere encouraged women to excel in all fields." Wardle plunged into teaching the new CS courses, quickly gaining a reputation as one of the best teachers in the department. She also started working in a new research area: computer graphics and programming languages.

In 1975 Wardle moved to Boston University Metropolitan College, where she designed the bachelor's and master's degree programs in computer science and information systems. She later founded and chaired the Department of Computer Science. "The environment at BU was quite different from Hunter," Wardle recalled. "There were few women in senior positions, and thus I felt called on to be a role model for women students."

In 1980 Wardle took a leave of absence from BU to become associate dean and, later, dean of the Wang Institute of Graduate Studies, where she continued her role as an academic leader. "I had built bachelor's programs, master's programs, a computer science department, and now I was offered the opportunity to build an institute. How could I resist the challenge?" she laughed.

She did everything from obtaining degree-granting authority from Massachusetts to designing organizational structures, participating in computer facilities management, seeking equipment donations, writing catalog copy, doing public relations, starting a library and recruiting students, faculty and staff. "It was a very exciting time," she said. When her leave ended, Wardle returned to BU and to her first love: teaching. But she also began a new research project, this time in information systems.

In 1985 Wardle made a significant change in her life. She elected to become a single parent. "I am delighted that CRA-W will publish a booklet on balancing careers and family. This aspect of my life has certainly been difficult," she disclosed. "My daughter Ann is now 11 years old, and it is vital to me to be a good role model for her. That is one reason I moved to NSF in 1990. I wanted to be in an environment where I could contribute in a different way to research and education as well as increasing opportunities for women in science."

On joining NSF, Wardle became a program director in the Computer and Information Science and Engineering Directorate's (CISE) Office of Cross-Disciplinary Activities (OCDA), managing research and educational programs, including research infrastructure, research instrumentation, educational infrastructure and faculty awards for women. "NSF allows professional staff a day a week for research, which has let me collaborate with colleagues at American University and the National Institute of Standards and Technology in a research project in software engineering," Wardle said. "To be happy in my work, I need the intellectual challenge of scientific research."

In 1995 Wardle received the NSF Director's Award of Excellence for outstanding achievements in CISE administration and management. For the past year, she has served as deputy division director in the Division of Computer and Computational Research. She recently returned to OCDA as deputy, where her new responsibilities include managing a cross-disciplinary program focused on integration of research and education and being CISE's representative for women's activities.

"NSF has funded a number of professional women's organizations in the computing disciplines," she said. "CRA-W is one of the most successful I have seen. Each committee member assumes responsibility for a project, and the results have been truly impressive."

CRA's A. Nico Habermann Award

The Computing Research Association is pleased to name Caroline Wardle as recipient of the 1996 A. Nico Habermann Award. This award is presented to Wardle for the outstanding contributions she has made to improve opportunities available for women in the computer and information science and engineering (CISE) disciplines.

Wardle received the award July 14 at CRA's Conference at Snowbird in Utah.

The A. Nico Habermann award honors the late Dr. Habermann, who headed NSF's CISE Directorate until his death in 1993. He was deeply committed to increasing the participation of women and underrepresented minorities in computing research.

CRA makes the award, usually annually, to a person who has made an outstanding contribution to aiding members of underrepresented groups within the computing research community. This award recognizes work in the areas of government affairs, educational programs, professional societies, public awareness and leadership that has a major impact on advancing these groups in the computing research community.

Past A. Nico Habermann Award winners:

1995 - *Eugene Lawler* (posthumous award), University of California at Berkeley

1994 - *Richard Tapia*, Rice University

CRA-W from Page 3

tion about programs and opportunities that already exist. This booklet contains information about how to go about picking and applying to a graduate program. It includes an appendix with information on graduate fellowships in CS&E targeted for applicants from underrepresented groups.

• *Mentoring workshops* (Jan Cuny, University of Oregon): These workshops are designed to provide guidance to senior women, Ph.D. students and junior women faculty in CS&E on such issues as getting that first academic job, succeeding at promotion and tenure, developing research and teaching programs, making contacts and balancing career and family. More than 120 women attended the first workshop held in 1993. CRA-W has held similar workshops since, including a two-day workshop in 1994 and 1996 and two afternoon workshops in conjunction with the 1995 and 1996 ACM Conferences.

• *Grace Hopper Celebration of Women in Computing* (Anita Borg, Digital Equipment Corp.; Ruzena Bajcsy, University of Pennsylvania): The hugely successful first celebration of women in computing conference was held in 1994 in Washington, DC. The second celebration will be held Sept. 19-21, 1997, in San Jose, CA.

• CRN *Expanding the Pipeline Column* (Leah Jamieson, Purdue): Because *CRN* goes to most faculty at Ph.D.-granting departments, department chairs, research labs and corporate members (about 5,000 people), it provides an excellent vehicle for informing the community about committee projects. The "Expanding the Pipeline" columns also have played a role in educating a wider audience about mentoring activities and issues of importance to both genders.

• *Systers Academia* (Nancy Leveson, University of Washington): The goal of this moderated electronic mailing list is to provide mentoring and communication between women CS&E faculty and Ph.D. students. Topics discussed have included sexual harassment, overcoming hurdles and discouragement in the Ph.D. process, selecting and approaching Ph.D. advisers, university and department maternity policies, scholarships and fellowships available for women and dealing with pornographic term papers.

• *Ph.D. database* (Joan Feigenbaum, AT&T): A common argument for not including women on important panels and committees has been that "there aren't any." The committee's database of women with Ph.D.'s in CS&E has shown that argument to be false. It has been used by recruiters in personnel searches, by editors-in-chief looking for editorial board candidates, by conference program chairs in selecting members for their program

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CRA Conference at Snowbird '96

Aspray: CRA to focus on its mission, leveraging efforts

By William Aspray
CRA Staff

The following is an edited excerpt of a talk CRA's executive director gave at the CRA Conference at Snowbird.

Five principles will govern my direction of the association:

Focus: Strong organizations are ones that clearly understand their missions and know how to keep their activities focused on their principal objectives. CRA is a small organization with a very clear purpose: to strengthen research and advanced education in computing and allied fields. CRA is not a general-purpose computing organization, such as the Association for Computing Machinery or the Computer Society, and it should not try to be. We must constantly ask ourselves whether our actions will advance our primary purpose.

Leverage: CRA is small; it has a staff of fewer than 10 people and a modest budget. If CRA is to make a difference, it must find a way to leverage its efforts. Fortunately, through our board and our staff, we have excellent connections with our affiliated computing societies, the academic computer science and engineering departments, the industrial research labs of our profession and the major federal and private funding agencies. It is my intention to have CRA leverage its resources by partnering, as much as possible, with these other organizations on issues of mutual concern.

Building board structure: Like many association boards, the CRA Board meets only a couple of times a year. It is not possible for any board meeting so infrequently to carry out ongoing programs. But not taking advantage of the talents of the leading members of the profession who sit on our board is a terrible waste of human resources. The CRA Committee on the Status of Women in Computer Science and Engineering Research has provided an excellent model for our committee structure: a strong and activist committee on which every member is expected to have her or his own project that is moved forward between committee meetings.

This structure has resulted in a remarkably successful program—one that has received much-deserved recognition throughout the scientific and engineering professional communities. My goal is to develop several

Continued on Page 7

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Intellectual property rights and CS&E workshop in December

By Randy Katz

At the recent CRA Conference at Snowbird '96, it became clear to many participants of a panel session on university-industry interactions that the current university policies with respect to intellectual property rights and licensing are having a chilling effect on this very important form of collaboration for the university and industrial research communities.

Because of the interest in this subject, CRA is planning a workshop in Washington, DC, in early December, held in conjunction with the CRA Board meeting. The workshop will discuss the practical issues of intellectual property rights from the viewpoint of how they can best support our desires for enhanced university-industry interactions rather than limiting them. Participants will include department chairs, managers of industrial research laboratories and selected heads of campus technology licensing organizations.

Financial pressures at the nation's universities have caused university administrators to look toward new methods of more aggressively leveraging the financial and intellectual assets of the university. The result has been increased emphasis on university intellectual property through associated patent and licensing policies, with the hope that this can yield substantial additional campus income.

Although fields like biotechnology may yield fundamental new techniques, with substantial licensing fees, this does not appear to be the case for software and many other engineering technologies.

Aggressive pursuit of licensing fees may actually inhibit university-industry interaction and may yield substantially reduced industrial support for university research in the future. Sponsoring companies often feel they have a double indemnity; they must pay licensing fees in addition to the financial support they originally provided to a project.

For example, for the entire University of California system, only two patents in the field of microelectronics—for switched capacitor filters—have yielded significant licensing income in the last 20 years. While these may have yielded a few million dollars for the university, one wonders how many industrial collaborations were lost because of the university's restrictive licensing policies. Contrast this with the positive impact on the community of freely distributed versions of the Berkeley Software Distribution of Unix in the 1980s. Berkeley benefited enormously from the good will and fame that accrued because of that highly visible activity. The X Consortium at the Massachusetts Institute of Technology and Mosaic at the University of Illinois at Urbana-Champaign are just two more examples of the value of freely available software in transforming the computing industry.

Among university licensing offices, there seems to be little understanding of the realities of university-developed software or the new economies of software in the Internet Age. As for the former, university software is rarely "industrial strength" and may require substantial additional effort to yield production-quality code. For the latter, client software is often given away, while server software and services such as documentation and technical support are sold. There is little evidence that any university software has obtained substantial licensing fees for its developers.

A probable outcome of the December workshop is extensive information sharing about existing campus policies and a tabulation of how successful—or unsuccessful—campus licensing efforts have been.

A concrete product will be the formulation of a reference software licensing policy for voluntary adoption by CRA member organizations. Such a licensing document could be taken back to your campus to help make the case for a discipline-specific intellectual property rights policy at your university.

In addition, we will develop draft policies and formulate recommendations on how to accommodate the special intellectual property rights needs of visiting researchers at educational institutions and industrial research laboratories. The standard policies of intellectual property ownership, such as patent rights, accruing to employers are inappropriate for situations in which personnel are exchanged between a university and an industrial research laboratory.

If you are interested in more information about this workshop, interested in helping organize it or are interested in attending, please contact CRA Board member Randy Katz at randy@cs.Berkeley.edu.

Katz is a CRA Board member and professor of computer science at the University of California at Berkeley.

Attention Department Chairs: The 1996 CRA Taulbee Survey was mailed September 6. If you have not received your copy of the survey by September 15, please send an e-mail message to info@cra.org. We are counting on your cooperation in returning the survey before the November 15 deadline so that your data can be included in the preliminary salary results printed in the January issue of *CRN*. You are encouraged to complete an online version of the survey (http://www.cra.org/Survey/FillOut).

Association News

8 begin 3-year terms on CRA Board of Directors

Seven new directors recently were elected to serve on the Computing Research Association Board. One director was re-elected.

CRA's new board members, who joined the board July 1 and will serve three-year terms, are James D. Foley, Randy Katz, James Morris, Kenneth Sevcik, Lawrence Snyder, Mary Lou Soffa and John Stankovic. Mary Vernon was re-elected.

CRA appreciates the time and effort contributed by its retiring board members: Rick Adrion of the University of Massachusetts at Amherst, Ruzena Bajcsy of the University of Pennsylvania, Barry Boehm of the University of Southern California, Maria Klawe of the University of British Columbia, Duncan Lawrie of the University of Illinois at Urbana-Champaign, Robert Ritchie of Hewlett-Packard Co. and John Savage of Brown University.

The CRA Election Committee, chaired this year by Anita Borg of Digital Equipment Corp., puts together a slate of candidates from nominations made by members of the computing research community. In preparing the slate, the committee seeks reputable computer researchers and research administrators who are willing to devote time and energy to CRA. The committee looks for a varied slate in terms of research field, organization type, gender, ethnic background and geography.

James D. Foley

Director, MERL; Executive vice president, Mitsubishi Electric Information Technology Center America.

Foley has a doctorate in computer, information and control engineering from the University of Michigan at Ann Arbor. His research interests are computer graphics and human-computer interface.

Awards and honors: IEEE Fellow, 1986. National Computer Graphics Association Academic Award, 1991. Sigma Xi Sustained Research Award (Georgia Tech Chapter), 1993. Georgia Tech Interdisciplinary Activities Award, 1994.

Previous involvement with CRA: Member, 1988-90 as chair of the Department of Electrical Engineering and Computer Science, George Washington University; organized technology transfer session at the 1992 CRA Conference at Snowbird; Editorial Board member.

Randy H. Katz

Chair, Electrical Engineering & Computer Science Department, University of California at Berkeley.

Katz has a doctorate in computer science from the University of California at Berkeley. His research interests are wireless communications and mobile computing.

Awards and honors: IEEE Fellow, 1996. ACM Fellow, 1996. CRA Distinguished Service Award, 1995. Distinguished Alumni Award, Computer Science and Engineering, Berkeley, 1994. Distinguished Teaching Award, Academic Senate, Berkeley, 1992.

Previous involvement with CRA: Invited plenary lecture, Federated Computing Research Conference '96.

Relevant experience: Chair, EECS Department, Berkeley, July 1996-99. Program manager and deputy director, DARPA Computing Systems Technology Office, 1993-94. Assistant, associate and full professor, Computer Science Division, EECS Department, Berkeley, 1983-present. Assistant professor, University of Wisconsin at Madison, 1981-82. Worked at Bolt Beranek and Newman Inc. and the Computer Corporation of America, 1980-81.

James H. Morris

Professor of computer science and department chair, Carnegie Mellon University.

Morris has a doctorate in computer science from the Massachusetts Institute of Technology. His research interests are distributed computer systems and their use for human communication.

Awards and honors: IBM ACIS Academic Award, 1988. Xerox Research Fellow, 1982.

Relevant experience: Assistant professor, University of California at Berkeley, 1969-74. Researcher, Xerox PARC, 1974-82. Director, CMU's Information Technology Center, 1983-87. Founder, MAYA Design Inc., 1989-92. Head, CMU's CS Department, 1992-present.

Kenneth C. Sevcik

Professor and director of the Computer Systems Research Institute, University of Toronto.

Sevcik has a doctorate in information sciences from the University of Chicago. His research interests are performance evaluation of computer and communication systems, information structures, and parallel and distributed database systems.

Awards and honors: Award for Excellence in Research, Information Technology Association of Canada, 1990-92. Member, Natural Sciences and Engineering Research Council, 1988-94. IFIP Silver Core Award, International Federation of Information Processing Societies, 1989.

Previous involvement with CRA: Participated in four CRA Conferences at Snowbird, 1984-92.

Relevant experience: NSERC Computer and Information Science Grant Selection Panel, member from 1984-87 and chair in 1986-87. Member, NSERC Committee on Research Grants, 1988-94. Member, ad hoc committee for increasing research funding in Canada, 1990-91. Member, NSERC Ad Hoc Committee on Research Computing, 1989-91.

Lawrence Snyder

Professor of computer science and engineering, University of Washington.

Snyder has a doctorate in computer science and engineering from Carnegie Mellon University. His research interest is parallel computing.

Awards and honors: ACM Fellow, 1994. IEEE Fellow, 1992.

Previous involvement with CRA: Participated in four CRA Conferences at Snowbird, 1984-92.

Relevant experience: Chair, NSF Computer and Computation Research Directorate Advisory Committee. Chair, ACM Doctoral Dissertation Award Selection Committee. General chair, Symposium on Parallel Algorithms and Architectures, 1991-94. Chair, Academic Careers in Experimental Computer Science, NRC, 1992-93. Advisory/evaluation committees for the CS departments at Princeton, Dartmouth, Santa Cruz, Utah, Carnegie Mellon, Penn State, Oregon Graduate Institute and others.

Mary Lou Soffa

Professor of computer science, University of Pittsburgh.

Soffa has a doctorate in computer science from the University of Pittsburgh. Her research interests are program analysis, programming language implementation, parallelizing compilers and software tools.

Awards and honors: NSF Professorship for Women, University of California at Berkeley, 1987. Outstanding Service Award, ACM SIGPLAN, 1995.

Previous involvement with CRA: Panelist, CRA Academic Careers for Women in Computer Science Workshop.

Relevant experience: Founding participant of the annual Symposium for Graduate Education, sponsored by Florida A&M (a special program to ensure that African-American students have the proper credentials and encouragement to enter graduate school in computer science). Initiated programs to recruit minorities into graduate programs in Arts and Sciences at the University of Pittsburgh; increased the representation by 40% in three years.

John A. Stankovic

Professor of computer science, University of Massachusetts at Amherst.

Stankovic has a doctorate in computer science from Brown University. His research interests are real-time systems, operating systems, distributed systems, database systems and multimedia.

Awards and honors: Ph.D. thesis chosen as one of the year's best and published as a book, 1979. Outstanding Scholar Award, School of Engineering, University of Massachusetts, 1983. IEEE Computer Society's Meritorious Service Award, 1991. IEEE Fellow, 1993. ACM Fellow, 1996.

Relevant experience: Editor-in-chief and member of editorial boards of major journals: *Real-Time Systems Journal*, IEEE *Transactions on Computers*, IEEE *Transactions on Parallel and Distributed Systems*, 1986-present. General chair, program chair and member of program committees for many conferences, 1979-present. Chair, IEEE Technical Committee on Real-Time Systems (elected to a two-year term), 1993-94. Industrial experience working at Bell Labs, 1970-74. President of the Brown University Student Chapter of the ACM, 1975-78.

Mary K. Vernon

Professor of computer science, University of Wisconsin at Madison.

Vernon has a doctorate in computer science from the University of California at Los Angeles. Her research interests are computer systems performance modeling and analysis, parallel computer architectures and distributed systems.

Awards and honors: NSF Presidential Young Investigator award, 1984. Award paper, IFIP WG 7.3 International Seminar on Performance of Distributed and Parallel Systems, 1989. NSF Faculty Award for Women in Science and Engineering, 1990. Member, IFIP WG 7.3 on Information Processing System Modeling, Measurement and Evaluation, 1993. ACM Fellow, 1996.

Previous involvement with CRA: Member, CRA Board of Directors, December 1993-present. Program chair, NIST Forum, R&D for the NII: Technical Challenges, February 1994. Testified on behalf of CRA, House Science Subcommittee on Basic Research, March 1996.

Relevant experience: Member, NSF CISE Directorate Advisory Committee, 1992-present. Member, NSF Blue Ribbon Panel on High-Performance Computing, 1993. Member, NSF Task Force on the Future of the Supercomputing Centers, 1995.

Association News

1995-96 COMPUTING RESEARCH ASSOCIATION MEMBERS

Affiliated Professional Societies

American Association for Artificial Intelligence
Association for Computing Machinery
IEEE Computer Society
Society for Industrial and Applied Mathematics

Industry and Government Labs

Apple Computer Inc.
AT&T Bell Laboratories
Digital Equipment Corp.
DIMACS Center
GE Corporate Research & Development
IBM Research
Microsoft Corp.
Mitsubishi Electric Research Labs
NEC Research Institute Inc.
San Diego Supercomputing Center
Sun Microsystems Inc.
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Arizona State University (CS)
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California Institute of Technology (CS)
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Clemson University (CS)
Colorado State University (CS)
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Columbia University (CS)
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Dartmouth College (CS)
Duke University (CS)
Florida Atlantic University (CS&E)
Florida State University (CS)
George Mason University (CS)
George Washington University (CS)
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Harvard University (CS)
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Lehigh University (CS)
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Michigan State University (CS)
Mississippi State University (CS)
Montana State University-Bozeman (CS)
New York University (CS)
North Carolina State University (CS)
Northeastern University (CE)
Northeastern University (CS)
Northwestern University (EE&CS)
Oakland University (CSE)
Ohio State University (CIS)
Ohio University (CS)
Oklahoma State University (CS)
Old Dominion University (CS)
Oregon Graduate Institute (CS)
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Portland State University (CS)
Princeton University (CS)
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Rice University (CS)
Rutgers, State Univ. of New Jersey (CS)
Santa Clara University (CE)
Simon Fraser University (CS)
Southern Methodist University (CE&CS)
Stanford University (CS)
State University of New York, Albany (CS)
State Univ. of New York, Binghamton (CS)
State University of New York, Buffalo (CS)
Stevens Institute of Technology (CS)
Syracuse University (CIS)
Temple University (CS)
Texas A&M University (CS)
Tulane University (CS)
Univ. of Alabama, Birmingham (CI&S)
University of Alabama, Tuscaloosa (CS)
University of Alberta (CS)
University of Arizona (CS)
University of British Columbia (CS)
University of Calgary (CS)
University of California, Berkeley (CS)
University of California, Davis (CS)
University of California, Irvine (I&CS)
University of California, Los Angeles (CS)
University of California, Riverside (CS)
Univ. of California, Santa Barbara (CS)
University of California, Santa Cruz (CE)
University of California, Santa Cruz (CIS)
University of Central Florida (CS)
University of Chicago (CS)
University of Colorado, Boulder (CS)
University of Delaware (CIS)
University of Florida (CIS)
University of Houston (CS)
University of Idaho (CS)
University of Illinois, Chicago (CS)
Univ. of Illinois, Urbana-Champaign (CE)
Univ. of Illinois, Urbana-Champaign (CS)
University of Iowa (CS)
University of Kansas (CE)
University of Kentucky (CS)
University of Manitoba (CS)
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Univ. of MD, Baltimore Co. (CS&CE)
University of Massachusetts, Amherst (CS)
University of Michigan (CSE Div.)
University of Minnesota (CS)
University of Mississippi (CIS)
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University of New Mexico (CS)
Univ. of North Carolina, Chapel Hill (CS)
University of North Dakota (CS)
University of Oklahoma (CS)
University of Oregon (CIS)
University of Pennsylvania (CIS)
University of Pittsburgh (CS)
University of Quebec, Montreal (CS)
University of Rochester (CS)
University of Saskatchewan (CS)
University of South Carolina (CS)
University of Southern California (EES)
University of Southern California (CS)
Univ. of SW Louisiana (CE&CS)
University of Tennessee, Knoxville (CS)
University of Texas, Arlington (CSE)
University of Texas, Austin (CE)
University of Texas, Dallas (CSP)
University of Texas, El Paso (CS)
University of Toronto (CS)
University of Tulsa (CS)
University of Utah (CS)
University of Virginia (CS)
University of Washington (CSE)
University of Waterloo (CS)
University of Western Ontario (CS)
University of Wisconsin, Madison (CS)
Univ. of Wisconsin, Milwaukee (EE&CS)
University of Wyoming (CS)
Vanderbilt University (CS)
Wake Forest University (CS)
Washington State University (EECS)
Washington University (CS)
Wayne State University (CS)
West Virginia University (CE)
Williams College (CS)
Worcester Polytechnic Institute (CS)
Wright State University (CS)
Yale University (CS)
York University (CS)

Patterson from Page 1

contagious. The two major counter-examples are that our colleagues are imitating us, and members of our field are filling prestigious positions.

First, scientists and engineers are doing what we have done for 25 years: sending e-mail, sharing data electronically, writing programs and inventing algorithms and data structure. In short, they are spending less time in the lab and more time on the computer. Just as a competent scientist or engineer had to learn physics or math to be able to do research in the past, today they must also study computing. De facto acceptance of the importance of your field is having other scientists and engineers require their students to learn your material.

The second counter-example regards appointing computer scientists and engineers to positions of importance. Here are a few examples:

• The EECS Department at Berkeley has always had an EE faculty member as chair and a CS faculty member as vice chair for the CS Division. On July 1, Randy Katz became the first CS faculty member to serve as EECS chair.

• Several in our field have become deans: Ziv Galil, College of Engineering at Columbia University; John Hopcroft, College of Engineering at Cornell University; John Hennessy, College of Engineering at Stanford University; Susan Merrit, School of Computer Science and Information Systems at Pace University; Peter Freeman, School of Computer Science at the Georgia Institute of Technology; and Raj Reddy, School of Computer Science at Carnegie Mellon University.

We even have several provosts: Maria Klawe is vice president of Student and Academic Services at the University of British Columbia, Thomas LeBlanc is acting vice provost and dean of the College at the University of Rochester, and Joel Moses was dean of the College of Engineering and did so well he is now provost at MIT.

Members of our field also are serving in government positions: Paul Young as the head of Computer and Information Science and Engineering at the National Science Foundation, Ed Feigenbaum as the Air Force's chief scientist, and Anita Jones as director of Defense Research and Engineering. And Bill Wulf recently was appointed interim president of the National Academy of Engineering.

My conclusion on computing research is that there is plenty of evidence and ample reasons for CS&E to continue to attract the best and brightest. We will see this in future enrollments, and it is time to cast off any remaining feelings of self-doubt and assertively take our rightful seat at the head table of scientists and engineers.

Aspray from Page 5

committees covering many different areas of interest to CRA. I hope these committees will look to CRA-W as a model and develop their own active programs.

Learning from the community: Through its Forsythe list and other contacts, CRA has excellent lines of communication with the leaders of the computing research profession in the academic, industrial and government sectors. I intend to establish a set of procedures—such as site visits, surveys and conversations with these leaders—to learn what activities they think CRA should be involved in and to obtain their guidance and assistance in carrying out these programs. CRA will be strong only if it listens to the entire community—and involves them in its efforts.

Financial resources: The computing research community has identified a wealth of programmatic activities for CRA—far more than we can carry out with our present financial resources. We have been blessed with strong financial support from our affiliated professional societies, from most of the Ph.D.-granting computer science and engineering departments and from some of the most foresighted industrial research laboratories. However, there are many other organizations that are not members—often because we have not thought to invite them to join.

Our goal is to get 100% participation from the computer science and computer engineering departments that support research and advanced education as well as full participation from the industrial labs carrying out computing research.

We intend to reach out beyond these core members—to undergraduate departments interested in research; to graduate departments in related fields, such as computational mathematics and computer-oriented library and information science; to federal laboratories with active computer programs; to companies with computer researchers but no official research labs; and to companies not directly involved in computing research but that would gain from being consumers of computing research.

With a larger base of financial supporters we can build our reserves in a way that will ensure our continued operation and expand the activities that serve the entire computing research community and the larger community that depends on it.

Awards and Honors

Distinguished Service Award

The Computing Research Association is pleased to name Paul Young as recipient of the 1996 CRA Distinguished Service Award. This award is made in recognition of the numerous and significant contributions Young has made to the computing research community.

Young received the award July 14 at CRA's Conference at Snowbird in Utah.

Young has served as assistant director of the National Science Foundation's Directorate for Computer and Information Sciences and Engineering. He has provided outstanding representation and leadership for the computing research community during a period of critical changes in our nation's approach to research and education. He is an eminent researcher and academic leader with an international reputation, and his vision extends beyond his own discipline.

Young's many accomplishments include overseeing the privatization of the NSFnet and the transition of the NSF focus to the vBNS, chartering a task force to examine the recompetition of the supercomputer centers contracts, and co-chairing a committee that constructed a strategic plan for the next generation of multiagency cooperation in computing research.

As chair of the CRA Board of Directors during the association's formative years, Young helped the computing research field develop a presence in science and technology policy making.

Before his NSF appointment, Young was professor of computer science and engineering and associate dean of engineering at the University of Washington, where he had served as chair of the Department of Computer Science from 1983-88. He joined the University of Washington in 1983, after 17 years at Purdue University. Young graduated from Antioch College and received his Ph.D. from the Massachusetts Institute of Technology in 1963.

CRA makes an award, usually annually, to a person who has made an outstanding service contribution to the computing research community. The CRA Distinguished Service Award recognizes service in the areas of government affairs, professional societies, publications or conferences, and leadership that has a major impact on computing research.

Past CRA Distinguished Service Award winners:

1995 - *Randy Katz*, University of California at Berkeley
1994 - *William A. Wulf*, University of Virginia
1993 - Not awarded
1992 - *Joseph Traub*, Columbia University
1991 - *David Gries*, Cornell University
1990 - *Robert Kahn*, NCRI
1989 - *Peter Denning*, George Mason University
1988 - *Kent Curtis*, National Science Foundation

Donald Knuth wins Kyoto Prize

The Inamori Foundation has selected Donald Ervin Knuth as the winner of the 1996 Kyoto Prize in the category of Advanced Technology. At a November awards ceremony in Japan, he and the other laureates each will receive a diploma, a gold medal and a cash gift of 50 million yen (about $460,000).

Knuth, a Professor Emeritus at Stanford University, is being honored as "America's foremost computer programmer, whom *Byte* magazine recently recognized…as one of the '20 Most Important People' who have had the greatest impact on microcomputing," an Inamori Foundation press release said. "Dr. Knuth's development of information processing technology made a great contribution to the arrival of our present information-based society."

Knuth's achievements include:

• Publication of the three-volume work, *The Art of Computer Programming*, referred to by scientists as "the bible and encyclopedia for computer science" and the research of important algorithms.

• Development of the TEX computer typesetting system and the Metafont font design system. These systems were the first to make computers capable of doing document publishing and professional-quality typesetting.

• Development of LR parser and attribute grammar, which established a new method of language analysis and made a basic contribution to compiler technologies used in computer programming.

"Through these achievements, Dr. Donald Ervin Knuth has helped support the rapid development of the information sciences and entire associated industries throughout the last 25 years, providing firm directions and concrete technologies for further development," the release said. "His enormous contributions to these fields have established him as a giant in the field of information sciences."

The Kyoto Prizes, Japan's highest private awards for lifetime achievement, are presented annually by the nonprofit Inamori Foundation to recognize individuals and groups worldwide that have made significant contributions to the betterment of humankind.

Guggenheim Fellow appointed

Stephen A. Vavasis, an associate professor at Cornell University, has received a 1996 Guggenheim Fellowship.

Guggenheim Fellows are appointed on the basis of unusually distinguished achievement and exceptional promise for future accomplishment.

The topic of Vavasis' Guggenheim grant is "Geometry in Scientific Computing." The goals of the proposed research are to develop algorithms for handling complex geometry in scientific computing, to gain understanding of the impact of complex geometry on accuracy and convergence rates of numerical methods and to explore the role of optimization in inverse geometric problems.

Outstanding undergrads

The Computing Research Association is pleased to announce the results of the second annual CRA Outstanding Undergraduate Awards competition. We would like to acknowledge the support of Hewlett-Packard Co., the NEC Research Institute Inc. and Xerox Corp. as this year's sponsors.

Awards are presented in two categories: Outstanding Female Undergraduate and Outstanding Male Undergraduate. Candidates were nominated by their departments, which were allowed to nominate no more than one candidate in each category. Nominees had to be majoring in computer science, computer engineering or an equivalent program. A total of 12 female and 27 male candidates were nominated. The two winners each receive a cash prize of $1,000.

The Selection Committee consisted of Ruzena Bajcsy of the University of Pennsylvania (committee chair), Daniel Huttenlocher of Cornell University and Jeff Ullman of Stanford University. In addition to choosing an overall winner in each category, the committee recognized a small number of runners-up.

Outstanding Female Undergraduate

Winner

• *Jennifer Nolan,* North Carolina State University, Computer Science

Runners-up

• *Miranda Wai Sum Ko,* University of British Columbia, Computer Science
• *Jennifer Sun,* Harvard University, Mathematics–Division of Applied Sciences
• *Stephanie Weirich,* Rice University, Computer Science
• *Bin Song,* Dartmouth College, Computer Science and Mathematics

Outstanding Male Undergraduate

Winner

• *Amit Sahai*, University of California at Berkeley, Mathematics with minor in Computer Science

Runners-up

• *Corin Anderson*, University of Washington, Computer Science and Engineering
• *Jeremy Buhler*, Rice University, Computer Science
• *Regis Colwell*, University of Pittsburgh, Computer Science
• *Dani Goldberg,* Brandeis University, Computer Science
• *Jeffrey Grossman*, University of Toronto, Computer Science and Mathematics
• *David Knol*, Northwestern University, Electrical Engineering and Computer Science
• *Alexander Mallet*, University of Pennsylvania, Computer Science and Engineering
• *Robert Runser*, University of Kansas, Electrical Engineering and Computer Science
• *Peter Sloan*, University of Utah, Computer Science
• *Michael Wittman*, Purdue University, Computer Science
• *Ka-Ping Yee*, University of Waterloo, Electrical and Computer Engineering

About the Winners

Jennifer Nolan is in her junior year as an undergraduate in computer science at North Carolina State University. For her research project as part of the CRA Distributed Mentor Program, she conceived and implemented innovative recurrences and algorithms in the areas of basis and graphical integer partitions. This work resulted in two papers submitted for publication on which she is a co-author. Jennifer also has excelled in research projects at Burroughs-Wellcome (now Glaxo-Wellcome) and IBM. A member of the University Scholars Program, Jennifer carries a 4.0 grade point average and is a recipient of a Barry M. Goldwater Scholarship, among many others honors and awards. Her interests outside of academia include creative writing and playing violin and viola for the Raleigh Civic Symphony.

Amit Sahai is in his senior year as an undergraduate in mathematics with a minor in computer science at the University of California at Berkeley. Two of his many accomplishments stand out. During an internship at the Xerox Palo Alto Research Center last summer, Amit, working with Marshall Bern, solved the Kneser-Thue Poulsen problem. The results of this work will appear in a paper accepted to the 1996 ACM Symposium on Theory of Computation. Their result also establishes a new property of the Dual Complex. For his honors senior thesis project, Amit worked on the problem of finding the minimal DNA sequence that contains as subsequences every possible DNA sequence of a given length and, using combinatorial methods, found a recursive formula for these minimum distances. Amit plays a major leadership role in Eta Kappa Nu, the electrical engineering society, and is a member of Berkeley's Programming Team, which was recently declared the 1996 ACM International Collegiate Programming Contest World Champion.

Research News

Table 1. NSF Funding by Program (in millions of dollars)

Directorate	1995 Actual	1996 Planned	1997 Request
Research & Related Activities			
Biological Sciences	301	300	326
CISE	258	255	277
Engineering	323	316	354
Geosciences	420	418	454
Mathematical & Physical Science	645	651	708
Social, Behavioral & Econ. Science	110	117	124
Other/misc.	224	217	229
Subtotal: Research & Rel. Activities	**2,281**	**2,274**	**2,472**
Education & Human Resources	612	599	619
Academic Research Infrastructure	117	100	0
Major Research Equipment	126	70	95
Salaries & Expenses	129	133	134
Office of Inspector General	4	4	5
Total NSF Budget	**3,270**	**3,180**	**3,325**

Correction: Due to an editing error in Table 1 on Page 1 of the May issue, the 1997 budget requests for Biological Sciences and Other/misc. were incorrect. The correct numbers are $326 million and $229 million, respectively.

Committee urged to support NSF

Fred W. Weingarten, CRA's director of government affairs, testified at a May hearing on National Science Foundation appropriations before the House Appropriations Subcommittee on Veterans Affairs, HUD and Independent Agencies.

Members of this committee have helped protect research in the face of excruciating budget pressures. That you have done as well as you have up to now is testimony to your leadership and understanding that our research establishment is one of the nation's critical resources.

Clearly those budget pressures are not getting any easier. I am here representing the computing research community. I urge you to continue the strong support this Congress has shown for NSF by appropriating the full amount requested, a 4.5% increase overall. This amount includes an 8.6% increase in funding for the Computer and Information Science and Engineering (CISE) Directorate, which supports fundamental research in computing and communications. This research will be important to our nation's future economic development and international leadership well into the 21st century.

I want to focus on three key points:

1. We are in a particularly critical window of opportunity with respect to information systems, in which continued investment in fundamental research promises to have enormous payoff.

2. The programs of the CISE Directorate are a key component of the government's R&D portfolio in computing research.

3. Reaping the social benefits of R&D requires a complex and close relationship among fundamental research (mainly at universities), industrial R&D and government.

Weingarten's testimony is available at http://www.cra.org/~rick/rg/documents/apptest-96.html.

Karp awarded Medal of Science

On July 26 President Clinton awarded the 1996 National Medal of Science to Richard M. Karp, a professor of computer science and engineering at the University of Washington. The president awarded 13 Medals of Science and Medals of Technology to scientists and engineers who have made significant advances in their fields.

The National Medal of Science, established by Congress and administered by the National Science Foundation, honors individuals for contributions to the present state of knowledge in one of the following fields: physical, biological, mathematical, engineering or social and behavioral sciences. The medal has been awarded to 344 distinguished scientists and engineers.

Also established by Congress, the National Medal of Technology honored 94 individuals and seven companies for technological innovation and the advancement of US global competitiveness. Past recipients include Bill Gates of Microsoft Corp. and Ed McCracken of Silicon Graphics Inc. However, no one from the computing field was honored this year.

Technology changing way we live, work, learn and consume

The following is the executive summary from the recently published report Culture, Society and Advanced Information Technology.

The National Information Infrastructure is the major technological development affecting broad segments of the American public at the end of the 20th century. Built upon convergent technological developments in telecommunications and computing and avidly promoted by industrial, government and academic interests, the NII is already changing the way Americans live, work, learn and consume.

Recognizing the potential of these technological developments to transform society, on June 1-2, 1995, the American Anthropological Association and the Computing Research Association, under National Science Foundation sponsorship, convened the *Workshop on Culture, Society and Advanced Information Technology.* This workshop brought 33 social and computer scientists from government, industry and the academic community together (plus three attendees from NSF, two from AAA and one from CRA) to examine the dimensions of social impacts of the NII and to ask what useful, critical and researchable questions the NII raises for society.

It is important to understand how social groups use, adapt and reinterpret technologies such as computing and digital telecommunications, often in ways not anticipated by those who design the systems or by those who create policies for their deployment and use. New ways of creating, storing and transmitting information are transforming institutions and cultural practices. A dialogue among information scientists, marketers and policy makers, on the one hand, and social scientists, on the other, will enhance the possibility that these new technologies will contribute to a better world.

The workshop found that recent breakthroughs in the speed, communications capability and storage capacity of digital information devices would have far-reaching and unforeseen effects on families, communities, institutions and democratic processes. To understand the social consequences of these breakthrough technologies, government, academic and corporate researchers need to build on the solid foundation that exists in studies of sociotechnical systems, media studies and online communication; in the social science study of computing; and in the social sciences generally.

To further this understanding, the workshop explored the implications of these new technologies for the education and careers of social scientists as well as for social science methods, funding, ethics and theory.

The complete report is available electronically at http://www.cra.org/Reports/Aspects.

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division budget to support the larger grants anticipated in the ESS program. The number of awards will be few, and successful proposals will need to reflect careful planning as well as good ideas.

Another significant change in CCR is the adoption of deadlines for the submission of proposals. In the past the division has suggested that proposals be submitted by a target date each fall, but proposals have been accepted at any time during the year. However, it has been increasingly difficult to find funds for proposals submitted late in the annual cycle. In a competitive situation, it will be advantageous to the decision process to have all the proposals submitted to each program available for consideration at one time. To accomplish a comparative evaluation of proposals, the division will use peer-review panels for the proposals submitted to each program. Panel reviews will be supplemented by ad hoc mail reviews when additional expert advice is deemed useful. We believe we shall be able to offer faster turnaround as well as better decision making through this process.

CCR's other programs also have been repackaged for 1997. Computer graphics has been folded into Numerical, Symbolic and Geometric Computing, which now includes all scientific applications of computing covered in the division. Computer architecture has been packaged with operating systems and compiler research, combining all aspects of architecture-dependent systems research in the division. Research on programming and specification languages is packaged with software engineering, the driving application area for computer languages. The Theory of Computing program has not been changed, but it will respond to new initiatives from the research community.

For more information, please refer to the CCR Web page at http://www.cise.nsf.gov/ccr. The information is updated frequently. The CISE/CCR Web site will be used to post new announcements throughout the year.

Kieburtz is director of NSF's Division of Computer and Computation Research.

Deadlines for CCR programs

Theory of Computing:	October 1
Numeric, Symbolic and Geometric Computing	
optimization, numeric computing, computer graphics:	September 15
symbolic, geometric, automated deduction:	Feb. 28, 1997
Computer Systems, Architecture and Software	
operating systems, distributed computing:	November 4
computer architecture, compiling techniques:	Feb. 14, 1997
Software Engineering and Languages:	September 15
Experimental Software Systems (target date):	November 1
CAREERS:	October 17

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project an image of fresh, new ideas stressing high tech and its impact on the economy. This campaign, that of an incumbent, will stress how well the economy is doing and focus on areas it claims have been threatened by the Republican Congress. For some time—since the great budget debate and government shutdowns—the president has announced his campaign priorities as education, the environment and Medicare. Campaign experts predict that Republicans will likely continue to stress character and social issues. There is not much room in that mix for new S&T initiatives, aside from the perfunctory "white paper" every campaign puts out at some point

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Washington Update

David Clark replaces Bill Wulf as chair of CSTB

William A. Wulf has been appointed interim president of the National Academy of Engineering. He is the first computer scientist appointed to such a post.

"The fact that a computer scientist is the president of the NAE has been unremarkable—no one has said a word about it, " Wulf said. "This is a strong indication of the recognition and acceptance of our discipline."

Wulf, AT&T Professor of Engineering and Applied Science at the University of Virginia, will serve until a permanent president is named. A special election will be held as soon as possible. Wulf succeeds Harold Liebowitz, who was recently recalled as president by a vote of the NAE membership.

Wulf has had a distinguished career that includes serving as assistant director of the National Science Foundation's Computer and Information Science and Engineering Directorate, chair and CEO of Tartan Laboratories, and professor of computer science at Carnegie Mellon University. He has served on the CRA Board of Directors and received the 1994 CRA Distinguished Service Award.

Wulf had been serving as chair of the National Research Council's Computer Science and Telecommunications Board (CSTB). David D. Clark of the Massachusetts Institute of Technology is the new chair; he will serve a three-year term ending June 30, 1999.

Clark graduated from Swarthmore College in 1966 and received his Ph.D. in electrical engineering from MIT in 1973. Since then he has worked at the MIT Laboratory for Computer Science, where he is a senior research scientist in charge of the Advanced Network Architecture group. His research interests include networks, network protocols, operating systems, distributed systems, and computer and communications security.

After receiving his Ph.D., Clark worked on the early stages of the ARPAnet and on the development of token-ring local area network technology. Since the mid-1970s, he has been involved in the development of the Internet. From 1981-89, he acted as chief protocol architect in this development and chaired the Internet Activities Board.

His current research area is protocols and architectures for very large and very-high-speed networks. Specific activities include extensions to the Internet to support real-time traffic, explicit allocation of service, pricing and new network technologies. In the security area, Clark participated in the early development of the multilevel secure Multics operating system. He developed an information security model that stresses integrity of data rather than disclosure control.

Clark has been a CSTB member for the past year. He chaired the committee that produced the CSTB report, *Computers at Risk: Safe Computing in the Information Age*. He also served on the committees that produced the CSTB reports, *Toward a National Research Network*; *Realizing the Information Future: The Internet and Beyond*; and *The Unpredictable Certainty: Information Infrastructure Through 2000*.

CSTB also announced changes in committee membership.

Newly appointed for three-year terms are: Pat Hanrahan, Stanford University; Susan Graham, University of California at Berkeley; Ed Lazowska, University of Washington (He is also a member of the CRA Board of Directors and chair of its Government Affairs Committee.); Donald Simborg, KnowMed Systems; and Judith Hempel, Molecular Simulation Inc.

Several board members retired on June 30: Henry Fuchs, University of North Carolina; Charles Geschke, Adobe Software; Ted Shortliffe, Stanford University; William Press, Harvard University; and Casimir Skrzypczak, Nynex.

Richard Tapia appointed to National Science Board

Richard A. Tapia, the Noah Harding Professor of Computational and Applied Mathematics at Rice University, has been appointed to the National Science Board (NSB), an oversight and advisory body to the National Science Foundation. He joins John Hopcroft of Cornell University as the second computing researcher serving on the current board. In addition to his substantial research contributions, Tapia has received numerous awards for his significant contributions to minority education and his public service.

In 1994 he received CRA's A. Nico Habermann award for his outstanding contribution to aiding members of underrepresented groups within the computing research community. Tapia formerly served on the National Board of Directors of the Society for Advancement of Chicanos and Native Americans in Sciences, and he is a member of the National Academy of Engineering. He earned his Ph.D. from the University of California at Los Angeles.

NSB, established by the NSF Act of 1950, has 24 members appointed by the president with the advice and consent of the Senate. Members, who serve six-year rotating terms, are drawn from industry and universities and represent a variety of science and engineering disciplines.

President Clinton nominated seven other new NSB members:

John A. Armstrong of Amherst, MA, is a former vice president of Science and Technology and member of the Corporate Management Board at IBM Corp. His expertise is in quantum electronics and laser physics.

Mary K. Gaillard of Berkeley, CA, is a professor of physics at the University of California at Berkeley and a faculty senior scientist at the Lawrence Berkeley National Laboratory. Gaillard is an expert in theoretical particle physics. She is a member of the National Academy of Sciences.

M.R.C. Greenwood of Davis, CA, is chancellor of the University of California at Santa Cruz. She is the former dean of graduate studies at the University of California at Davis and is an expert in the fields of physiology and nutrition. Greenwood served as associate director for science in the White House Office of Science and Technology Policy from November 1993 to May 1995.

Stanley Vincent Jaskolski of Cleveland is the chief technical officer and vice president of technical management for Eaton Corp. He was a faculty member in the Electrical Engineering and Computer Science Department at Marquette University for 15 years and served as chair during part of his tenure.

Eamon M. Kelly of New Orleans is president of Tulane University. Kelly is an economist with national and international recognition in the fields of applied economic and health development. He earned his doctorate from Columbia University.

Vera C. Rubin of Washington, DC, is a research astronomer with the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. She has received numerous awards for her studies of motions of stars and gas within galaxies, and motions of galaxies in the universe. She received the president's National Medal of Science in 1993.

Robert H. Suzuki of Pomona, CA, is president of California Polytechnic University. He has conducted research in engineering and educational sociology and has had a distinguished career in both fields.

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about how much their candidate loves research.

The issue of interest is the broadening of the program to cover most of federal computing research. HPCC has its roots in a 1982 report known as the "Lax Report" because Peter Lax of the Courant Institute chaired the committee that wrote it. The issue presented in that report was simple: Academic scientists lacked access to supercomputer power they needed to pursue research in several critical areas. They argued that more computational cycles needed to be made available and that the government should do more to push the performance envelope.

As the National Science Foundation began planning a program in response, another more public issue hit the political scene: concern that Japan was threatening to overtake US leadership in many fields of technology, including supercomputers. Thus, industrial competitiveness took hold as a driving force. Technological change turned the focus away from pure high-end supercomputing, resulting in a change from "supercomputing" to "high-performance computing." A proposal by then-Rep. Gore for what was originally conceived as a national optical fiber information superhighway was grafted onto the program. This had two benefits. For the public and many politicians, it was a more easily understood concept. And its inclusion meant the bill had a strong congressional champion in Al Gore, who had since moved to the Senate. In December 1991 the HPC Act passed with four components: systems, software, networking, and basic research and human resources.

After passage, the program continued to evolve. In 1994 the administration added a fifth element, information infrastructure and technology, which stressed public applications such as education, health care and libraries. As it continued to broaden in focus, the initiative grew in funding (more than $1 billion) and in the number of participating agencies (10).

Inevitably, as the HPCC program grew broader in scope and encompassed more of computing research and related activities, such as research infrastructure and computational science, it became ever harder to distinguish it from other computing research programs. In 1995 the National Science and Technology Council released a strategic plan that tried to present an all-encompassing look at federal information technology research, putting it in the context of broad national goals. That plan has become the guiding principal and driving force behind federal R&D budgets in computing research.

In some sense, the demise of HPCC can be attributed to the fact that computing and communications technology has simply grown too big for its past programmatic britches, too important to society and too big budgetarily to be contained in a single initiative or program. The plan also represents another step toward stating explicitly that the main reason the federal government wants to fund computing research is that it is critically important to a wide variety of societal goals.

Not all people concerned with computing research are comfortable with this explanation. They suggest we need a new vision to fuel the next stage of growth, or political support for research funding will wilt in the heat of the budget battles. There is enough political history to suggest that such a thing might happen. But, to date, no one has been able to articulate such a new vision, rhetorically or substantively.

Professional Opportunities

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Send copy and payment for Professional Opportunities advertisements to Advertising Coordinator, *Computing Research News*, 1875 Connecticut Ave. NW, Suite 718, Washington, DC 20009-5728. Tel. 202-234-2111; fax: 202-667-1066; e-mail: crn@cra.org. E-mail submissions are preferred.

The format of an ad must conform to the following: 1) the first line must contain the name of the university or organization, 2) the second line must contain the name of the department or unit and 3) the body of the ad should be in paragraph form. The words in the first two lines are included in the total word count for the ad. You may request in writing that some text be set in bold; a bold word in the body of the ad counts as two words.

The rate is $2.25 (US) per word. Purchase orders, money orders and checks are acceptable *(please do not send cash)*. All CRA members receive at least 200 free words per dues year. CRA's standard advertising package consists of running an ad in *CRN*, sending it to CRA's jobs@cra.org list and posting it to CRA's Jobs Index Web page for two months. As an alternative to this package, advertisers may request that their Professional Opportunities ads just be published in *CRN* or just distributed electronically. The cost of the ad is the same whether the standard or the alternative package is selected.

Professional Opportunities display ads cost $60 (US) per column inch, with a two-inch minimum. Ads must be submitted in camera-ready, offset (positives or negatives) or mechanical form. If your ad is larger than three inches, please request our Advertising Rate Card.

Computing Research News is published five times per year: in January, March, May, September and November. Professional Opportunities ads with application deadlines falling within the month of publication of *CRN* will not be accepted for publication in *CRN* unless the ad says applications will be accepted until the position is filled. If the closing date of a Professional Opportunities ad does not correspond with the publication of an issue of *CRN*, advertisers can choose the alternative advertising package and only have the ad distributed electronically. Advertising copy that is to appear in *CRN* must be received at least one month before publication. The deadline for the November issue is October 1. Ads for electronic distribution only may be submitted at any time.

Texas A&M University, College Station
Department of Computer Science

The College of Engineering invites nominations and applications for head of the Department of Computer Science. It seeks an individual to provide high-quality administrative, educational and research leadership. The position is available Sept. 1, 1997. Applicants must possess appropriate credentials and experience.

The Dwight Look College of Engineering, highly ranked in national polls, is one of the nation's largest engineering colleges. The Computer Science Department recently advanced significantly in quality and size, and the university is committed to furthering the development of quality. The department offers B.S. to Ph.D. degrees in computer science. Computer engineering degrees are offered in cooperation with the Department of Electrical Engineering. The undergraduate programs are CSAB and EAC/ABET accredited, respectively. There are 28 tenured and tenure-track faculty, six full-time lecturers and six part-time lecturers. There are approximately 1,100 undergraduate and 250 graduate students. The current annual funded research volume is $3 million. More information may be viewed on the department's Web page at www.cs.tamu.edu.

Nominations and applications will be accepted, beginning immediately, until the position is filled. Send curriculum vitae and names of at least three references to Dr. John A. Weese, Chair, Search Committee for Computer Science Head, Engineering Technology Department, Texas A&M University, College Station, TX 77843-3367. Tel. 409-845-4951; fax: 409-847-9396; e-mail: J-Weese@tamu.edu.

Texas A&M is an affirmative action, equal employment opportunity employer.

Santa Clara University
Department of Computer Engineering

The department is pleased to announce a one-year visiting faculty position at the assistant or associate professor level for the 1996-97 academic year. Applicants must possess a Ph.D. in computer engineering or computer science, and must be qualified to teach courses in software engineering and two or more of the following areas: C++ with an emphasis on OOP, graphical user interfaces (X or MS/Windows), Unix systems programming and Java.

Santa Clara University is a private Jesuit university located in the heart of Silicon Valley. The department offers B.S., M.S. and Ph.D. degrees, has nine full-time faculty and 40 adjunct faculty, and serves approximately 120 undergraduate majors and 400 graduate majors. Additional information about the department is available at http://www-comp-eng.scu.edu.

Applicants should submit a curriculum vitae and the names of three references to Dr. Dan Lewis, Chair, Department of Computer Engineering, Santa Clara University, Santa Clara, CA 95053. Due to the late announcement, applicants wishing to start in January will be considered. However, preference will be given to applicants who are available by Sept. 15, 1996; such applicants must submit their application by August 31. Applications may be sent electronically via e-mail to dlewis@scu.edu or by fax to 408-554-5474.

Santa Clara University is an equal opportunity, affirmative action employer; it actively seeks the candidacy of women and minorities.

University of California, Irvine
Department of Information and Computer Science

The Department of Information and Computer Science (ICS) invites applications for a tenured position at the full professor level, although promising candidates at other levels may also be considered. Research emphases of interest include databases; digital libraries; human-computer interaction studies, techniques and approaches; intelligent information retrieval; multimedia; networking and communications; visualization; and the study of these technologies and their effect, including aspects of management, privacy, public policy and security. We are looking for candidates with strong research records who would thrive in a highly productive setting. Duties include research and undergraduate and graduate teaching. Applicants must possess a Ph.D.

The ICS Department is an independent campus unit reporting to the executive vice chancellor. ICS faculty emphasize core computer science as well as research in emerging areas of the discipline, with effective interdisciplinary ties to colleagues in biology, cognitive science, engineering, management, medicine and the social sciences. The department currently has 29 full-time faculty and 120 Ph.D. students. The ICS Department has research groups in the areas of algorithms and data structures, artificial intelligence, computer and distributed systems, computer-supported cooperative work, computer systems design, parallel processing, social and managerial analysis of computing, and software/software engineering.

UC-Irvine is located in Orange County, three miles from the Pacific Ocean near Newport Beach and approximately 40 miles south of Los Angeles. The campus is situated in the heart of a national center of high-technology enterprise. Both the campus and the enterprise area offer exciting professional and cultural opportunities. Salaries and benefits are competitive. Mortgage and housing assistance are available. Housing options include newly built, for-sale housing located on campus and within short walking distance from the department.

Send resume and contact information for five references to ICS Faculty Position, c/o Joy Schuler, Department of Information and Computer Science, University of California, Irvine, Irvine, CA 92697-3425.

Application screening will begin immediately upon receipt of curriculum vitae. Maximum consideration will be given to applications received by Dec. 1, 1996.

The University of California is an equal opportunity employer, committed to excellence through diversity.

University of Waterloo
Department of Computer Science

Applications are invited for chair of the Department of Computer Science at the University of Waterloo. The appointment as chair is for a four-year term commencing July 1, 1997, and is renewable for an additional two-year term. Candidates should have relevant experience in an academic environment and a strong research record in an area of interest and priority within the department. Demonstrated energy, innovation, leadership skills and relevant administrative experience are required, as is a keen interest in leading a strong and active department.

The Department of Computer Science, the largest of the five departments in the Faculty of Mathematics, has 45 faculty members, including 42 full-time tenured or tenure-track positions, 165 full- and part-time graduate students, and 30 technical and support staff members. The department has a strong history of innovation, with demonstrated accomplishments in both basic and applied research, and extensive involvement with industry. The department attracts excellent students at the undergraduate and graduate levels, and prides itself on the strength of its teaching. More information is available through the department's Web site: http://math.uwaterloo.ca/CS_Dept.

The successful candidate will be appointed to a tenured position as professor within the department, with salary at a level commensurate with qualifications experience. The closing date for applications is Sept. 30, 1996.

Send curriculum vitae and the names and addresses of three references to Professor J.D. Kalbfleisch, Dean, Faculty of Mathematics, University of Waterloo, Waterloo, Ontario N2L 3G1.

In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and permanent residents. The University of Waterloo encourages applications from all qualified individuals, including women, members of visible minorities, native peoples and persons with disabilities.

University of Southern California
Department of Computer Science

Applications are invited for a tenure-track faculty position in robotics. Candidates should also have an interest and background in related areas, such as autonomous agents and other aspects of artificial intelligence, neural networks, evolutionary computation, kinematics and dynamics or related areas.

The Computer Science Department has a strong and widely recognized research program in robotics and intelligent systems, performing research in such areas as autonomous robots, robot learning, walking machines, biological models for robotic systems and image understanding. The Robotics Research Laboratory of the Institute for Robotics and Intelligent Systems cooperates closely with the Brain Simulation Laboratory and other laboratories in the neurosciences.

The Computer Science Department is ranked in the top 12 computer science departments nationally. It offers B.S., M.S. and Ph.D. degrees. Candidates should have a strong research record, a vigorous commitment to teaching, and a strong desire and capability to build a sponsored research program.

Applications consisting of a letter of application and career goals, a short curriculum vitae, a list of publications and the names of at least three references should be sent to the search chair: Professor George Bekey, Computer Science Department, University of Southern California, Los Angeles, CA 90089-0781.

USC is an equal opportunity, affirmative action employer.

Oregon Graduate Institute of Science and Technology
Department of Computer Science and Engineering

The department anticipates a position in the immediate future at the assistant or associate professor level in areas of human language technology dealing with the design and implementation of spoken language dialogue systems. The department is especially interested in researchers with experience and demonstrated accomplishment in the areas of dialogue and natural language understanding.

Applicants' interests must complement teaching, research and system building efforts at the Center for Spoken Language Understanding (http://www.CS&E.ogi.edu/CSLU) and the Center for Human Computer Communication (http://www.cse.ogi.edu/CHCC). Applicants should have prior faculty or postdoctoral research and teaching experience, although exceptional candidates who are anticipating completion of a Ph.D. may also be considered.

OGI is an independent graduate school with no undergraduate programs. Teaching loads are light, but the quality of teaching and research is valued highly. The department currently has 18 full-time faculty and 35 doctoral students, and external research funding approaching $6 million annually. More information can be found at http://www.cse.ogi.edu.

To apply, send a brief description of research interests, the names of at least three references and a resume with a list of publications to Chair, Recruiting Committee, Department of Computer Science and Engineering, Oregon Graduate Institute, PO Box 91000, Portland, OR 97291-1000. E-mail: csedept@cse.ogi.edu.

OGI is an equal opportunity employer and particularly welcomes applications from women and minority candidates. Appointment is subject to the availability of funding.

Rutgers and Princeton Universities
DIMACS Center

DIMACS, the Center for Discrete Mathematics and Theoretical Computer Science, invites applications for several postdoctoral fellowships for 1997-98.

DIMACS, an NSF Science and Technology Center, is a partnership of Rutgers University, Princeton University, AT&T Research, Bell Laboratories and Bellcore. Research and education activities at DIMACS focus on such areas as analysis of algorithms, combinatorics, complexity, computational algebra, discrete and computational geometry, discrete optimization and graph theory. Outreach programs are directed to other sciences and industry.

Postdoctoral fellows work on research in any area supported by DIMACS, and have the opportunity to collaborate with many visitors and 150 permanent members at the partner sites. They are encouraged to participate in the research, outreach and educational activities of the center's partners.

Applicants with interests in all areas of discrete mathematics and theoretical computer science are welcomed. Some postdoctoral fellowships will be in DIMACS-focused research areas. Focused areas for 1997-98 will be massive data sets, networks and security, mathematical and computational support for molecular biology, and simulations.

Application procedure: The center's WWW site http://dimacs.rutgers.edu contains full information about these postdoctoral positions and should be consulted for application information. Applications are due Dec. 2, 1996.

DIMACS Center, PO Box 1179, Rutgers University, Piscataway, NJ, 08855-1179. Tel. 908-445-5928; e-mail: center@dimacs.rutgers.edu.

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Technology Update

Livermore supercomputer 'fastest and largest'

BY Fred Weingarten
CRA Staff

President Clinton recently announced that the Energy Department signed a $93 million contract with IBM Corp. to install what is billed as the world's fastest and largest supercomputer at DOE's Lawrence Livermore Laboratory in California.

The president said the new supercomputer, scheduled to go online in 1998, will be 300 times more powerful than any in the world. Secretary of Energy Hazel O'Leary, in a joint press conference held with Jack Gibbons, the presidential science adviser, repeated that figure. However, supercomputer experts have expressed some doubts about the accuracy of that estimate, suggesting that a decimal place may have slipped. The new machine, expected to be rated in the 3 teraflop peak-performance range, is a highly parallel multiprocessor system based on the RS 6000 architecture. There is at least one RS 6000 SP, located at the Cornell Theory Center, rated at more than 130 gigaflop peak performance. (A "flop," a common rating of supercomputer speed, is one numerical operation per second. A teraflop is one trillion operations per second.)

According to IBM's press release, the new computer will use "a building-block approach to high-performance computing, in which the system consists of clusters of shared-memory processors. There will be staged delivery of the system, with the initial components due at Livermore by the end of September 1996. The production model, a 3 teraflop system, is scheduled for demonstration in December 1998."

Whether those speeds actually will be obtained is another matter. As designers and users of high-performance computers well know, peak performance is an even trickier metric because it refers to the absolute limit on speed. Actual performance, particularly with new, experimental architectures, can be significantly less.

Realizing the potential of new supercomputer architectures requires fundamental advances in computer science and engineering.

Wimpy qualifications do not make for interesting presidential sound bites. But they do, in the words of Bob Borchers, head of the National Science Foundation's Advanced Scientific Computing Division, "create a real challenge and opportunity for the computing research community." He pointed out that realizing the potential of these new architectures will require fundamental advances in computer science and engineering.

According to DOE, the project "is part of the Department of Energy's Accelerated Strategic Computing Initiative (ASCI), a 10-year, $1 billion program designed to deliver tera-scale…computing capability." That program began last year with a contract for Intel Corp. to deliver a 1.8 teraflop machine to Sandia Laboratory in New Mexico. The next three planned contracts after the one just announced with IBM will be for a 10 teraflop, a 30 teraflop and a 100 teraflop machine.

Livermore's IBM supercomputer is specifically intended to be used for nuclear weapons design and test simulation; however, the president pointed out its wider potential applicability to civilian R&D. O'Leary, in her press conference, said the computer could be converted from highly classified applications to fundamental civilian research applications in about an hour.

The announcement was reminiscent of the important role the Energy laboratories played in the 1950s and 1960s, when they pioneered the development of supercomputer technology through developmental contracts for custom-designed machines such as the IBM Stretch, the Univac LARC and the Control Data 6600. Many historians of technology credit the Stretch design with technological advances that formed the basis for the IBM 360 series, which appeared a few years later.

Although many of those early projects were "ground-up" designs, this one is much more evolutionary. O'Leary said IBM already had a business plan that would have eventually taken their RS 6000 line to this new level in performance, but on a slower schedule. DOE funding, she said, would allow IBM to bring the machine to market much more quickly.

Missing from the announcement was any reference to the High-Performance Computing and Communication program, the coordinated multiagency research program. This raises the question whether these new architectures would be directed mainly at weapons applications. But John Toole, director of the National Coordinator's Office, said that there has been "high-bandwidth communication" between DOE and the other agencies participating in HPCC and its successor programs. He said he expected these new machines to have a big impact on federal computing research and computational science.

Civilian researchers craving access to such computing power will not be left out in the cold, Borchers said. ASC has restructured its program of support for national supercomputer centers (renaming it Partnerships for Advanced Scientific Computation) and is in the middle of a major recompetition among the centers and the restructuring of their missions.

Thus, it is a difficult time for NSF staff to plan for the future in much detail. However, Borchers did say it was the specific intent of the partnerships program to provide researchers with access to the best computation capabilities available.

Cornell officials confirmed they would be making the new IBM system a key part of their own proposal for renewal. The Cornell Supercomputer Center has from the beginning had a close relationship with IBM and has an RS/6000 SP with 512 processors. Mal Kalos, director of the Cornell Center, also stressed the need for more fundamental computer science research aimed at understanding such new, highly sophisticated array architectures.

An important trend in high-performance computing, identified in NSF and Computer Science and Technology Board studies that led up to the recompetition, has been an increased blurring of the boundaries between computer science and engineering and computational science, and a greater need for the supercomputer centers to interact with the broader computing research community. In recognition of this growing mutual interest, NSF's recompetition notice included the requirement that the center "enable interdisciplinary partnerships among the academic computer science, mathematics and computational science research communities." Most supercomputer center proposals are expected to include such partnership arrangements with academic computer science programs.

CRA-W from Page 4

committees and by CRA-W itself to generate lists of women to be nominated for awards.

• *Combining Family and Work pamphlets* (Mary Vernon, University of Wisconsin at Madison): The first in a series of planned pamphlets discussing issues related to careers and family is a report describing experiences and pointers on combining careers and family.

• *Promoting women for important prizes, editorships and other prestigious positions* (Mary Jane Irwin, Pennsylvania State University): The committee regularly informs women in CS&E (using Systers Academia) about various awards open to them and the steps necessary to apply for such positions. Eligible and deserving women are often completely unaware of the processes involved and the fact that they often have to initiate the process themselves. This past year the committee nominated seven women for ACM Fellow, five of which were awarded (nine of 53 ACM Fellowships were awarded to women). In the previous year, only two of the 54 ACM Fellows were women.

• *CRA-W Web site* (Ann Redelfs, San Diego Supercomputer Center; Fran Berman, University of California at San Diego): CRA-W has built a Web site for distribution of information about committee programs and projects as well as other links of interest for women in science and engineering. A link can also be found for a Web version of the careers booklet. Other CRA-W publications will be added soon.

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Irwin is a professor of computer science and engineering at Pennsylvania State University.

SIAM looks at math applications

The Society for Industrial and Applied Mathematics recently released the *SIAM Report on Mathematics in Industry.* The following is the report's conclusions section:

A substantial part of this report has explored the applications of mathematics in industry, business and government as well as many aspects of nonacademic careers for mathematicians. These topics have quite recently received great attention in the mathematics community because of their relationship with two phenomena: the current crisis in the academic job market and the perceived sharpened attention of US funding agencies to work on applications. In some instances, discussion of applications and nonacademic jobs conveys grudging acceptance of unpleasant necessities that will, if all goes well, pass away; then the mathematics community can return to business as usual.

The Mathematics in Industry Steering Committee emphatically does not take this view. Even if the academic job market improves and funding pressure eases, we are convinced that mathematics and mathematicians should change permanently along the lines indicated in our multiplicity of suggestions. We also believe that the traits valued in nonacademic mathematicians are important and worthwhile in a far wider context.

Throughout the history of mathematics, ideas and inspiration have flowed strongly in both directions between mathematics and applications. Nonacademic applications offer opportunities not simply for mathematicians to solve practical problems, but to enrich and deepen mathematics as well as a wide variety of other fields, including science, engineering, medicine and business.

To receive a copy of the report, contact SIAM, 3600 University City Science Center, Philadelphia, PA 19104-2688. Tel. 215-382-9800; e-mail: siam@siam.org; URL: http://www.siam.org.