COMPUTING RESEARCH NEWS

The News Journal of the Computing Research Association

March 1996 *Vol. 8/No. 2*

Groups to challenge telecom law in court

By Fred W. Weingarten
CRA Staff

After languishing in conference committee for several months, the Telecommunications Act of 1996 passed Congress and was signed into law by President Clinton a few days later. The president and vice president extolled the importance of the bill, both as a mechanism for unlocking investments in a new advanced information infrastructure and as a major jobs creator.

To the dismay of many in the Internet user and service provider communities, content controls imposing severe criminal penalties were included in the bill. The amendment's wording and form did not change substantively from the version that distressed many proponents of free speech. Clinton and Gore were silent on this issue in their initial statements. The president did applaud the so-called "V-chip" provision mandating that television sets be produced with technology that allows people to screen out violent programs.

Civil liberties and other public interest groups, publishers and writers began filing petitions to federal courts asking for an injunction against enforcement of those provisions and an immediate court review of their constitutionality.

The telecommunications law inevitably represents political compromise much more than rational economic and market analysis.

It was apparent the bill contained a lot that the president wanted in the form of regulatory reform, and, thus, he would sign it. Some civil liberties groups hoped he would at least express concern about the restrictions and that a court would overturn the content controls. The groups now say they expect the Justice Department to defend the restriction vigorously and aggressively in court.

Given the complexity and the controversy that have swirled around the bill since it was submitted in January 1995, the margins of victory were very high and bipartisan: 414-16 in the House and 91-5 in the Senate. This consensus was probably due to a combination of factors, not least of which must have been the strong desire on the part of both the White House and Congress to demonstrate a major legislative accomplishment before primary elections began.

The Senate and House passed markedly different versions of the bill in the spring and summer of 1995, respectively. Since then the legislation has been the subject of endless conference meetings, as congressional staff members and their bosses negotiated over sometimes fundamental differences in language and approach. Lobbying was intense. The bill rearranges the markets and roles of an information and communications industry sector whose markets approach $1 trillion.

In December movement was halted when Senate Majority Leader and presidential candidate Robert Dole (R-KS) opposed the free allocation of spectrum for broadcasters to provide high-definition television service. House leaders stated they were happy with the bill as it stood and had no intention of changing it. Congress watchers began to think the bill might unravel.

The issue was straightforward. In recent years, the government has increasingly allocated spectrum for commercial use through auction. Economists like it because, in their view, it leads to efficient use of the spectrum. Politicians like it because it raises funds in an era of budget cutting.

Dole's objection was on fiscal grounds. He pointed to estimates that the economic value of the spectrum, if auctioned, was tens of billions of dollars. Why, in these days of budget cutting, is Congress giving away such a valuable public resource? he asked.

House negotiators were firmly opposed to auctioning the spectrum to broadcasters. Commerce Committee Chair Thomas Bliley Jr. (R-VA) said the provision was not a "giveaway," because the government was "loaning" the spectrum for transition purposes.

Unexpectedly, Dole retreated from direct opposition to the bill, although he still expressed doubts during floor debate. Whether this had anything to do with the state of his presidential campaign is an open question.

It is hard to characterize the 200-plus-page bill, especially because it was not published and distributed before the vote. Basically, it is an attempt to modernize and strip down a 75-year accumulation of regulations and procedures for deciding who can

Continued on Page 2

Inside CRN

S&T funding affected by shutdown

By Bill Gregory
Special to CRN

Ripples from the federal government shutdown are dissipating, but a larger issue over the future of science and technology funding will hang on much longer: the nebulous planning environment that has left program and contracting officers in limbo, reluctant to commit new money.

Most agencies that support basic research are innocent bystanders sideswiped in the budget battle over welfare and entitlements between a Republican Congress and a Democratic White House. The result is an unprecedented disruption of the long, continuous and complex federal budget process and threats of more funding delays to researchers.

Federal agencies generally massage their budgets for the next fiscal year through the previous summer and fall, when internal decisions are made. Then the Office of Management Budget reviews and changes budgets in accordance with White House policy. Finally a finished product goes to Capitol Hill in late January or early February.

This February, the fiscal 1997 budget is still in gestation. (Clinton's 1997 budget is available on the Internet at http://www.doc.gov/BudgetFY97/index.html.) Half a year sounds like enough time to recover the timetable, but Congress is likely to take even more time than that. If Congress is a little late, a continuing resolution keeps the government operating for a month or two at appropriation levels of the past year.

The government has now had five months of continuing resolutions with different levels and ceilings. If the deadlock runs on—and it could—the outcome will be a de facto budget cut.

The National Science Foundation is typical of the agencies caught in the middle. Here's how Melvyn Ciment, deputy assistant director of the Computer and Information Science and Engineering Directorate, sketches the problem.

Planners are told to take the lower of House or Senate fiscal 1996 authorizations or the significantly smaller 1995 appropriation, then limit obligations to 75% of that until the budget is settled. "It turns out very often that National Science Foundation business is such that 60% of a program's funds are already committed," he said. "If you're committed at 60% and can only go to 75%, you don't have a whole lot left. A lot of people are delaying their actions, putting things off until the end of the year."

Multidisciplinary work that the agency is pushing has been one casualty. "This year we were going to establish a computer science multidisciplinary challenge," Ciment said. "It wasn't done." Why? Lack of new money perhaps, but Ciment added: "We wouldn't even attempt it in this environment. It takes a lot of extra work to find the money, for people to go around the building and ask for contributions to an innovative new project. People don't make contributions to innovative new things when they're not sure what they're going to have for their ordinary things."

A budget ceiling of 75% of the last appropriation translates into authority to spend at a tight daily rate. Continuing grants for research to universities or industry come up, and increments have to be paid. With those kinds of commitments to meet, the agency runs out of money for routine new things, such as travel expenses, consultants and ad hoc panels.

New programs mean review panels. "When you are closing out your financial books in August, you're not holding a lot of panels," Ciment said. "They're held at this time of the year to make the decisions. We're

Continued on Page 2

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LETTERS TO THE EDITOR
Joan Bass
1875 Connecticut Ave. NW
Suite 718
Washington, DC 20009

Tel: 202-234-2111
Fax: 202-667-1066
E-mail: jbass@cra.org

Letters may be edited for space and clarity.

Letters

Keeping our customers happy

Editor:
In his article in the January 1996 *CRN*, "Criticism of Undergrad Curricula Justified," Peter Denning tells computer science faculty to view employers and students as their customers. While the suggestion is apt, I wish Denning had explored further the multiple and conflicting demands from these customer classes.

As Denning says, employers seek competence in the graduates they hire. But what is the nature of that competence? Where computer science faculty would emphasize competence in fundamental principles, many employers would like students to have extensive experience with a particular program or system.

Employer-customers may present a mixed bag of demands, but the demands from student-customers vary much more widely. Students differ greatly in the energy, enthusiasm, independence, talents and time they bring to learning. Of particular concern to this topic is the pernicious yet common misconception among students that their grades should be proportional to effort expended rather than to results achieved or competence demonstrated. One can only imagine the mismatch in expectations they will encounter with their first employers.

Faculty members teach at the nexus between employer-customers and student-customers, yet the teacher-effectiveness training mentioned by Denning often is concerned exclusively with student-customers. Such programs can place tremendous responsibility on teachers to vary their teaching to stimulate different input-processing modalities, accommodate each student's individual learning style, devise empowerment strategies that ensure success for all and warm up a chilly classroom atmosphere. After all this work, if students do not succeed, the programs may suggest that the assessment strategy was insufficiently authentic. Notable by their absence are descriptions of students' responsibilities or of requirements for competence in subject material.

In no way do I intend to denigrate all aspects of training in teaching effectiveness. Indeed, after I leave a workshop or finish reading about teaching and learning, I almost always have some new ideas and more food for thought. Still, I would welcome material on teaching that presents a more balanced view of the need of student-customers for good teaching and the need of both faculty and employer-customers to preserve high scientific content.

Christopher J. Van Wyk
Dept. of Mathematics & Computer Science
Drew University

Denning Replies:

I am heartened that Professor Van Wyk accepts the notion of students as customers and proposes the questions that we need to explore to sort out the complexities in practice. His questions about the nature of competence and the expectations of students and employers go right to the heart of the criticisms directed at us as educators.

The essence of the customer-performer relationship is that the performer makes a promise to deliver to the customer the conditions of satisfaction agreed to between them. The key word here is "promise." Most of our catalogs promise students preparation for their chosen professions, a timely and relevant curriculum, a knowledgeable faculty, a state-of-the-art research program and opportunities for a good job. These are broad promises that raise expectations in the minds of students and employers that we are not meeting.

Most students think that these promises mean: 1) they will gain the necessary competencies in action and habits of mind that are widely expected of entry-level professionals; 2) most of the subject matter will be related to emerging trends and every program maintains a regular planning process to track trends; 3) the research program and research faculty will be accessible to undergraduates; 4) getting a job will be fairly certain on graduation; and 5) getting individualized advice on demand will be easy. Every difference in expectations among students, parents and employers on the one side and faculty on the other is a surefire recipe for a dissatisfied customer.

How many of us as faculty have the same understanding as our students of what we are promising? How many of us can tell students exactly what they will be competent at on graduation? How do we—and they—know whether we have delivered these competencies? How many of us regularly get feedback from students, parents and employers about their expectations of our programs? When we do get the feedback, do we act on it? How many of us are ready to be judged for promotion, tenure and raises on the basis of the results produced by our students?

I gave preliminary answers to these questions in "Educating a New Engineer" (*Communications of the ACM*, December 1992), and I accept Van Wyk's challenge to put together a deeper essay on this topic.

S&T Funding from Page 1

having trouble scheduling panels. We can't schedule beyond the horizon of the next continuing resolution deadline. In this environment you don't start new initiatives. Everything starts focusing on just getting the bare-bones work done."

Proposals will be processed. Grants will be made. These numbers may not look much different from the past. "What will be missing will be the usual level of new calls for proposals, the new initiatives and new panels that might energize new ideas," Ciment said.

Looming over all the furlough and current budget issues in Ciment's view is the long-term prospect of cuts in research and development. "For the first time anyone can recall in modern budgeting cycles, we are being told by Congress and the White House—this is not a unilateral decision—that R&D is going to diminish in this country," he said. "They're talking about 30% declines overall. The National Science Foundation will probably experience a 2% to 5% cut this year." Over seven years, that translates into a range of 14% to 35%.

In the expansionary promises of the last 10 or 15 years, larger budgets were dangled in front of the agency. It was told to think boldly and create programs. "Maybe we overexpanded," Ciment said. "Perhaps we funded too many people, just to get them started. We got to the point where we were slicing the pie too thin. Now there won't be new money."

Telecom from Page 1

provide what service, under what terms and for what price. Much of the bill's language is a detailed exposition of which companies will be freed up to do what and when.

For instance, the bill ends federal regulation of cable television in three years and allows regional telephone companies that meet certain criteria to offer long-distance services. It goes on in a similar vein through dozens of more specialized and general telecommunications services.

The end result inevitably represents political compromise much more than rational economic and market analysis, and economists differ on how the compromises will work out. Most agreed it was time to try something—inaction threatened to leave the communications industry increasingly bogged down in a morass of outdated restrictions and regulatory procedures. The hoped-for outcome is greater competition and, as a result, lower prices and faster innovation.

Many consumer and other public interest groups have been more skeptical. They worry that decreased regulation will lead to further concentration and market domination by a few very large firms. The recent wave of mergers and buyouts in the communications and information industry may lend some weight to the concern. Similarly, the argument that this is a "jobs" bill rang a little hollow, coming as it did on the heels of another major wave of layoffs in the telecommunications sector.

The bill contains a few provisions that had been promoted by public interest groups. Most notable is an amendment establishing a system of "preferential rates" for connectivity to educational institutions, libraries and other groups.

The bill contains provisions for universal service, although it ducks the key issue of what the term means for an advanced infrastructure.

In general, the act constitutes a major revision of the country's telecommunications laws. To be sure, Congress has not heard the last of telecommunications policy.

Expanding the Pipeline

Women's science contributions celebrated

BY Anita Borg, Adele Howe and Mary Jane Irwin

Projects that bridge the boundaries between computing and other disciplines create conditions ripe for drawing women into computing.

On Dec. 13-15, 1995, more than 700 scientists and engineers attended the Women and Science: Celebrating Achievements, Charting Challenges conference, sponsored by the National Science Foundation. The stated goal of the conference was to be "outcomes oriented—fostering the exchange of information and spurring attendees to action at their home institutions. Out of the celebration of achievements will come new ideas for meeting challenges to the full participation of all in the future science and engineering work force."

This article notes conference highlights but focuses on sessions organized by NSF's Computer and Information Science and Engineering Directorate. The authors of this article participated in these sessions; Anita Borg of Digital Equipment Corp. presented recommendations from the technology session to the plenary meeting. Information about the overall conference structure with bios of plenary keynote speakers can be found at http://www.ehr.nsf.gov/conferences/women95.htm.

The conference began on Wednesday evening with a video welcome by Hillary Rodham Clinton and an inspiring keynote address by France A. Cordova, NASA's chief scientist. We also heard from Lynda Jordan and Lydia Villa-Komaroff, who were featured in the PBS "Discovering Women" series. All represented wonderful contradictions of the cultural stereotypes of the successful scientist.

After Thursday morning talks by Linda Wilson, president of Radcliffe College, and Anne Petersen, NSF's deputy director, the day was divided into two sets of breakout sessions. In the morning, discipline-based groups organized by each NSF directorate asked the question, "Where are we now?" In the afternoon, cross-disciplinary groups asked, "What are the new directions?"

CISE organized its morning session around efforts to recognize women's achievements and to attract and retain women in computer science and engineering. Projects of the CRA Committee on the Status of Women in Research (CRAW) were very prominent. Borg delivered the keynote "Celebrating Achievements by Women in CS & CE." The talk described the successes of the 1994 Grace Hopper Celebration of Women in Computing and the goals of the 1997 GHC. Borg then proposed a challenge and a new initiative to meet it.

The challenge is to increase the percentage of new scientists and engineers who are female to 50% by 2010. Borg said she believes the challenge can be met through strong corporate support and intensive use of the Internet to connect and inform those working toward the goal.

Fran Allen, an IBM Fellow and CRA Board member, responded: "What Anita is proposing is extraordinarily important for us in industry. My first reaction was, we can't do it. My second is that we must do it. My third was that we absolutely can do it, by starting with the young girls and using the technology."

Following the keynote, Mary Jane Irwin of Pennsylvania State University, Joan Feigenbaum of AT&T, Fran Berman of the University of California at San Diego and Joe O'Rourke of Smith College—all CRAW members—described both the alarming downward trend in female participation in computing and the exciting efforts of the CRAW committee. These efforts include the database of women Ph.D. recipients, mentoring workshops and the CRA Distributed Mentoring Project. [See the September 1994, May 1995 and September 1995 issues of *CRN*, respectively.]

Computer science and engineering was the only discipline represented at the conference that is suffering a downward trend in participation.

The afternoon session, "The Impact of Technology," included reports on a number of technical projects women ran or participated in, or that were relevant to women. A common thread among these very different projects was their integration of traditional technical endeavors with other fields or their use of unusual approaches to the technical aspect of the project.

- Tom Defanti and Maxine Brown's Electronic Visualization Laboratory (University of Illinois at Chicago) brings together technologists and artists to create virtual-reality and virtual-prototyping instrumentation for viewing scientific and engineering data.
- Judith Klavans' Digital Libraries project (Columbia University) is a collaboration between computer scientists and librarians fostered in part by creating an organization outside of the normal academic departments.
- Nancy Leveson's work in software safety (University of Washington) bridges many gaps among CS interface designers, domain experts, risk assessors and psychologists to develop a systems theory that looks at whole systems with the goal of understanding how they can be made safe.
- Borg's work on Mecca, an interorganizational group communication system, unites 2,100 women in computing in 24 countries in an information-rich virtual community.
- Cynthia Lanius described her participation in GirlTECH (Rice University), a program to train teachers to teach technology to girls. Engineers and teachers worked together to build teaching strategies, use online resources, design lessons that use technology and explore representation issues.
- Cheris Kramarae is involved in the Women, Information Technology and Scholarship program (University of Illinois at Urbana-Champaign) that tries to increase female involvement in campus decisions. The group is noted for collecting and disseminating information about gender issues in information technology.

In both the morning and afternoon sessions, discussion among audience members was lively and contributed significantly to our effort to recommend policies to NSF. Based on Adele Howe's great record of the sessions, she, Borg and O'Rourke assembled a set of five recommendations.

Friday morning's plenary session began with an introduction by Luther Williams, head of NSF's Education and Human Resources Directorate, and an extraordinary talk by Shirley Malcom, who heads Education and Human Resources at the American Association for the Advancement of Science and is a member of the president's Committee of Advisers on Science and Technology. These were followed by presentations by the reporter from each of Thursday's afternoon sessions.

Borg began by putting the question, "How do we get there?" in context. The first question to answer is, "Where do we want to go?" She repeated her earlier challenge, suggesting that the conference mantra be "50/50 by 2010." In this context, she made the following points and recommendations:

1. Computing suffers from a serious gender-ratio crisis. The repercussions may be felt far beyond the computing field. An early rejection of computing may be as devastating to a girl's future prospects in science as is a rejection of mathematics. We urge NSF to continue significant funding to address this.

2. All ages and all levels present challenges to gender-ratio equity. We lose girls and women to science and engineering at every stage in the pipeline. We recommend increased funding for programs such as GirlTECH for K-12; merit awards for women and mentoring toward graduate school for undergraduate women; mentoring, networking and fellowships for graduate women; and visiting professorships for faculty and professional women.

3. Projects that bridge the boundaries between computing and other disciplines create conditions ripe for drawing women into computing. We recommend that interdisciplinary work be highly valued in funding decisions.

4. Projects with relevance to reality seem to attract women. Science and technology education should be firmly grounded and connected to real-world examples showing their relevance and worth. Funding criteria should value projects that make a solid connection to real-world problems.

5. The information revolution embodied by the Internet presents a risky opportunity. We are at a fork in the road. We can follow a path to disenfranchisement and social stratification, or we can use the technology to reduce isolation and increase the level of scientific education for all citizens. NSF should take this into account when evaluating programs.

We hope NSF's directorates will continue their commitment to increasing the participation of women in science and engineering and will foster the collaborations of industry, academia and government to actively use information technology to this end.

Anita Borg is a consultant engineer at Digital Equipment Corp.

Adele Howe is an assistant professor of computer science at Colorado State University.

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

COMPUTING RESEARCH NEWS

Vol. 8/No. 2/March 1996

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Conferences

CRA CONFERENCE AT SNOWBIRD ✦ JULY 14-16 ✦ SNOWBIRD, UTAH

Preliminary Agenda

Sunday, July 14

CRA Board of Directors Meeting 9:00AM–5:00PM

Registration 3:00PM–6:30PM

Welcome Reception 6:00PM–7:30PM

Dinner and State of the CRA Address 7:30PM–9:30PM

Speakers: David A. Patterson, chair of the CRA Board of Directors
Fred W. Weingarten, CRA's acting executive director

The CRA Distinguished Service Award and the CRA A. Nico Habermann Award will be presented after dinner.

Monday, July 15

Breakfast Buffet 7:00AM–8:30AM

Plenary Session I: The Future of Academic Research 8:30AM–10:00AM
Speaker: To be announced

Morning Break 10:00AM–10:30AM

Workshop I (parallel sessions) 10:30AM–NOON
- Discussion of Academic Research Plenary
- Department Management I: Research Support
- ACM/IEEE-CS Initiative on Software Engineering as a Profession

Luncheon NOON–1:30PM

Plenary Session II: The Future of Education 1:30PM–2:30PM
Speaker: To be announced

Workshop II (parallel sessions) 2:30PM–3:30PM
- Discussion of Education Plenary
- Department Management II: Recruiting and Training Faculty and Students from Underrepresented Groups
- Computing, Communications and Public Policy

Afternoon Break 3:30PM–4:00PM

Birds of a Feather/Open Time 4:00PM–6:00PM

Reception 6:00PM–7:00PM

Dinner 7:00PM–9:00PM
Speaker (invited): Neal Lane, director of the National Science Foundation

Tuesday, July 16

Breakfast Buffet 7:00AM–8:30AM

Plenary Session III: The Future of Industrial Research 8:30AM–10:00AM
Organizer: Stuart Feldman, IBM T.J. Watson Research Center

Morning Break 10:00AM–10:30AM

Workshop III (parallel sessions) 10:30AM–NOON
- Discussion of Industrial Research Plenary
- Department Management III: Faculty and Students
- NSF Funding Opportunities

Luncheon NOON–1:30PM

Workshop IV (parallel sessions) 1:30PM–3:00PM
- Department Management IV: Equipment and Facilities
- Influencing Government Policy
- The World Wide Web in Research and Education

For more information, contact CRA at 1875 Connecticut Ave. NW, Suite 718, Washington, DC 20009. Tel. 202-234-2111; e-mail: info@cra.org; URL: http://cra.org.

FCRC scheduled for May

BY Mary Jane Irwin

The second Federated Computing Research Conference (FCRC '96) will be held May 20-28 in Philadelphia. This year's conference follows the same model of the highly successful FCRC '93, in which nine constituent conferences participated.

The FCRC model is one that assembles a number of existing, specialized research conferences into a coordinated meeting held at a common time in a common place. This retains the advantages of the smaller conferences while facilitating communication among researchers in different subfields in computer science and engineering. And because of its size, FCRC '96 also will provide great visibility for the field as a whole.

The conference is sponsored by the Association for Computing Machinery, the Computing Research Association, the IEEE, the National Science Foundation and the Society for Industrial and Applied Mathematics.

FCRC '96 includes a number of venues for attendee interaction throughout the week.

Five mornings will start with a plenary talk on a topic of broad appeal to the CS&E community:

- "Information Technology is the Lever, But Where Shall We Stand?" William A. Wulf, University of Virginia.
- "Designing Your Own Multi-Threaded Processor." Burton Smith, Tera Computer.
- To be announced. Cynthia Dwork, IBM Almaden Research Center.
- "Computing is Interaction." Robin Milner, University of Cambridge.
- "The Case for Wireless Overlay Networks." Randy Katz, University of California at Berkeley.

FCRC '96 also features an evening panel on May 24 organized by CRA. "Our Precarious Future: Who Will Fund Computing Research and Why?" will be moderated by CRA Chair Dave Patterson.

Exhibits, consisting of books and education software displays and demonstrations, will be open May 22-26.

The FCRC '96 Organizing Committee is made up of the chair of each constituent conference plus general chair, Mary Jane Irwin of Pennsylvania State University; general vice chair, Steve Mahaney of Rutgers University; treasurer, Alan Berenbaum of AT&T Bell Laboratories; exhibits chair, Frank Friedman of Temple University; and Steering Committee chair, David Wise of Indiana University.

The conference's advance program, which includes the technical program for each constituent conference and registration and hotel information, is now available. The registration deadline is April 26. For more information about FCRC '96 see http://www.acm.org/conferences/fcrc.

Mary Jane Irwin is a professor of computer science and engineering at Pennsylvania State University and general chair of FCRC '96.

FCRC '96 constituent conferences

- CRA Workshop on Academic Careers for Women in Computer Science
- 23rd Annual ACM/IEEE International Symposium on Computer Architecture
- International Conference on Supercomputing
- ACM SIGMETRICS International Conference on Measurement and Modeling of Computer Systems
- 28th Annual ACM Symposium on Theory of Computing
- 11th Annual IEEE Conference on Computational Complexity
- 15th Annual ACM Symposium on Principles of Distributed Computing
- 12th Annual ACM Symposium on Computational Geometry
- First ACM Workshop on Applied Computational Geometry
- ACM/UMIACS Workshop on Parallel Algorithms
- ACM SIGPLAN '96 Conference on Programming Language Design and Implementation
- Workshop of Functional Languages in Introductory Computing
- ACM SIGPLAN International Conference on Functional Programming
- 10th ACM Workshop on Parallel and Distributed Simulation
- ACM SIGMETRICS Symposium on Parallel and Distributed Tools
- 4th Annual ACM/IEEE Workshop on I/O in Parallel and Distributed Systems
- SIAM Symposium on Networks and Information Management

CRA workshop planned

Another version of the successful CRA Workshop on Academic Careers for Women in Computer Science is being offered May 20-21 in conjunction with the Federated Computing Research Conference.

The workshop will bring women just starting their academic careers—either advanced graduate students or newly hired faculty—together with established researchers. The more senior women will serve as panelists, giving information and advice on many aspects of academic careers. Topics will include getting a job, preparing for the tenure decision, building a research program, advising graduate students, teaching, the importance of networking, time management and family issues. Also featured is a mini-workshop on writing a National Science Foundation proposal.

The workshop is sponsored by the Computing Research Association with support from NSF.

The NSF support allows the workshop organizers to offer a limited number of travel grants to cover transportation, registration and hotel expenses. The deadline for travel grant applications is March 15. For more information, contact Jan Cuny, e-mail: cuny@cs.uoregon.edu.

Policy News

Agencies play catch-up after blizzard, shutdown

By Bill Gregory
Special to CRN

Federal science and technology agencies in Washington are catching up with backlogged paperwork from budget- and blizzard-induced furloughs. But short delays inflicted at the beginning of a budget cycle, compounded by uncertainty over funding levels, will propagate longer delays downstream.

The initial Dec. 15, 1995, shutdown affected the National Science Foundation and its grant system supporting basic research in the following ways:

• More than 2,500 proposals, including those in computer science, backed up in the mail room in a month.

• Nearly 40,000 pieces of mail and 1,500 requests for forms and publications queued up for response or waited for distribution.

• Grant installments—156 due Dec. 31, 1995, and 266 in January—backed up for processing. These were being worked off at the end of January. But in the interim, graduate students went without pay, and laboratories were left short of funds to pay bills.

• Review panel meeting schedules were disrupted. As many as 50 were delayed or cancelled. At least a dozen were in computer science and engineering.

Because of the lost three and a half weeks, NSF advised university presidents and industrial laboratories that it might not be able to meet its six-month proposal processing target or honor start dates. Delays in receiving proposals or holding advisory panel meetings can cause delays in funding decisions or possibly gaps in funding for renewals. New competitions will be delayed while backlogs are cleared.

Under pressure in the furlough's wake is the advisory panel review process. In no case, though, the agency said, "will NSF compromise on its standards for rigorous peer review." In effect, the agency is trying to maintain review integrity while avoiding a specter: back-logged awards at year end that could leave some dangling without funding.

Among specific computer science programs:

• NSFnet program review and board of visitors meetings had to be rescheduled.

• Renewal programs for the domestic Networking Connections program and recompetition for the International Connections award will probably be delayed six months.

• Partnerships for Advanced Computational Infrastructure won approval from the National Science Board in mid-December. Submission deadlines slipped two weeks. NSF's Advanced Scientific Computing Division is playing catch-up with meeting schedules to explain the new program.

Not directly affecting computer science grantees now—but it might in the future—is a restudy of the agency's decade-old organization for its Computer and Information Science and Engineering Directorate. A review committee headed by Rick Adrion, professor of computer science at the University of Massachusetts and a Computing Research Association Board member, had scheduled a sequence planning meeting Dec. 22, 1995, for a report due in May.

Now that meeting has slipped until June. "That may sound trivial," said Melvyn Ciment, the directorate's deputy assistant director. "It's not. We have to get the reorganization plans to Congress for the next budget. If we miss that cycle, we may be a year behind."

Another case is recompetition of the International Connections program, for which Sprint is the contractor. "It's under an extension right now," Ciment said. "But because of the furlough's three-week delay in getting internal

Continued on Page 9

NSF supercomputer center recompetition back on track

By Bill Gregory
Special to CRN

Just a day before the federal government furlough sequence began, a program announcement release was due for a major transition in computer science: the Partnerships for Advanced Computational Infrastructure. This program is to recompete National Science Foundation contracts for four university supercomputer centers.

Much study and discussion had revolved around the question of whether to recompete, renew or extend the existing four centers, funded since 1985. Since then, other centers have sprung up. Last August a report by a committee headed by Edward Hayes, along with other reports, brought a decision for recompetition. The announcement was written and ready in December.

"It never made it out then," said Melvyn Ciment, deputy assistant director for the foundation's Computer and Information Science and Engineering Directorate. "But it's back on track." Deadlines slipped only a couple of weeks.

"If we had slipped it the full month, it would have really run into major problems downstream," Ciment said. "People don't realize these things are written with a staging process." Announcements have to go out, and responses have to come back for inside-the-building and outside blue-ribbon-panel review. Then comes source selection and negotiation of complex contracts. The whole process takes about 12 months. In this program, the target is April 1997.

Inherent in the supercomputer recompetition is a plan for transition if a new center is selected. "A major supercomputer center has thousands of users," Ciment said. "Let's say we decide not to renew center X. We have to figure out a plan to migrate those users to some other system—a withdrawal plan. That can take several months by itself."

All this assumes that furloughs are over. Beyond that comes the more critical question of eventual budget levels, still very much up in the air.

Rep. Walker won't run again

Robert Walker (R-PA), chair of the House Science Committee, has announced he will not seek re-election. He has served 10 terms and became chair of the Science Committee last year when Republicans won control of the House.

In explaining his decision to retire, Walker referred to the 200-year-old tradition that no one in the congressional seat he occupies had ever served more than 20 years. "As someone who came to office promising myself that I would not spend the rest of my working life in the Congress, this is the right time to move on and in the process help keep a little bit of history intact," he said.

Walker's tenure as Science Committee chair has been most notable for his efforts to move the R&D agenda away from what he considered inappropriate technology policy and toward an increased focus on basic research. To symbolize that effort, he removed the word "technology" from the full committee's previous name and changed the name of the Subcommittee on Science to the Subcommittee on Basic Research.

Walker also was deeply involved in the budget process and is a close confidant of House Speaker Newt Gingrich. His influence in those roles has been credited with helping protect the National Science Foundation's appropriation at a time when major cuts were being made in government programs.

Rep. Jim Sensenbrenner Jr. (R-WI) is next in line to chair the committee after Walker departs. But the volatility of elections these days, coupled with the usual game of musical committee chairs played in any new Congress, make any predictions at this point highly speculative.

Gries wins Karlstrom award

David Gries has been named the 1995 Karl V. Karlstrom Outstanding Educator by the Association for Computing Machinery.

Gries, the William L. Lewis Professor of Engineering at Cornell University, is being honored in "recognition of his leadership in the training of several generations of computer science students," an ACM press release said.

"Professor Gries has played a central role in national curricula development committees and has been a visible presence within national organizations in the discussion of future directions for computer science education," the press release said. "[He] often serves not just as a mentor for students at Cornell, but as a mentor for his faculty colleagues as well."

The award, sponsored by Prentice-Hall Publishing Co., includes a $5,000 prize.

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1995 CRA Taulbee Survey

New enrollment in Ph.D. programs drops

Results of the 1995 CRA Taulbee Survey on the Production and Employment of Ph.D.s and Faculty in Computer Science and Computer Engineering

BY Gregory R. Andrews
Chair, CRA Surveys Committee

This is the 25th year of publication of the Computing Research Association's annual survey on the production and employment of Ph.D.s in computer science and engineering. A few years ago the CRA Taulbee Survey[1] was expanded to include computer engineering as well as computer science. Last year we began reporting on the areas of Ph.D. study (see Table 5).

Each September this survey is mailed to all organizations included on the CRA Forsythe List of departments in the United States and Canada that offer a Ph.D. in computer science or computer engineering.[2]

The accompanying tables present the results of the 1995 CRA Taulbee Survey. Information was gathered during the fall and early winter. The tables include all responses received by the first week of February.

The response rate continues to be quite high (about 91%). This is excellent for surveys of this kind, although it is not as high as a few years ago.

Information on degree production and enrollment applies to the previous academic year (1994-95). Information on faculty applies to the current fiscal year (1995-96). Faculty salaries reflect those in effect as of Jan. 1, 1996. Readers should keep in mind that survey results are from Ph.D.-granting departments only; there are hundreds more departments that award bachelor's and master's degrees.

This article draws attention to the most significant results of the survey, especially results that are substantially different from last year.

Degree production (Figures 1-2; Tables 1-8)

Although the tables and graphs show a total of 1,006 Ph.D. degrees awarded in CS and CE, CRA staff called the 9% of departments that failed to respond. We found 73 degrees that went unreported, bringing the total number of Ph.D.s to 1,079. Last year's survey indicated 1,005 Ph.D.s, with 8% of departments failing to respond. Because no attempt was made last year to count unreported degrees and because the response rate dropped only one percentage point, one could assume that degree production has remained flat.

Ph.D. production has remained essentially steady throughout the 1990s (see Figure 2). The predicted number for this year is for only slightly more than last year, but predictions have historically been high by about 100. So perhaps only about 1,000 Ph.D.s will actually be awarded in 1996. Far more significant is the drop in new enrollment in Ph.D. programs (see student enrollment section below).

The only significant change in the gender or ethnicity of Ph.D. recipients is that the number of CS and CE Ph.D.s awarded to Hispanics tripled from 9 to 28. However, the percentage of degrees at all levels awarded to females and minorities remains low.

There are no significant differences in the fields of specialization of Ph.D. recipients relative to last year. Once again—and despite student fears—almost all new Ph.D.s appear to have gotten jobs. The number who found jobs in Ph.D.-granting departments or in industry is much higher than it was a year ago, but this could be because the number of "unknowns" is much smaller this year.

The numbers of bachelor's and master's degrees awarded by the Ph.D.-granting departments are down about 8% and 15%, respectively, relative to a year ago. The change in bachelor's degree numbers appears to be transitory; the master's degree numbers appear likely to continue to fall (see below).

Student enrollment (Tables 9-11)

The number of new bachelor's students is up about 4%, but the numbers of new master's and doctoral students both are down almost 25%. The lower doctoral numbers could quite possibly reflect student reaction to the current job market. Also, there is probably a significant correlation between the master's and doctoral numbers in the Ph.D.-granting departments.

Faculty growth (Tables 12-17)

Faculty sizes are down about 3%, and anticipated growth in faculty size is down from 345 to 310 new positions over the next five years. Estimates of growth have always been optimistic, so it is plausible to predict that the total number of faculty positions will remain essentially constant for the remainder of the decade.

Far fewer faculty left their current positions—for whatever reason—than a year ago (178 versus 252).

Faculty salaries (Tables 18-26)

Faculty salaries rose about 3.5% in all ranks relative to a year ago. However, the average salary of a newly appointed faculty member rose only about 2%.

The salary numbers reported here are slightly higher than the preliminary numbers report in the January 1996 *CRN*. (A few more departments responded to the survey.)

For Tables 18-26, each department was asked for the minimum, mean and maximum salary for each category of professor. Because tables show the minimums and maximums of the minimums and maximums reported by each department, these figures reflect salaries of individual professors. Also shown are

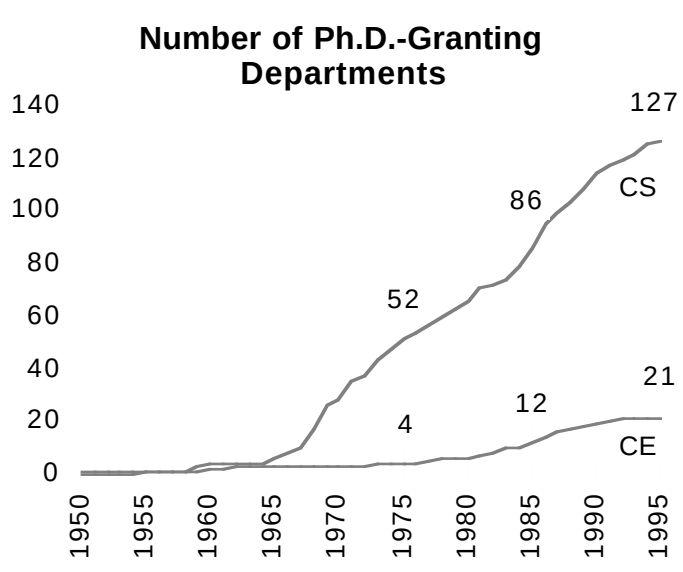
Text continued on next page

[1]The title of the survey honors the late Orrin E. Taulbee of the University of Pittsburgh, who conducted these surveys for the Computer Science Board from 1970 until 1984.

[2]The CRA Forsythe List is a list of departments in the United States and Canada that grant a Ph.D. in computing—computer science (CS) and computer engineering (CE). It is maintained by the Computing Research Association. This is the ninth year computer engineering departments have been included.

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

DEGREE PRODUCTION IN ACADEMIC YEAR 1994-95



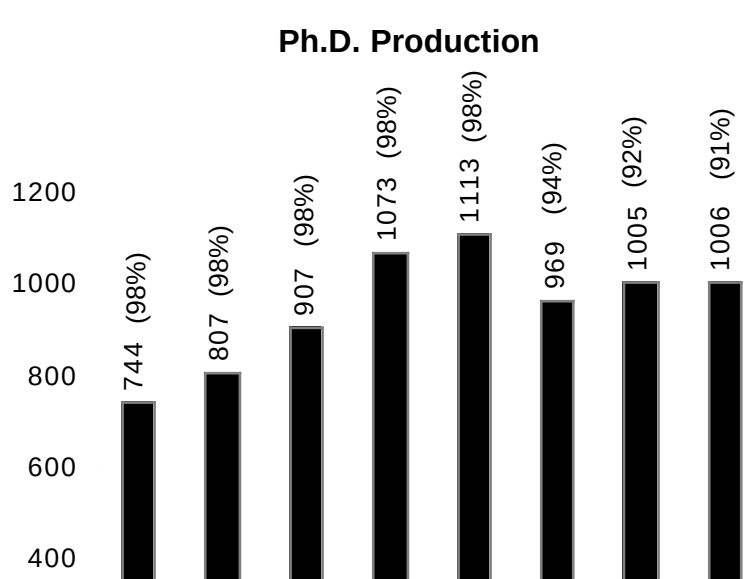


Figure 1 (above) shows a steady growth in the number of departments awarding CS and CE degrees. It does not include 14 CS/CE departments we believe offer Ph.D.s, but that did not respond to the survey. **Figure 2** (right) shows a slight decline or plateau in the total Ph.D. production of CS and CE degrees. However, these historical indications may be slightly inaccurate. First, the survey response rate has dropped, raising the possibility of more unreported degrees. (The response rate is shown in parentheses for each year.) Second, a few electrical engineering degrees may have been included in past statistics. During the last two years, more rigorous attempts were made to include only CS and CE degrees.

1995 CRA Taulbee Survey

Table 1. Ph.D. Production by Ranking

	Ph.D.s Produced	Average per Dept.	Ph.D.s Next Year	Average per Dept.	Passed Qualifier	Average per Dept.
US CS Ranked 1-12	213	17.8	222	18.5	164	14.9
US CS Ranked 13-24	170	14.2	153	12.8	165	16.5
US CS Ranked 25-36	85	7.7	133	12.1	84	10.5
US CS Other	417	5.6	489	6.5	422	6.4
Canadian CS	77	5.1	78	5.2	64	7.1
US CE	44	7.3	74	12.3	84	14.0
Total CS&CE	**1,006**	**7.7**	**1,149**	**8.3**	**983**	**9.4**

Table 2. Gender and Ethnicity of Ph.D. Recipients

	CS			CE			CS & CE		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Nonresident Alien	251	30	281	28	3	31	298	34	332
African American	7	1	8	0	0	0	8	1	9
Native American	0	0	0	0	0	0	1	0	1
Asian	96	19	115	15	0	15	125	24	149
Hispanic	20	7	27	0	0	0	21	7	28
White	286	60	346	15	4	19	325	70	395
Other/Did Not Indicate	66	22	88	3	0	3	70	22	92
Unknown	-	-	6	-	-	2	-	-	0
Total			**726**			**139**			**871**

Total	**61**	**7**	**70**	**848**	**158**	**1,006**

Table 3. Gender of Ph.D. Recipients by Percentage

	CS		CE		CS & CE	
Male	727	(83%)	63	(90%)	843	(84%)
Female	144	(17%)	7	(10%)	163	(16%)
Total	**871**		**70**		**1,006**	

Table 4. Gender of Bachelor's and Master's Recipients

	Bachelor's		Master's	
Male	6,189	(82%)	3,554	(80%)
Female	1,372	(18%)	871	(20%)
Total	**7,561**		**4,425**	

Table 5. Employment of Ph.D. Recipients by Specialty

Ph.D.s Employed Domestically in:	Artificial Intelligence/ Robotics	Hardware Systems/ Architecture	Numerical Analysis/ Scientific Computing	Software Systems	Theory	Other	Total
Ph.D. CS/CE Dept.	63	22	9	49	19	21	208
Non-Ph.D. CS/CE Dept.	10	12	5	18	9	10	67
Non-CS/CE Dept.	3	0	1	4	2	2	12
Industry	47	76	14	89	30	53	336
Government	11	2	2	7	4	3	39
Self-Employed	5	1	2	8	1	1	18
Other Categories:							
Employed Abroad	26	15	8	40	16	16	132
Unemployed	3	2	0	5	3	3	17
Unknown	22	13	4	9	10	38	188
Total	**193**	**143**	**45**	**229**	**94**	**147**	*****

Table 6. Ethnicity of Ph.D. Recipients by Percentage

	CS		CE		CS & CE	
Nonresident Alien	281	(35%)	31	(46%)	332	(35%)
African American	8	(1%)	0	(0%)	9	(1%)
Native American	0	(0%)	0	(0%)	1	(0%)
Asian	115	(14%)	15	(22%)	149	(16%)
Hispanic	27	(3%)	0	(0%)	28	(3%)
White	346	(43%)	19	(28%)	395	(42%)
Other	25	(3%)	2	(3%)	27	(3%)
Subtotal	**802**	**(100%)**	**67**	**(100%)**	**941**	**(100%)**
Did Not Indicate	69		3		65	
Total	**871**		**70**		**1,006**	

Table 7. Ethnicity of Bachelor's and Master's Recipients

	Bachelor's		Master's	
Nonresident Alien	525	(11%)	1,457	(38%)
African American	152	(3%)	55	(1%)
Native American	15	(0%)	3	(0%)
Asian	826	(17%)	707	(18%)
Hispanic	145	(3%)	52	(1%)
White	3,063	(63%)	1,507	(39%)
Other	142	(3%)	63	(2%)
Subtotal	**4,868**	**(100%)**	**3,844**	**(100%)**
Did Not Indicate	2,693		581	
Total	**7,561**		**4,425**	

Table 8. Degrees Awarded to People with Disabilities

	Bachelor's	Master's	Ph.D.
CS	20	10	5
CE	4	3	0
CS & CS	24	13	5

Footnotes

All ethnicity tables: "Native American" includes Alaskan natives; "Asian" includes people originating from the Pacific Islands, China, Japan, Korea, the Philippine Islands, Samoa, India and Vietnam; "white" includes people originating from Europe, North Africa and the Middle East.

All tables with rankings: Statistics sometimes are given according to departmental rank. Schools are ranked only if they offer a CS degree and according to the quality of its CS program as determined by reputation. Those that only offer CE degrees are not ranked, and statistics are given on a separate line, apart from the rankings. In Table 1, the "Ph.D.s Produced" column shows the number of CS and CE degrees produced throughout the rankings. While CE degrees are mixed into all rank categories, there are no CS degrees in the CE category.

**Totals do not match:* The reader may find that totals from certain tables do not equal each other, even though theoretically they should. These discrepancies stem from inconsistencies in the way departments answered different questions. We tried to minimize this by calling departments that provided inconsistent answers. The horizontal and vertical totals in Table 5 do not equal each other because many departments could not tell us the specialty area of the Ph.D.s.

Nonresident faculty: A small percentage of faculty were nonresident aliens when they were hired to work in fiscal 1995-96. In many cases, these new employees were gaining residency based on their new employment prospects.

All faculty tables: The survey makes no distinction between faculty specializing in CS versus CE programs. We tried to minimize inclusion of any faculty in electrical engineering.

Survey from previous page

the means of the minimums and maximums reported by each department. Finally, the average of all salaries is the average of the means reported by each department. If a department gave only a partial answer for a category of professor, it was discounted. All Canadian salaries are in Canadian dollars.

Rankings

For Tables 18-26, which group Computer Science Departments by the rank of 1-12, 13-24 and 25-36, we based our ranking on information released in the 1995 assessment of research-doctorate programs in the United States done under the auspices of the National Research Council.

Our top 12 schools are Stanford University, the Massachusetts Institute of Technology, the University of California at Berkeley, Carnegie Mellon University, Cornell University, Princeton University, the University of Texas at Austin, the University of Illinois at Urbana-Champaign, the University of Washington, the University of Wisconsin at Madison, Harvard University and the California Institute of Technology.

The departments ranked 13-24 are Brown University, Yale University, the University of California at Los Angeles, the University of Maryland at College Park, New York University, the University of Massachusetts at Amherst, Rice University, the University of Southern California, the

Continued on Page 8

1995 CRA Taulbee Survey

STUDENT ENROLLMENT IN ACADEMIC YEAR 1994-95

Table 9. Gender of Enrolled Ph.D. Students

	CS				CE				CS & CE			
	Full Time		Part Time		Full Time		Part Time		Full Time		Part Time	
Male	4,930	(84%)	791	(82%)	410	(88%)	64	(91%)	5,663	(85%)	976	(82%)
Female	927	(16%)	178	(18%)	57	(12%)	6	(9%)	1,038	(15%)	209	(18%)
Total	**5,857**		**969**		**467**		**70**		**6,701**		**1,185**	

Table 10. Ethnicity of Enrolled Ph.D. Students

	CS				CE				CS & CE			
	Full Time		Part Time		Full Time		Part Time		Full Time		Part Time	
Nonresident Alien	1,999	(37%)	143	(19%)	176	(43%)	18	(27%)	2,212	(37%)	188	(21%)
African American	94	(2%)	20	(3%)	3	(1%)	2	(3%)	105	(2%)	24	(3%)
Native American	15	(0%)	2	(0%)	0	(0%)	0	(0%)	15	(0%)	2	(0%)
Asian	635	(12%)	127	(17%)	95	(23%)	12	(18%)	807	(13%)	153	(17%)
Hispanic	96	(2%)	14	(2%)	8	(2%)	2	(3%)	108	(2%)	16	(2%)
White	2,453	(46%)	427	(58%)	125	(30%)	32	(48%)	2,653	(44%)	520	(57%)
Other	93	(2%)	8	(1%)	3	(1%)	1	(1%)	102	(2%)	10	(1%)
Subtotal	**5,385**	**(100%)**	**741**	**(100%)**	**410**	**(100%)**	**67**	**(100%)**	**6,002**	**(100%)**	**913**	**(100%)**
Did Not Indicate	472		228		57		3		699		272	
Total	**5,857**		**969**		**467**		**70**		**6,701**		**1,185**	

Table 11. New Students in Fall 1995

	Bachelor's Full Time	Dept. Avg.	Master's Full Time	Dept. Avg.	Ph.D. Full Time	Dept. Avg.
US CS Ranked 1-12	1,375	114.6	215	17.9	200	16.7
US CS Ranked 13-24	480	40.0	231	19.3	181	15.1
US CS Ranked 25-36	710	59.2	163	13.6	114	9.5
US CS Other	5,428	57.1	1,155	12.2	466	4.9
Canadian CS	1,892	118.3	254	15.9	80	5.0
US CE	214	16.5	155	11.9	31	2.4
Total CS&CE	**10,099**	**63.1**	**2,173**	**13.6**	**1,072**	**6.7**

FACULTY GROWTH IN FISCAL 1995-96

Table 12. Anticipated Faculty Growth

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	Five-Year Increase	
US CS Ranked 1-12	312.4	316.4	319.9	321.9	323.9	326.1	13.7	(4%)
US CS Ranked 13-24	298.5	304.5	310.5	315.5	317.5	319.5	21.0	(7%)
US CS Ranked 25-36	243.2	253.2	259.2	264.2	269.2	274.2	31.0	(13%)
US CS Other	2,784.0	2,849.5	2,902.0	2,950.0	2,984.0	3,015.2	231.2	(8%)
Canadian CS	395.6	398.3	399.3	403.3	405.3	406.3	10.7	(3%)
US CE	182.0	183.0	183.0	184.0	184.0	184.0	2.0	(1%)
Total CS&CE	**4,215.7**	**4,304.9**	**4,373.9**	**4,438.9**	**4,483.9**	**4,525.3**	**309.6**	**(7%)**

Table 13. Gender of Professors

	Assistant		Associate		Full	
Male	499	(80%)	872	(90%)	1,086	(95%)
Female	125	(20%)	96	(10%)	58	(5%)
Total	**624**		**968**		**1,144**	

Table 14. Ethnicity of Professors

	Assistant		Associate		Full	
Nonresident Alien	31	(5%)	4	(0%)	6	(1%)
African American	8	(1%)	3	(0%)	3	(0%)
Native American	1	(0%)	2	(0%)	0	(0%)
Asian	128	(21%)	204	(23%)	124	(12%)
Hispanic	12	(2%)	9	(1%)	10	(1%)
White	403	(67%)	650	(73%)	902	(85%)
Other	17	(3%)	20	(2%)	21	(2%)
Subtotal	**600**	**(100%)**	**892**	**(100%)**	**1,066**	**(100%)**
Did Not Indicate	24		76		78	
Total	**624**		**968**		**1,144**	

Table 15. Faculty Losses

	With Ph.D.	Without Ph.D.	Total
Died	3	0	3
Retired	28	4	32
Visitors Returning to Employer	25	1	28
Teaching Elsewhere	51	1	52
Left for Nonacademic Position	35	9	44
Returned to Graduate School	0	0	0
Remained, Changed to Part Time	3	1	4
Other	11	0	11
Unknown	4	0	4
Total	**160**	**16**	**178**

Table 16. Gender of Newly Hired Faculty

	Tenured		Tenure-Track		Other	
Male	14	(82%)	79	(80%)	105	(81%)
Female	3	(18%)	20	(20%)	24	(19%)
Total	**17**		**99**		**129**	

Table 17. Ethnicity of Newly Hired Faculty

	Tenured		Tenure-Track		Other	
Nonresident Alien	1	(6%)	8	(9%)	17	(15%)
African American	0	(0%)	1	(1%)	0	(0%)
Native American	0	(0%)	1	(1%)	0	(0%)
Asian	5	(31%)	18	(20%)	16	(14%)
Hispanic	0	(0%)	2	(2%)	1	(1%)
White	10	(63%)	57	(64%)	75	(68%)
Other	0	(0%)	2	(2%)	2	(2%)
Subtotal	**16**	**(100%)**	**89**	**(100%)**	**111**	**(100%)**
Did Not Indicate	1		10		18	
Total	**17**		**99**		**129**	

Survey from Page 7

University of Michigan, the University of California at San Diego, Columbia University and the University of Pennsylvania.[3]

The departments ranked 25-36 are the University of Chicago, Purdue University, Rutgers—the State University of New Jersey, Duke University, the University of North Carolina at Chapel Hill, the University of Rochester, the State University of New York at Stony Brook, the Georgia Institute of Technology, the University of Arizona, the University of California at Irvine, the University of Virginia and Indiana University.

Acknowledgments

Phillip Louis, Frank Winstead and Juan Osuna of CRA drafted the survey, collected the data, made follow-up calls and prepared the accompanying tables.

1995 CRA Taulbee Survey

FACULTY SALARIES IN FISCAL 1995-96

Table 18. Nine-Month Salaries, 110 Responses of 133 US CS Departments

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	477 of 481	$33,300	$51,405	$66,000	$53,913	$42,500	$56,640	$73,800
Associate	677 of 685	$36,941	$56,968	$97,250	$62,536	$51,529	$69,114	$97,250
Full	823 of 845	$47,871	$68,540	$100,000	$84,203	$54,500	$106,599	$186,900

Table 19. Nine-Month Salaries, 11 Responses of 12 US CS Departments Ranked 1-12

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	70 of 74	$52,000	$55,066	$63,000	$57,705	$54,970	$62,843	$73,800
Associate	75 of 76	$49,050	$58,755	$64,750	$65,624	$69,700	$74,754	$86,790
Full	156 of 158	$55,600	$71,328	$81,500	$94,732	$111,078	$133,678	$166,667

Table 20. Nine-Month Salaries, 12 Responses of 12 US CS Departments Ranked 13-24

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	57 of 57	$43,000	$53,613	$61,500	$56,448	$53,813	$59,729	$69,500
Associate	86 of 86	$54,247	$61,596	$70,700	$66,507	$63,000	$75,004	$92,700
Full	142 of 143	$60,377	$70,869	$85,500	$93,843	$106,300	$129,424	$186,900

Table 21. Nine-Month Salaries, 11 Responses of 12 US CS Departments Ranked 25-36

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	49 of 49	$50,800	$53,614	$57,000	$56,136	$55,518	$59,080	$70,810
Associate	84 of 84	$55,980	$61,316	$71,400	$65,470	$62,697	$69,965	$86,800
Full	111 of 116	$60,300	$71,539	$86,400	$89,186	$83,880	$113,934	$167,000

Table 22. Nine-Month Salaries, 76 Responses of 97 US CS Departments Ranked Higher Than 36 or Unranked

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	301 of 301	$33,300	$50,204	$66,000	$52,658	$42,500	$54,887	$73,000
Associate	432 of 439	$36,941	$55,417	$97,250	$61,152	$51,529	$67,393	$97,250
Full	414 of 428	$47,871	$67,351	$100,000	$80,469	$54,500	$98,477	$157,200

Table 23. Nine-Month Salaries, 9 Responses of 13 US CE Departments

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	45 of 45	$50,000	$52,539	$57,000	$54,687	$52,000	$56,646	$60,480
Associate	57 of 58	$52,018	$58,396	$64,076	$63,603	$61,800	$69,746	$77,300
Full	67 of 68	$69,336	$72,618	$77,950	$84,653	$72,099	$105,889	$138,430

Table 24. 12-Month Salaries, 11 Responses of 16 Canadian CS Departments (Canadian Dollars)

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	58 of 58	$43,000	$52,212	$62,252	$57,086	$52,984	$61,330	$69,538
Associate	149 of 154	$52,000	$60,574	$76,086	$69,985	$58,000	$81,516	$125,233
Full	138 of 138	$63,000	$77,492	$108,488	$89,668	$84,165	$111,857	$159,539

Table 25. Nine-Month Salaries, 119 Responses of 146 US CS and CE Departments

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	522 of 526	$33,300	$51,484	$66,000	$53,965	$42,500	$56,640	$73,800
Associate	734 of 743	$36,941	$57,066	$97,250	$62,614	$51,529	$69,157	$97,250
Full	890 of 913	$47,871	$68,814	$100,000	$84,237	$54,500	$106,551	$186,900

Table 26. Salaries of Newly Appointed Faculty, 46 Responding CS and CE Departments

Dept. Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
US: CS 1-12	5 of 5	$54,325	$55,606	$57,600	$55,606	$54,325	$55,606	$57,600
CS 13-24	4 of 4	$50,000	$52,314	$55,600	$53,209	$51,157	$54,489	$58,700
CS 25-36	4 of 4	$50,000	$54,333	$57,000	$54,400	$50,000	$54,467	$57,000
CS Other	34 of 35	$27,000	$49,093	$54,500	$49,309	$30,000	$49,538	$56,000
CE	4 of 6	$50,000	$52,875	$57,000	$52,875	$50,000	$52,875	$57,000
CS&CE	**51 of 52**	**$27,000**	**$50,755**	**$57,600**	**$50,984**	**$30,000**	**$51,257**	**$58,700**
Canadian: CS&CE	12 of 12	$27,500	$42,514	$56,202	$45,639	$43,000	$48,889	$56,202

Paperwork from Page 5

review, we now shift two months. That review was scheduled perhaps three months in advance. Rescheduling is not going to happen in three weeks."

The contracts office, facing its own problems because of the furloughs, can do little to help make up lost time. "We've lost six months. We hoped to get something done this year. Most probably it will have to go the Science Board for approval, something it otherwise might not have needed."

Holding off obligation of funds until later in the year avoids spending money that is not appropriated by Congress, but it leaves the grant or contract in the paperwork squeeze. Program offices have to close out their books by the middle of August so the agency can close its books at the end of September, the last month of the fiscal year. Contract offices decline to handle certain actions late in the year because of paperwork processing demands. So the prospect that a three-week furlough delay could stretch into a year for a program is not an idle one.

In another case, a review of the campus connections segment of the domestic Networking Connections program was scheduled in December, before the program announcement went out. Now the announcement has slipped two months. "We may not even be able to wait for that review," Ciment said. "We may have to do it with an internal review, which may not be the best kind of review we want."

Furlough effects outside of Washington varied widely. Officials at some federally supported laboratories contacted for this story said they did not notice any effects from the furlough; others reported missed grant payments that left unpaid bills.

Professional Opportunities

CRN Advertising Policy

Send copy and payment for Professional Opportunities advertisements to Advertising Coordinator, *Computing Research News*, 1875 Connecticut Ave. NW, Suite 718, Washington, DC 20009. Tel. 202-234-2111; fax: 202-667-1066; e-mail: jbass@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 and will be printed in bold, 2) the second line must contain the name of the department or unit and will be printed in italics, 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 headings or text be set in bold; a word set in bold will count as two.

The rate is $2 (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 includes 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 three-inch minimum. Ads must be submitted in camera-ready, offset (positives or negatives) or mechanical form. Please call for information on placing display ads for products or services.

Computing Research News is published six times per year: in January, March, May, September, November and December. Professional Opportunities ads with application deadlines falling within the month of publication will not be accepted unless the ad says applications will be accepted until the position is filled. Advertising copy must be received at least one month before publication. The deadline for the May issue is April 1.

Cornell University
Department of Computer Science

Computer Science announces an opening for a lecturer. This is a three-year, non-tenure-track position beginning in August 1996, with the possibility of renewal. The successful candidate will teach introductory computer science courses and participate in the activities of a top-rated Computer Science Department dedicated to quality teaching and research.

Qualifications include a Ph.D. in computer science and substantial teaching experience. Exceptional candidates with a master's degree in computer science and a record of outstanding teaching will be considered. Demonstrated commitment to teaching is essential. In addition to outstanding qualifications as a teacher, candidates must possess the interest and style to be effective in a research institution.

Further information about the department is available on the World Wide Web at URL: http://www.cs.cornell.edu/.

Applicants should submit a curriculum vitae and the names of at least three references to Chair, Lecturer Recruiting Committee, Department of Computer Science, 4130 Upson Hall, Cornell University, Ithaca, NY 14853-7501.

Cornell University is an equal opportunity employer and welcomes applications from women and ethnic minorities.

Cornell University
Department of Computer Science

Tenure-track assistant professor: Applications are invited for tenure-track positions beginning in August 1996. These positions are at the assistant professor level, although appointments at the associate and full professor level will be considered for highly qualified applicants. Applicants should have a Ph.D. in computer science or in a closely related field. The department requires demonstrated research accomplishment at a very high level as well as outstanding teaching ability and leadership qualities.

The Department of Computer Science at Cornell University encompasses a wide range of research areas, including algorithms, applied logic and semantics, artificial intelligence, computing theory, concurrency and distributed computing, databases, information organization and retrieval, multimedia systems, numerical analysis and scientific computing, programming languages and methodology, and robotics and computer vision. REF: AP#1.

Non-tenure-track assistant professor: Three-year, non-tenure-track position at assistant professor level beginning in August 1996 to teach introductory computer science courses, assist in coordinating and teaching in the Master of Engineering program. Applicants should have a Ph.D. in computer science, substantial teaching experience and a demonstrated commitment to teaching. REF: AP#2.

Research: Research positions in scientific computing and software systems. REF: RES#3.

Further information about the department is available on the World Wide Web at URL: http://www.cs.cornell.edu/.

Applicants should submit a curriculum vitae and the names of at least three references to Chair, Faculty Recruiting Committee, Department of Computer Science, 4130 Upson Hall, Cornell University, Ithaca, NY 14853-7501. Please include the reference number with application.

Cornell University is an equal opportunity employer and welcomes applications from women and ethnic minorities.

National Science Foundation
Division of Computer and Computation Research

Two program director positions will be available in the Division of Computer and Computation Research starting Aug. 1, 1996. Program directors are responsible for the planning and administration of research programs and serve as spokespersons for their programs in the scientific community. There are opportunities to influence the direction of programs and to initiate new programs, to be involved in cross-disciplinary activities within NSF, to collaborate with other federal agencies on programs of joint interest and to represent NSF at professional meetings and seminars. Program directors are encouraged to keep abreast of relevant scientific research by participating in independent research and attending professional meetings and conferences.

A program director must have six or more years experience since receiving a Ph.D. and a successful record of personal research accomplishment. These positions are temporary; appointments usually are made for two years. A program director must be willing to relocate to the Washington, DC, area for the duration of his/her tenure at NSF. Salaries are competitive with academic/research positions. Relocation expenses or a housing allowance is provided for persons who must relocate.

Program director—Software Engineering, Languages and Architectures. This program director supports research in software engineering, programming and specification languages and semantics, and software architecture. Research topics include domain-specific languages; semantics-based program manipulation; verification and validation; software architecture, modularity and composition; software design reuse; software development processes; software metrics; and application-level fault tolerance.

Program director—Experimental Software Systems. This program supports experimental research on all aspects of software including team-oriented, multi-investigator projects with an experimental component. Because the scope of this program cuts across several technical areas within computer science and engineering, it will be important for the ESS program director to work with other program directors to obtain expert reviews that span a broad spectrum of the discipline.

For more information about these positions, please contact Richard B. Kieburtz, Division Director, Division of Computer and Computation Research, National Science Foundation, 4201 Wilson Blvd., Room 1145, Arlington, VA 22230. Tel. 703-306-1910; fax: 703-306-1947; e-mail: rkieburt@nsf.gov.

NSF is an equal opportunity employer.

National Science Foundation
Computer and Information Science and Engineering Directorate

The Computer and Information Science and Engineering Directorate of the National Science Foundation has anticipated program director positions in a number of its divisions. These one-to two-year temporary positions are filled with visiting scientists or with temporary assignment to NSF through the Intergovernmental Personnel Act (IPA).

The division director should be contacted for more information about possible vacancies and the division's programs.

Program vacancies are anticipated in the:

- Division of Computing and Computation Research (Dr. Richard Kieburtz, division director, tel. 703-306-1910, e-mail: rkieburt@nsf.gov).
- Office of Cross-Disciplinary Activities (Dr. John Cherniavsky, office head, tel. 703-306-1980, e-mail: jchernia@nsf.gov).
- Division of Networking and Communications Research and Infrastructure (Dr. George Strawn, division director, tel. 703-306-1950, e-mail: gstrawn@nsf.gov).
- Division of Microelectronics Information Processing and Systems (Dr. Bernard Chern, division director, tel. 703-306-1940, e-mail: bchern@nsf.gov).
- Division of Advanced Scientific Computing (Dr. Robert Borchers, division director, tel. 703-306-1970, e-mail: rborcher@nsf.gov).
- Division of Information, Robotics and Intelligent Systems (Dr. Yi-Tzuu Chien, division director, tel. 703-306-1930, e-mail: ytchien@nsf.gov).

IPA position compensation is based on the individual's home institution salary; visiting scientist positions usually are AD-4 positions ($62,472-$97,365 per annum). A successful applicant usually has six or more years of experience since receiving a Ph.D. and has a successful record of personal research accomplishment.

The CISE Directorate's home page is http://www.cise.nsf.gov/.

Women and members of groups underrepresented in CISE disciplines are especially encouraged to investigate serving in these positions. NSF is an equal opportunity, affirmative action employer.

University of Virginia
Department of Computer Science

The University of Virginia invites applications and nominations for chair of the Computer Science Department. The department is rapidly becoming known as a leader in both education and research. The department is seeking a qualified candidate who is interested in leading it to its next levels of excellence and recognition. Qualifications include acknowledged excellence in scholarship, a broad vision of the field, a strong commitment to quality, strong management and leadership skills, an entrepreneurial spirit, integrity and a special sensitivity to increasing the number of faculty and students from underrepresented groups.

For further information, please contact Professor William Wulf, Department of Computer Science, University of Virginia, Charlottesville, VA 22903.

The University of Virginia is an equal opportunity employer. It especially invites applications from underrepresented groups.

University of Alberta
Department of Computing Science

Applications are invited for a tenure-track position at the assistant professor level in the areas of software engineering or communication networks. The successful candidate should have a strong software systems background. Responsibilities include research as well as teaching at both the graduate and undergraduate levels.

The department consists of 33 academic and 22 support staff and offers a graduate program with more than 100 M.Sc. and Ph.D. students. Current computer equipment consists of a network interconnecting several multiprocessor Sun servers, two multiprocessor SGI servers, four Sun file servers delivering 60 gigabytes of storage, and more than 160 Sun, SGI, HP, DEC and IBM workstations in research laboratories and offices. The department is well connected via the campus FDDI network to the remainder of the campus units and the Internet via Arnet. There is also a connection to the WURCnet ATM test bed. Instructional facilities include eight Unix workstation (Sun, SGI and Xterm) laboratories, two of Macintoshes and one Intel 486. There are well-supported research laboratories in artificial intelligence, cognitive science, communication networks, computer graphics, computer vision and robotics, database, distributed/parallel programming systems, software engineering, and theory and scientific computation.

The current salary minimum is $39,230 with the appointment level being commensurate with qualifications and experience. Send curriculum vitae, the names of three references and up to three reprints or copies of important publications. A Ph.D. or equivalent is the minimum qualification; new Ph.D.'s should include a copy of their transcript. Applications will be accepted until April 1, 1996, with employment commencing July 1, 1996. For further information on the department, please see our WWW site at http://web.cs.ualberta.ca.

Please send applications to Dr. Paul G. Sorenson, Chair, Department of Computing Science, University of Alberta, Edmonton, Alberta T6G 2H1, Canada. E-mail: sorenson@cs.ualberta.ca.

In accordance with Canadian Immigration requirements, priority will be given to Canadian citizens and permanent residents.

The University of Alberta is committed to the principle of equity in employment. As an employer, we welcome diversity in the workplace and encourage applications from all qualified women and men, including Aboriginal peoples, persons with disabilities and members of visible minorities.

University of Pennsylvania
Department of Computer and Information Science

The University of Pennsylvania invites outstanding applicants for three tenure-track appointments in both experimental and theoretical computer science to start July 1, 1996. Senior-level appointments will also be considered.

Applicants are sought in the areas of artificial intelligence, algorithms and complexity, databases, graphics, operating systems, programming language implementation, robotics and software engineering, but attention will be given to exceptional candidates in any area of computer science.

Faculty duties include undergraduate and graduate teaching as well as research. As in previous years, the university is looking for applicants whose research would be enhanced by the department's existing strengths in algorithms and computational biology, computer graphics and animation, computer vision and robotics, databases, gigabit networks, logic and computation, and natural language processing. We are also eager to grow in the general area of experimental computer science and encourage applications from candidates who implement and measure complex systems.

Applications, including the names of at least three references, should be sent to Professor Susan B. Davidson, Chair, Faculty Search Committee, Department of Computer and Information Science, School of Engineering and Applied Science, University of Pennsylvania, 200 S. 33rd St., Philadelphia, PA 19104-6389.

To be assured full consideration, applications should be received as soon as possible. Questions can be addressed to faculty-search@central.cis.upenn.edu. Applications should not be sent via e-mail.

The University of Pennsylvania is an equal opportunity, affirmative action employer.

Brown University
Department of Computer Science

Applications are invited for a three-year tenure-track, renewable faculty position in computer science at the level of assistant professor commencing Sept. 1, 1996. Applicants are sought with research interests in theoretical and analytical aspects of computer science. Preference will be given to candidates with broad interests who are clearly motivated by applications. Candidates are expected to have an outstanding research record and an aptitude for teaching. They are also expected to have completed all the requirements for the Ph.D. in computer science or a related field by no later than Sept. 1, 1996.

Successful applicants will find at Brown a stimulating environment conducive to professional growth. Brown has a strong department with a variety of interesting research projects in the areas of analysis of algorithms, artificial intelligence, combinatorial optimization, computational complexity, computational geometry, computer graphics, concurrent data structures and architectures, database systems, graph drawing, logic programming, operating systems, parallel computation, parallel and distributed debugging, programming environments, programming languages and software engineering. The undergraduate and graduate students are first-rate.

The department is very well-equipped with

Professional Opportunities

computing technology. It manages a network of approximately 200 workstations, of which about 170 are Sun Sparc-10 workstations. It also has access on campus to a 24-processor IBM SP/2. The department occupies the two top floors of Brown's new Thomas J. Watson Sr. Center for Information Technology. This striking building houses many of the university's computer activities, including an innovative instructional environment.

Applicants should send a resume and have at least three referees send letters of recommendation to Professor John E. Savage, Department of Computer Science, Brown University, Box 1910, Providence, RI 02912. E-mail: faculty_search@cs.brown.edu.

All application materials must be received by March 31, 1996, for full consideration. Electronic submissions in PostScript are encouraged.

Brown University is an equal opportunity employer and encourages applications from women and members of minority groups.

Johns Hopkins University
Department of Computer Science

The Department of Computer Science at Johns Hopkins University invites applications for anticipated faculty positions. We are particularly, but not exclusively, seeking candidates with research and teaching interests in all aspects of computer systems, computer graphics and geometric modeling, distributed systems and databases, distributed language design, and networking and mobile computing. All applicants must have a Ph.D. in computer science or a related field and are expected to have an outstanding research record, commitment to quality teaching and the ability and willingness to develop a research program of the highest quality.

Since its creation in 1986, the Department of Computer Science at Johns Hopkins University has grown to have significant research strengths in the areas of parallel and distributed computing, algorithm design, programming languages, fault-tolerant computing, geometric computing, computational biology, natural-language processing, computer vision, robotics, artificial intelligence, and biomedical applications and computer-assisted surgery. Computer Science faculty members at Johns Hopkins University are also actively involved in many exciting interdisciplinary research activities in university-affiliated institutes and centers, including the Space Telescope Science Institute, the MIND/BRAIN Institute, the Human Genome Database, the Center for Language and Speech Processing and the newly founded Center for Geometric Computing.

The Johns Hopkins University is a private university well-known for its commitment to academic excellence. Recently ranked as a "top 10" university by *US News & World Report*, Hopkins attracts extremely talented undergraduates and graduate students nationally and internationally.

Applicants with Internet access should have LaTeX, ASCII or PostScript copies of a comprehensive curriculum vitae, a statement of future plans for research and teaching and at least three letters of reference sent via e-mail to search@cs.jhu.edu; see also the World Wide Web page: http://www.cs.jhu.edu/search. Applicants who do not have access to the Internet should have their information sent to Faculty Search Committee, Department of Computer Science, Room 224, New Engineering Building, Johns Hopkins University, Baltimore, MD 21218-2694. Fax: 410-516-6134. To ensure full consideration, complete applications should arrive by March 19, 1996.

The Johns Hopkins University is an equal opportunity and affirmative action employer.

University of Tennessee, Knoxville
Vice Chancellor for Information Infrastructure

The vice chancellor for information infrastructure at the University of Tennessee at Knoxville (UTK) reports directly to the chancellor and has executive responsibility for the policy making, planning, development, implementation and overall administration for computing and related technologies in support of the university's teaching, research, outreach and administrative activities. Major features of that responsibility will be coordinating with other institutional leaders, both academic and administrative, to ensure that the university's vision of becoming the "Information University" and the "University of Choice in the 21st Century" is realized.

The vice chancellor will: 1) create and maintain a productive, dynamic environment for the use of computing and related technologies in teaching, research and public service; 2) create and maintain an organizational climate and a working environment within the Division of Information Infrastructure that encourages creativity, adaptability and cost-effectiveness in meeting UTK's needs; 3) have administrative responsibility for the Academic Technology, Computing and Administrative Systems, Network Services and Telephone Services organizations; 4) participate as a member of the chancellor's staff in policy making, strategic planning, goal setting and troubleshooting on institutional issues; 5) consult with campuswide policy advisory committees composed of faculty, students and staff; and 6) establish and maintain vibrant working relationships with UTK information content and service providers and with UTK's partners in industry, government and academia.

Minimum of five years of managerial experience in a broad variety of computer-related areas is required. Experience in directing and managing an open distributed-computing environment in a research university is desirable. Applicants must have a proven record of success in planning and problem solving and in managing complex information technology resources involving highly skilled professional personnel. Applicants must demonstrate a commitment to diversity. Ability to communicate effectively with all university and external constituencies and to achieve strong interpersonal working relationships with members of those constituencies is essential. A sound educational background that includes a doctoral degree or equivalent is required.

The University of Tennessee at Knoxville, a Carnegie Research Level One institution, enrolls approximately 26,000 students from every state in the United States and approximately 100 other countries. As Tennessee's comprehensive campus, UTK offers more doctoral programs than any other institution in the state, and its faculty attract nearly $80 million annually for sponsored research programs. UTK is one of 27 higher-education institutions holding the distinction of being both a land-grant institution and state university.

Candidates should send an official letter of application, a curriculum vitae, a list of five references and a one- to two-page statement of their vision of the role of computing and related technologies in a research university in the 21st century.

Applications may be sent via e-mail to vciisearch@cs.utk.edu or via US mail to Professor Robert C. Ward, Chair, VCII Search Committee, Computer Science Department, The University of Tennessee, Knoxville, TN 37996-1301. Further information may be obtained by browsing URL: http://www.ns.utk.edu/vcii.

UTK is an equal opportunity, affirmative action, Title IX, Section 504, ADA employer.

Boston University
Department of Computer Science

Applications are invited for two tenure-track assistant professorships beginning in September 1996. Qualifications required of all applicants include a Ph.D. in computer science; a strong research record; commitment to research and teaching; and a research interest in networking, algorithms, data visualization/navigation or a closely related area.

The Computer Science Department currently consists of 10 faculty and offers B.A., M.A. and Ph.D. programs. Our research interests include parallel, distributed and real-time systems; parallel languages and compilers; networks; image and video computing; logic of computation; and theoretical computer science. The department has excellent computing resources and in the last year has been the recipient of significant grants for research infrastructure and graduate student support.

Qualified applicants should send a detailed resume and arrange for at least three references to be sent to Faculty Search Committee, Computer Science Department, 111 Cummington St., Boston University, Boston, MA 02215.

Please include a cover letter stating the names of your references and your major area of specialization. Reference letters may be e-mailed (preferred) to search96@cs.bu.edu, marked "Reference Letter for <candidate>". Additional information is at http://cs-www.bu.edu.

These positions are offered pending final university approval. Boston University is an equal opportunity, affirmative action employer.

Rutgers University
Department of Computer Science

The Department of Computer Science at Rutgers (New Brunswick), the State University of New Jersey, anticipates hiring for a tenure or tenure-track position starting in fall 1996. Particularly sought are individuals pursuing research in systems. Areas of interest include parallel and distributed computing, databases, networking and operating systems. A candidate should have a Ph.D. in computer engineering or computer science and should be committed to excellence in research and teaching.

The department, with 35 full-time faculty, has graduate and undergraduate programs granting, typically, 12 Ph.D., 35 M.S. and 140 B.A./B.S. degrees per year. Rutgers offers excellent opportunities for cultural activities and close professional contact with nearby major research laboratories and other leading universities, as well as many on-campus, interdisciplinary centers (e.g., DIMACS, Rutgers Center for Cognitive Science and WINLAB).

Candidates should send a curriculum vitae, including names and addresses of three references, and copies of recent papers to Chair, Faculty Search Committee, Department of Computer Science, Hill Center, Busch Campus, Rutgers University, Piscataway, NJ 08855. E-mail: hiring@cs.rutgers.edu.

Rutgers is an affirmative action, equal opportunity employer.

Florida Institute of Technology
Department of Computer Science

Applications are invited for a faculty position in computer science commencing fall 1996. A Ph.D. in computer science or a related discipline is required. Of particular interest are candidates with expertise in database systems, operating systems and software engineering. Salary and rank will be commensurate with accomplishments and experience.

Florida Tech is a private university located in Melbourne, on Florida's Space Coast. Currently, there are 120 undergraduate majors, 200 master's students, 25 Ph.D. students and 11 faculty members in computer science. For more information, see our WWW page at http://cs.fit.edu.

Applicants should send a curriculum vitae and the names and addresses of three references to Dan E. Tamir, Recruitment Chair, Computer Science, Florida Tech, Melbourne, FL 32901. Review of applications will begin immediately, and applications will be accepted until the position is filled.

Florida Tech is an equal opportunity employer.

Louisiana State University
Department of Computer Science

The Department of Computer Science at Louisiana State University invites applications for a tenure-track position at the rank of assistant professor to begin employment in the fall of 1996.

The department is particularly interested in applications from those with an interest in the areas of high-performance computing. Candidates should be able to work with our CCLMS research group as well as other faculty members in the department. Applicants must have a Ph.D. in computer science or equivalent.

Research emphases of interest include, but are not limited to, scientific visualization, virtual reality, high-performance networking, graphic interfaces and other areas of computer science.

A detailed announcement of this position is to appear in the March issue of *Communications of the ACM*. If you are interested, please apply and send the names of three references to Professor S. S. Iyengar, Louisiana State University, Department of Computer Science, Baton Rouge, LA 70803. Tel. 504-388-1495; fax: 504-388-1465; e-mail: iyengar@bit.csc.lsu.edu. Submission via e-mail in PostScript is preferred.

LSU is an equal opportunity, affirmative action employer.

University of Colorado, Boulder
Institute of Cognitive Science

The Institute of Cognitive Science of the University of Colorado at Boulder invites applications for a tenure-track position. Preference will be given to candidates at the assistant professor level, but candidates at all levels will be considered. Candidates should have a demonstrated interest in theoretical and methodological applications of cognitive science to education. In particular, candidates with a strong background in and experience with computational environments in support of innovative educational approaches are sought. The position will be closely associated with the Center for LifeLong Learning and Design (L3D). Depending on the candidate's academic background and interests, the academic appointment will be in the Department of Computer Science or in the School of Education.

L3D is an educational and research unit of CU-Boulder sponsored jointly by the Institute of Cognitive Science and the Department of Computer Science. Its mission is the ongoing development of theory and technology to support learning (specifically lifelong learning, learning on demand and collaborative learning) and design in the context of authentic, self-directed, realistic problems. L3D collaborates with educational institutions, research organizations and industrial partners to develop innovative educational models supported by adequate technology to prepare learners and workers for the 21st century.

Preference will be given to candidates with strong interdisciplinary education and interests, and a commitment to contribute to interdisciplinary research. Candidates should expect to 1) teach a range of undergraduate and graduate courses in cognitive science and the affiliated department or school, and 2) actively engage in and contribute to the research activities of L3D.

Applicants should send a resume and three letters of reference to Dr. Martha Polson, Associate Director, Institute of Cognitive Science, Campus Box 344, University of Colorado, Boulder, CO 80309. Applications should be received by April 1, 1996, to ensure consideration. Early applications are encouraged.

For more information on the Institute of Cognitive Science, the Center for LifeLong Learning and Design, the Department of Computer Science or the School of Education, consult their respective World Wide Web pages: http://psychwww.colorado.edu/ics/home.html, http://www.cs.colorado.edu/~13d, http://www.cs.colorado.edu and http://www.colorado.edu/education_school.html.

The University of Colorado strongly supports the principle of diversity. We are particularly interested in receiving applications from women, ethnic minorities, disabled persons, veterans and veterans of the Vietnam era.

New York University
Department of Computer Science

The Computer Science Department seeks candidates for a clinical faculty position starting in September 1996, pending funding approval. Junior and senior candidates will be considered. The possible appointments are as a clinical assistant professor, clinical associate professor or clinical professor. This is a non-tenured position, with a renewable three-year term; it is primarily a teaching and not a research position. The main duties are 1) teaching in the professional M.S. programs (the department graduates 90 M.S. students annually) and 2) managing the projects course for the M.S. in information systems program, a joint program of the Computer Science Department and the Information Systems Department in the Stern School of Business. The projects are performed in collaboration with major local corporations.

Candidates must be experienced practitioners. Experience in an industrial setting especially involving one or more of the following topics is preferred: Internet services, groupware, computer security, networks and intelligent agents. Prior teaching experience is desired. A Ph.D. is preferred.

Applications should be sent to Professor Richard Cole, Chair, Department of Computer Science, New York University, 251 Mercer St., New York, NY 10012-1185.

To ensure full consideration, please submit your application by March 1; the search will continue until all positions are filled. Early application is encouraged. Please refer to the department's home page at URL: http://cs.nyu.edu for further information.

The university is an equal opportunity, affirmative action employer. The department welcomes applications from women and underrepresented minorities.

Harvard University
Department of Computer Science

We invite applications for a junior faculty position in computer science. We are especially, but not exclusively, looking for candidates with an outstanding research record in up-to-date aspects of programming languages, computer graphics, theory or networking. Candidates should have a Ph.D. in computer science or a closely related discipline. Responsibilities include teaching in the A.B. and graduate programs and a strong research commitment.

Applicants should submit a curriculum vitae and the names, addresses (including e-mail) and telephone numbers of three references to the CS Faculty Search Committee, Pierce Hall 218, Harvard University, 29 Oxford St., Cambridge, MA 02138. Application deadline is March 31, 1996.

Harvard is an equal opportunity, affirmative action employer and encourages applications from women and members of minority groups.

Oakland University
Department of Computer Science and Engineering

The Department of Computer Science and Engineering invites applications for two anticipated tenure-track positions at the assistant professor level to begin in August 1996. One position is in the area of software engineering (SE), the other in computer science. The SE position involves

Continued on Page 12

Computists International
An online CS association since 1991. Departmental queries welcome.
Dr. Kenneth Laws, laws@ai.sri.com.

Computists' Communique
Weekly M.S./Ph.D. jobs leads, grant news, software trends and online resources. Contact laws@ai.sri.com for info.

People in the News

CS community mourns death of Kanellakis

(By members of the Brown University Department of Computer Science.)
Paris Kanellakis, his wife, Maria Teresa Otoya, and their two children, Alexandra and Stefanos, died Dec. 20, 1995, in the American Airlines crash outside Cali, Columbia. Paris's tragic death has created a void both at Brown University and in computer science as a whole.

Paris was born in Athens, Greece; he received his undergraduate education at the National Technical University of Athens, where he was first in his class. He then went to the Massachusetts Institute of Technology, where he received his master's and Ph.D. degrees and came to Brown as an assistant professor in 1981. He became a US citizen in 1988 and a full professor here in 1990.

Paris's research area was theoretical computer science. His contributions were unique both in the breadth of his interests and in his ability to carve out research programs in which his keen mathematical insight could be put to the service of practical issues.

Broadly put, Paris was interested in how the formal language in which a problem is expressed affects the class of problems one can use it to attack. Most of us who have written programs feel intuitively that some problems are easier to express in one language than another. Paris worked at a more fundamental level: The languages he explored were deliberately kept simple, to make mathematical analysis possible. And the choice of language could decide not just ease of expression but whether or not a problem could be expressed at all.

Furthermore, he recognized that the more expressive a language, the wider the class of problems it can solve. It also follows that more expressive languages are less likely to admit efficiency—some of the programs expressed cannot be solved efficiently. Because this trade-off is inevitable, one is always searching for languages that best balance these concerns.

Within this broad area, Paris attacked a variety of issues. For example, computer databases require a language in which to express one's query. More recently the area of constraint programming languages attracted his attention. In a constraint language one says not merely that a particular variable is always an integer but that, say, it is an integer between certain values. Concerning efficiency, some of Paris' most important papers showed that language features previously thought unexceptionable—unification and type checking, to cite what are probably among his most important results—in fact contain pitfalls that require careful negotiation.

Also, because in many cases one is interested in efficiency when using not just a single computer but rather a large collection of computers, Paris made fundamental contributions to the area of parallel processing. In all these cases Paris worked closely with practitioners in the area here at Brown and elsewhere to ensure that his work was grounded in reality. For this and related work, Paris was viewed as a leader in theoretical computer science, particularly among those with a taste for practice.

Paris was not only an intellectual leader in his field but a professional leader as well, through his willingness to organize conferences, mentor students and generally work for the betterment of his intellectual community. Paris put his great energy and commitment at the service of our department and the university as well. He assumed many tasks for the department and performed them with skill, devotion and good spirits. But occasionally this caused small problems. For many years, our department has operated in two time zones: regular time and Kanellakis time, which uniformly ran about 12 minutes behind.

Paris had great insight into human nature and was fiercely honest. He was one of the people always consulted on tricky departmental issues because we respected his opinions and valued his insights. He also had a fine sense of humor, a wonderfully wholehearted laugh and an outgoing, energy-filled personality that drew everyone to him. He turned 42 just two weeks before his death. His accomplishments were immense even in the time he had, and we grieve for the loss of what he would have accomplished had he had more.

Jobs from Page 11

research and teaching in a new M.S. program in software engineering. The ideal expertise includes practical aspects of software engineering and its mathematical foundations. The CS position involves active research in computer science and teaching undergraduate and graduate CS courses.

Candidates should have a Ph.D. in computer science or computer engineering and strong interest in both research and teaching. For full consideration, applications should be submitted by April 15, 1996. Applications will be accepted until the positions are filled.

Applicants should send a letter of intent, resume, the names of three references, copies of publications and a statement of research and teaching interests to Professor Ronald Srodawa, Chair, Faculty Search Committee, Department of Computer Science and Engineering, Oakland University, Rochester, MI 48309-4401. E-mail: srodawa@oakland.edu.

For additional information about the department, college and the university, see http://unix.secs.oakland.edu.

Oakland University is an affirmative action, equal opportunity, ADA-compliant employer.

Southern Methodist University
Department of Computer Science and Engineering

The Computer Science and Engineering Department at Southern Methodist University invites applications for a faculty position in the area of software engineering beginning fall 1996. Applicants should hold a Ph.D. in computer science, computer engineering or a closely related area and must demonstrate a strong commitment to excellence in research and teaching.

SMU's CSE Department resides within the School of Engineering and Applied Science. The department offers degree programs in computer science, computer engineering and software engineering. It currently has 14 faculty members working in parallel processing, distributed operating systems, computer networks, computer arithmetic, database systems, artificial intelligence, computational programming, software engineering and other related areas. The department has plans to expand significantly in the next few years.

The Dallas area, where SMU is located, has one of the highest concentrations of high-tech companies in the nation, offering abundant opportunities for industrial research cooperation and consulting.

Candidates should send a complete resume, including the names of at least three references, to Professor Dan I. Moldovan, Department of Computer Science and Engineering, School of Engineering and Applied Science, PO Box 750122, Southern Methodist University, Dallas, TX 75275-0122. Applications will be accepted until April 15, 1996.

SMU is an affirmative action, equal opportunity, Title IX employer. The university particularly encourages the candidacies of women, minorities and persons with disabilities.

Clemson University
Department of Electrical and Computer Engineering

The Department of Electrical and Computer Engineering has an assistant professor tenure-track faculty position to fill in the computer engineering area. The department has strong research programs in communication systems and computational electromagnetics, power systems, single-wafer MOCVD processing, mechatronic systems, evolutionary computing, software standards and computer architecture. Research and teaching needs have identified software engineering as a priority for this position.

A candidate is sought with teaching and research interests that will sustain the basic core curriculum of computer engineering and support activities within the specialized computer systems research area. A detailed description of this area may be found at http://www.eng.clemson.edu/~ece/csagrp1.html.

A specific emphasis in software engineering, including real-time operating systems, programming systems and formal methods is desirable. Candidates should possess a Ph.D. in computer engineering or a closely related field. The individuals selected will be expected to contribute to active research programs at Clemson and to teach both undergraduate and graduate courses. A detailed description of the department is available at http://www.eng.clemson.

Send resume and names and addresses of five references to Chair, Search Committee, Department of Electrical and Computer Engineering, 102 Riggs Hall, Box 340915, Clemson University, Clemson, SC 29634-0915. Evaluation will begin April 15 and continue until the position is filled.

Clemson University is an equal opportunity, affirmative action employer.

Oregon State University
Department of Computer Science

The Department of Computer Science at Oregon State University has one or possibly more openings for tenure-track assistant professors, to start in April or September 1996. Specialization in software engineering is desirable, but all qualified applicants will be considered.

Applicants should have completed or expect to complete all requirements for the Ph.D. in computer science or a closely related field and should have demonstrated research and teaching potential.

To apply for these positions, send a complete resume, statement of research interests and at least three sealed letters of reference (electronic mail is acceptable) to Faculty Search Committee, Department of Computer Science, Oregon State University, Corvallis, OR 97331-3202. E-mail: sheryl@cs.orst.edu; WWW: http://www.cs.orst.edu.

For full consideration, apply by March 1, 1996; however, positions will remain open until filled. Applications from women and minorities are particularly encouraged.

OSU is an affirmative action, equal opportunity employer.

Polytechnic University
Department of Computer and Information Science

The Computer and Information Science Department welcomes applications at all levels for two tenure-track faculty positions. We are particularly interested in candidates with expertise in distributed and high-performance computing, operating systems, networking and/or software engineering, although excellent candidates in all areas of computer science are invited to apply.

Candidates should have a Ph.D. in computer science or in a closely related field, a strong research record and a commitment to excellence in teaching. Faculty candidates at the full-professor level will be expected to help develop, in concert with current faculty, an active and strong group in one of the above areas and to have a demonstrated ability to secure substantial external funding through grants or contracts.

The Department of Computer and Information Science, which offers B.S., M.S. and Ph.D. degrees, currently has 18 full-time faculty members. Areas of active research include parallel and distributed systems, algorithms and data structures, databases, software engineering, networks, image analysis, combinatorial optimization, computational biology and computational geometry. For more information regarding Polytechnic and the Computer and Information Science Department, you are invited to visit our Web site at URL: http://www.poly.edu/.

Applicants should send a resume, a select subset of papers, a one- to two-page statement of their future research plans and interests and the names of at least three references to the address below. In addition, the applicant should ask references to send letters directly to the same address. These letters will not be requested directly by the department.

Send to Chair, Search Committee, Department of Computer and Information Science, Polytechnic University, Five MetroTech Center, Brooklyn, NY 11201. Tel. 718-260-3828; e-mail: jps@pucs4.poly.edu.

Evaluation of candidates will begin immediately and continue until the search is complete.

Polytechnic is an equal opportunity employer. Applications from women and underrepresented minorities are strongly encouraged.

University of Texas, El Paso
Department of Computer Science

The University of Texas at El Paso (UTEP) seeks a tenure-track assistant or associate professor of computer science. The successful candidate must demonstrate a strong commitment to undergraduate education and research experiences. Additionally, the successful candidate is expected to develop a successful research program in a technical area of computer science. Although applications are welcome from anyone who holds a Ph.D. in computer science, the department has particular interest in candidates who specialize in systems or concurrency. Information about the department can be found in http://cs.utep.edu/csdept.

UTEP has recently been selected as a Model Institution for Excellence (MIE) by NSF. The university's MIE focus is on undergraduate education and undergraduate involvement in meaningful research experiences. The successful applicant is expected to participate in the university's MIE initiative and play an active role in the university's commitment to providing the environment to encourage and enable student success.

Applicants should submit a detailed resume and the names of at least four references to dcooke@cs.utep.edu.

UTEP does not discriminate on the basis of race, color, national origin, sex, religion, age or disability in employment or the provision of services.

Florida State University
Department of Computer Science

The Florida State University Department of Computer Science is seeking candidates for a position in system administration. The position is a 12-month, non-tenure-track faculty position with duties in the teaching and service categories. The SA position has three primary areas of responsibility:

1. Computer system administration. The SA will provide high-level oversight and leadership in the management of departmental computing resources, which include several student laboratories as well as faculty, graduate student and staff workstations, all supported by file and compute servers on a network. Several employees will report directly to the SA. This is the largest academic computer system in the university. Personnel and policy associated with the department have traditionally played leadership roles for the university.

2. Master's track administration. The SA will manage the department's new master's program in computer system administration, which was established in fall 1994 (see http://www.cs.fsu.edu/academics/sysadmin).

3. Graduate teaching. The SA will teach two graduate classes per year related to the system administration degree program.

The position is a non-tenure-track faculty position with a 12-month appointment, renewable indefinitely. The successful candidate will have a Ph.D. in computer science or a closely related field and experience in at least some of the areas of responsibility. Salary will be competitive, depending on qualifications.

Applicants should send a resume and arrange for three letters of recommendation to be sent to Chair, System Administration Search Committee, Department of Computer Science, Florida State University, Tallahassee, FL 32306-4019. (See the Web site http://www.cs.fsu.edu for more information about the department.) The deadline for applications is April 15, 1996.

The Florida State University is an equal opportunity, affirmative action employer. It especially encourages applications from women and minorities.