COMPUTING RESEARCH NEWS

More than 25 Years of Service to the Computing Research Community

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IT for the 21st Century Featured in Budget Proposal

By Lisa Thompson

President Clinton unveiled his Fiscal Year 2000 budget plan on February 1, making good on a promise in his State of the Union address to request a 28 percent increase for computing and communications research. The proposed increase is incorporated in a new research initiative, Information Technology for the Twenty-First Century (IT^2), which draws heavily on the recommendations that the President's Information Technology Advisory Committee (PITAC) made in its Interim Report (see *CRN*, November 1998).

"The budget proposes a bold, new Information Technology Initiative that will invest in long-term, fundamental research in computing and communications, and will increase development and purchases of extremely fast supercomputers … Long-term information technology research will strengthen America's leadership in an industry that accounts for one-third of our economic growth, create high-tech, high-wage jobs, and improve our quality of life."

"Investments for the Twenty-First Century," U.S. Budget, FY 2000

The $366 million initiative would support research in three categories: long-term information technology research that will lead to fundamental breakthroughs in computing and communications ($228 million); advanced computing for science, engineering, and the nation ($123 million); and research on the economic and social implications of information technologies ($15 million). The latter activity would also include efforts to help train additional information technology workers at universities.

Six federal agencies plan to participate in the initiative: the National Science Foundation ($146 million), the Department of Defense (DoD)($100 million), the Department of Energy (DoE)($70 million), the National Aeronautics and Space Administration ($38 million), the National Institutes of Health ($6 million), and the National Oceanic and Atmospheric Administration ($6 million).

The President's Advisor for Science and Technology, Neal Lane, and other research agency officials appeared at a briefing on the science and technology components of the budget plan, and information technologies R&D had center stage. Under Secretary of Defense for Acquisition and Technology Jacques Gansler described DoD's participation in the initiative as critical, given the Joint Chiefs of Staff directive that information superiority be a top strategic objective. NASA Director Dan Goldin noted that everything his agency wants to accomplish depends on advances in information technology. And NOAA Director James Baker said the initiative will "have enormous impact on the way [NOAA] does business."

NSF Director Rita Colwell called the initiative a "national imperative," and mentioned that NSF was pleased to be the lead agency. She said it goes to the very heart of the NSF's mission and stressed that it would benefit "every field, every discipline, and every level of education." The NSF's investment comprises $110 million for research on software systems, scalable information infrastructure, high-end computing, and on the social, economic, and workforce impacts of information technologies, with an additional $36 million for development of terascale computing systems. The NSF budget proposal includes a 41.5 percent increase for the Computer and Information Sciences and Engineering Directorate (CISE) to accommodate the new programs.

DoE's role in the initiative, which mostly falls under the advanced computing category, was described by Secretary of Energy Bill Richardson. A new program, the Scientific Simulation Initiative (SSI), would be established to build on the existing Accelerated Strategic Computing Initiative. While ASCI serves the DoE's nuclear weapons mission, SSI would be a civilian program designed to develop and deploy advanced computers to probe extremely complex scientific questions of interest to DoE and to improve environmental monitoring.

A new senior management team has been formed within the National Science and Technology Council to set policy and coordinate initiative activities. It will report directly to Lane, and consist of the Directors or Under Secretaries of the participating agencies as well as senior officials from the Office of Management and Budget and the National Economic Council. The team will assist the President in establishing and monitoring goals for the program and allocating research tasks to the agencies on the basis of their missions and capabilities.

The management team is being supported by a working group chaired by the NSF's Assistant Director, Ruzena Bajcsy (CISE). NSF

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Inside CRN

From: CRA Director of Government Affairs

As CRA's new Director of Government Affairs, I couldn't be more pleased with the way federal computing research policy is shaping up for 1999. The computing research community has a golden opportunity to build awareness of computing research and its contributions to the national interest, and my top priority is to make sure we are taking full advantage of that opportunity.

We have in President Clinton and Vice President Gore two techno-optimists who believe government has a responsibility to harness the power of technology for the good of society. They wasted no time in seizing on the recommendations of the President's Information Technology Advisory Committee and have proposed a new research initiative, Information Technology for the Twenty-First Century (see article, "Information Technology for the Twenty-First Century...," above) to accelerate R&D on a wide variety of computing and communications technologies. Congress, too, is in a pro-science mood, provided proposals have clear public-benefit rationales and accountability measures.

As you know from reading the excellent analyses in the columns of my predecessor, Rick Weingarten, the transformation of ideas into federal policy is not a straightforward matter. CRA will be devoting considerable effort to getting the proposed funding increases enacted, but we need your help, too. The active involvement of the computing research community is essential to ensuring the full implementation of the initiative.

Standing against us is a complicated budgetary environment. Although the federal budget is in surplus and is projected to be so for years to come, neither the White House nor the Congress is willing to spend the surplus until there is agreement on broad principles for doing so.

Congressional appropriators must be told early and often about the vast potential of the research that would be supported through increased funding, and those messages need to come from the computing research community. During my first few months at CRA, I have been working to formulate appropriate messages and devise a plan of action for conveying them. An important component of our activities is facilitating the individual efforts of computing researchers and leveraging their impact.

To that end, the CRA government affairs website, http://www.cra.org/main/cra.gov.html, has been reoriented to provide members of the community with the resources they need to become effective advocates for computing research. Visitors to the site will get crucial information on: the key policy issues affecting computing research; how the federal policy- and budget-making process works; and how to talk about computing research as part of that process.

For instance, we have collected links about the IT^2 initiative in a central location, and an Advocacy section features two key CRA "Policy Briefs" that can be used by the community to promote the initiative.

In addition, CRA has established a Computing Research Advocacy Network (CRAN), a subscriber-based electronic mailing list outlining opportunities to educate about the role and contributions of computing research.

All members of the computing research community are welcome to join CRAN. I hope you will do so today. Please visit the CRA government affairs website, http://www.cra.org/main/cra.gov.html, for more details. Working together, we can make 1999 a watershed year for recognition and support of computing research. ▮

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Expanding the Pipeline

Models for Innovation Bring Women to the Table

By Anita Borg

CRA Board member Anita Borg founded the Institute for Women and Technology in December 1997 with the support of Xerox's Palo Alto Research Center. Since then it has become established as an independent non-profit corporation, added Sun Microsystems to its list of corporate partners, and moved forward with its programs. The Institute's mission is to increase the impact of women on technology and to increase the positive impact of technology on the world's women. Eventually, as an R&D center, it will work with industry, academia, government, and communities around the world to involve women in defining and implementing future technology, and to develop technologies that incorporate women's genius, interests, situations, and needs. The Institute will be both a lab and a networked collection of projects that develop processes and products. We are not seeking to build a new "female computer science" or to create a niche subset of the field, but to expand and enrich the way we all think about what we do and for whom we do it. Our work is based on the fact that most organizations that have an impact on information technology remain culturally narrow and predominantly male, and often embody the attitude that elite technologists are the only people who have ideas for great new technologies.

Five Project Areas

Exploration and Innovation Events bring together technology experts, business people, potential users, community members, students, and social scientists. As a group, they explore and identify needs and new perspectives, and produce design outlines for key innovative and useful technologies. The first events are small workshops for women that generate ideas grounded in the social, political, economic, and personal contexts of the participants.

Development Projects are based to a large degree on workshop output. Virtual development centers maintain the momentum created during workshops by providing longer-term connections among workshop participants. In-person and Internet-based collaboration will develop concrete proposals, design solutions, and prototypes. These provide a foundation for development projects in industry and advanced research projects in academia. Consortia with the Institute and industrial partners will take high-potential ideas to market.

Studies, Research, and Information Collection Projects explore both technical and social science issues related to women and technology and will disseminate collected information widely.

Outreach Projects include support for educational efforts reaching into the schools and to the general public, as well as broad-based connections in Internet technology communities. The Institute currently host the 2,500-member Systers community, providing a connection with technical women in the computing field in twenty-five countries at over 100 companies and 100 universities.

Conferences include the Grace Hopper Celebration of Women in Computing, for which the Institute is now the new home. The conference drew international participation in 1994 and 1997, and was started with significant help from CRA. It is the only technical conference highlighting women's ongoing contributions to the computing field. GHC2000 will be held September 14-16, 2000 in Hyannis, MA on Cape Cod.

Exploration and Innovation

The initial exploration and innovation events are small workshops in which women explore needs and perspectives and identify candidate technologies for development. Often the majority of workshop participants will be non-technical. It may be easier to see "outside the box" if one is not "in the box." While each workshop's participants come from the same geographical area, we will maximize diversity in many other dimensions. Eventually we intend to move beyond all-female workshops. Unlike traditional focus groups, workshops are based on the premise that every person comes to the event as an expert, regardless of her background. The value that each person brings to the workshop is her own experience and perspective. Status hierarchies are avoided by deferring introductions until late in the workshop.

The Institute will develop model workshops covering a variety of topics and distribute materials encouraging their widespread replication. Institute staff will assemble, analyze, and report on the overall results.

Technical Ideas from Real Life

The first workshop series this winter included events at the University of Washington, Xerox PARC, and Santa Clara University. The topic for the series, *Technology in Support of Families*, was developed in reaction to projects in academia and industry about "technology for the home" that include little or no female participation. The Institute's workshops focus on technology that is useful to the people who inhabit a home and more broadly, whole families.

The workshop results exceeded our expectations. We were delighted by the range of ideas generated and the extraordinary way that these women, particularly the non-technical women, were able to think "outside the boxes" that the rest of us sit in. In a short nine hours, we progressed from a wide-ranging discussion of the future of families to a small number of fleshed-out, concrete ideas that the attendees agreed should be pursued. The ideas were both wonderful and rich. Even when they were not new, they were grounded in real experience and reflected potential markets, and usually required considerable research work to bring them to affordable reality.

A full report on the results of the series will be available on our webpage in the late spring. Here are a few ideas in brief:

The Wall: a real time wall-sized view into another room or another place, allowing distant family members to virtually connect their living spaces.

Universal Flea Market: a system to help address the wastefulness in our society; connecting people who have things that they no longer need or are not currently using with people who have a need or desire for them.

Family Scheduling and Coordination: a central family scheduler integrated with mobile personal devices; integrates everything from kid's class schedules to car maintenance timetables to mammogram reminders with a simple voice interface.

Integrated Family Medical System: monitors individual physical state and drug doses, and accesses medical history and emergency information.

Integrated Home Inventory System: sensor/scanner-based inventory with

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Policy 103: Challenging the Community to Move Ahead

By Fred W. Weingarten

In the first article in this series, I described the surprisingly wide range of issues that are contained in science policy. In the second, I talked about the number of potential players in the policy debate. I suggested that, in order to precipitate a major change in policy, a lot if not all of these forces have to be aligned behind the change or, in some cases, neutral to it.

In this third "chapter," it's time to discuss how this might play out in trying to change the levels and patterns of computing research support. In a way, this is the most idiosyncratic and subjective piece. My first two articles reflected more or less how many people who work in science policy professionally see the world. There is far more variation in the styles and approaches people use to get things done in this town. So, the views reflected here are mine alone, and I have tried to frame them in a way that will invite discussion within the community.

This isn't a theoretical debate. The Interim Report of the President's Information Technology Advisory Committee (PITAC) last fall, followed by the more recent announcement of the administration's new IT^2 program, promise a real opportunity for major increases in support for computing research. But they also challenge the community to take an active part in the debate over science policy in new ways to make the promises materialize. The community's future approach to advocacy must be not only more active, but more proactive in asserting the importance of computing research and the needs of the field. But first, let's take an overly simplified look at how computing research policy making has evolved.

I think that computing research policy is now moving into a new, third, phase of growth.

First, from the '60s until the late '80s, the level of funding, the research agenda, and even which universities could play in the game, were dictated by ARPA and NSF. ARPA was involved because of the importance of computers to defense, even in those early days. NSF support was a somewhat grudging recognition on the part of senior administrators that computer science and engineering were emerging as new research disciplines. During that time, the computing field basically didn't have an organized advocacy group, and had no seat at the science policy table.

The second phase began with the debate leading to the passage of the High Performance Computing Act in 1991 (HPCA). Computing and communications technology came to the fore in the general political debate as technologies critical to the nation's welfare. Again, government led the debate and agenda setting. The justification for computing research was still framed primarily as a response to agency needs and priorities. But that agenda was also much broader, touching more government and societal needs such as health, education, and libraries.

This was a smart strategy. The HPCC, as the program later became known (with the addition of communications), leveraged agency self-interests in order to stimulate a government-wide expansion of investment in computing research. It also managed to open up a broader public debate on the need for research support for the field. High Performance Computing was even mentioned in a presidential debate! It was during this time that CRA opened its doors in Washington, and the field began to develop a formal, organized voice in science policy.

The downside of this approach was twofold. Although broader, the combined agency research agendas did not cover the spectrum of research needs. They maintained the pattern of Washington setting the research priorities for the field. That top-down pattern was brought home to yours truly one day when a senior science official became angry that I had voiced some criticism of the programs (concerns I had heard expressed strongly by the research community). He reminded me that he and his government colleagues would set policy "behind closed doors" and we "troops" (as he called me and the CRA community that I represented) were to support that policy and march in the direction indicated, not ask questions — Yes, Sir!

It is interesting to note that the advisory committee called for in HPCA was not appointed until six years later — after the Act had expired, in fact. The executive branch simply saw no need for outside input in the program and no need to strengthen communication links with the research community (probably the most important function of an advisory committee).

But that was a transitional stage. Now we have arrived at a third phase in which computing research policy making will be made in a three-way dialogue among the research institutes, industry, and government. Computing and communications technologies have simply become too important to too many communities for such a top-down approach. Nurturing political support for higher levels of funding means bringing in many more voices and accommodating many more concerns.

One can see such three-way tensions already occurring in specific public policy debates, such as the domain name debate or the fight over cryptography.

Yet today, a blue ribbon expert advisory committee, not a government agency, pointed out that computing research was underfunded and recommended not only a major increase in funding, but a restructuring of support. The research community said "not enough support directed in the right way," and the administration, generally sympathetic to the needs of information technology, agreed and proposed IT^2 in the 2000 budget.

What does this mean to the research community? Its role in science policy must change. It must become more active, more involved with promoting a research agenda to the public and to the political system. It must also be more active in developing alliances and forming coalitions among those who stand to benefit from innovations in computing and communications. In essence, if the promises of the PITAC recommendations and the IT^2 initiative are to materialize, the computing research community must develop an active advocacy strategy. It has to take policy into its own hands,

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New Directions in CS Research

By John E. Savage

In its early history theoretical computer science research was strongly motivated by the problems of practice. When compilers were being invented, a framework was developed for the study of languages and their efficient translation. When large instances of problems were first being solved by computer, new algorithms and data structures were invented for them. Similarly, when problems were identified that did not seem to admit efficient algorithms, analysts developed methods to classify them by their complexity, identifying complexity classes such as the famous NP-complete languages in the process.

Traditionally experimental computer scientists identified an important computational problem that was not amenable to the modeling and analysis practiced by theoreticians, invented conceptual solutions, and then demonstrated their viability through proof of concept, that is, by building a system and studying its behavior through experimentation, measurement, and some analysis. Many important conceptual advances have resulted from this approach, advances that are reflected in the software, hardware, and communication technologies in use today.

Because computer science is now undergoing very rapid change, the early role of universities as the principal centers for the generation of knowledge and examples of new technologies is weakening. Important innovation is now occurring in development organizations out of sight of universities and research laboratories. As a consequence, important new problems and ideas are emerging that are not readily accessible to the research labs and the academic computer science community, and important opportunities are being lost to contribute to the application and development of these ideas and the solution of these problems.

The rapid development of computer science has introduced a new tension between innovation and the generation of knowledge. An important role has emerged for experimental academic computer scientists, namely, to work closely with industrial colleagues in order to understand and abstract from the large complex systems that they are building. A new opportunity is also emerging for theoreticians, namely, to work with their experimental computer science colleagues and industrial developers to study the deep and complex computational

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1997-98 CRA Taulbee Survey

Ph.D. Enrollment Up for the Third Straight Year

By Dexter Kozen and Jim Morris

This article and the accompanying tables present the results of the 28th annual CRA Taulbee Survey[1] of Ph.D. granting departments of computer science (CS) and computer engineering (CE) in the United States and Canada. This survey is conducted annually by CRA to document trends in student enrollment, employment of graduates, and faculty salaries. Information is gathered during the fall and early winter. Responses received by January 20, 1999 are included in the tables.

The survey results are from Ph.D. granting departments only. One hundred and eighty-six departments were surveyed. Information on degree production (Ph.D., Master's, and Bachelor's) and enrollment (Ph.D.) applies to the previous academic year (1997-98). New students in all categories and total enrollments for Master's and Bachelor's refer to the current academic year (1998-99). Projected production refers to the current academic year as well. Information on faculty salaries and demographics also applies to the current academic year. Faculty salaries are those effective January 1, 1999.[2]

This article presents the most significant results of the survey, with particular attention to those that differ markedly from last year or that appear to indicate long-term trends.

This year 144 departments submitted surveys — 144 responded to the Ph.D. section, 140 to the Master's section, and 138 to the Bachelor's section. All 144 departments provided faculty information. The response rate was 77%, down slightly from last year's rate of 80%; however, the overall number of departments responding this year was higher (144 versus 135). We thank all respondents who completed the questionnaire.

Two new questions were added to the survey this year. One requested the average number of years to receive a Ph.D.(5.014). The second asked for the number of positions left unfilled last year in the following categories: tenure-track (156), researcher (0), post-doc (5), lecturer (9), instructor (8), other (4). We expect to use this additional data in a long-term longitudinal analysis.

Degree Production

(Tables 1–6) A total of 933 Ph.D. degrees were awarded in 1998 by the 144 responding departments. This is up 4.5% from the 893 awarded in 1997, reversing a down-

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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	217	18.1	231	19.3	187	15.6
US CS Ranked 13-24	134	11.2	162@	13.5	179	14.9
US CS Ranked 25-36	103	8.6	129	10.8	104	8.7
US CS Other	375*	4.2	468+	5.3	479	5.4
Canadian CS	55	4.6	76	6.3	54	4.5
US CE	49#	7.0	62&	8.9	77	11.0
Total	**933**	**6.5**	**1,128**	**7.8**	**1,080**	**8.2**

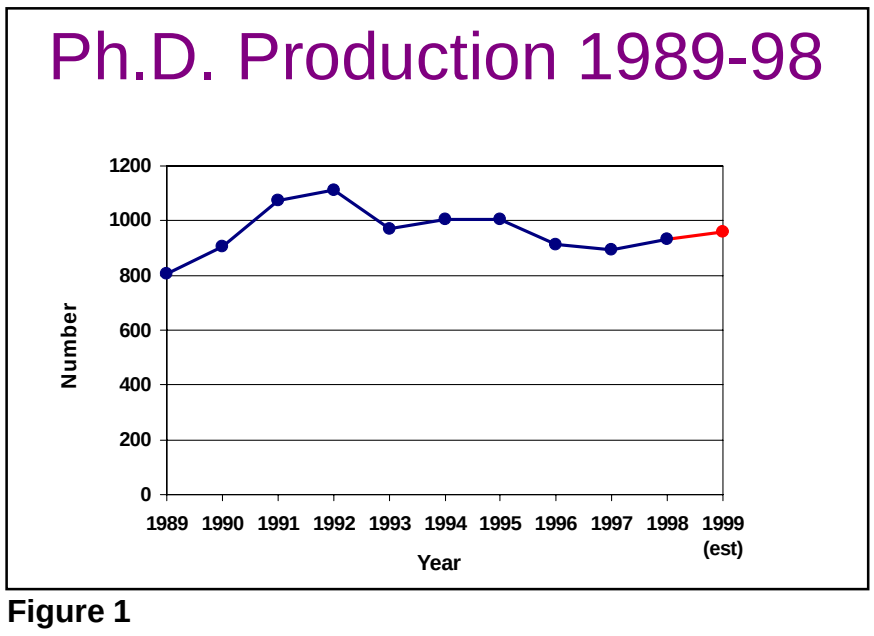

Figure 1

Table 2. Gender of Ph.D. Recipients

	CS		CE		CS & CE	
Male	747	(86%)	55	(83%)	802	(86%)
Female	120	(14%)	11	(17%)	131	(14%)
Total	**867**		**66**		**933**	

Table 3. Ethnicity of Ph.D. Recipients

	CS	CE	CS & CE
Nonresident Alien	339 (39%)	41 (62%)	380 (41%)
African American, Non-Hispanic	10 (1%)	0 (0%)	10 (1%)
Native American or Alaskan Native	5 (1%)	1 (2%)	6 (.5%)
Asian or Pacific Islander	85 (10%)	6 (9%)	91 (10%)
Hispanic	6 (1%)	0 (0%)	6 (.5%)
White, Non-Hispanic	382 (44%)	15 (22%)	397 (43%)
Other/Not Listed	12 (1%)	2 (3%)	14 (1%)
Subtotal	**839**	**65**	**904**
Ethnicity Unknown	28 (3%)	1 (2%)	29 (3%)
Total	**867**	**66**	**933**

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

New Ph.D.s in Ph.D. Granting Depts.	Artificial Intelligence/ Robotics	Hardware/Architecture	Numerical Analysis/ Scientific Computing	Programming Languages/ Compilers	OS/Networks	Software Engineering	Theory/Algorithms	Graphics/ Human Interfaces	Databases/ Information Systems	Other/Unknown	Total
Tenure-Track	34	14	5	8	14	9	21	7	15	13	140
Researcher	17	2	5	3	7	2	3	10	4	6	59
Postdoc	17	4	4	3	3	3	8	5	2	6	55
Instructor	4	1	0	3	3	1	3	1	1	3	20
New Ph.D.s, Other Categories											
Other CS/CE Dept.	7	2	1	5	3	2	1	2	0	4	27
Non-CS/CE Dept.	2	0	0	0	0	0	0	1	1	0	4
Industry	77	38	10	37	63	30	35	34	39	27	390
Government	7	2	4	2	2	2	0	5	3	3	30
Self-Employed	4	0	0	2	3	2	0	3	3	2	19
Employed Abroad	7	4	1	1	6	0	5	3	7	7	41
Unemployed	0	0	0	0	2	0	1	0	0	1	4
Other/Unknown	8	2	1	2	3	1	1	0	2	124	144
Total	**184**	**69**	**31**	**66**	**109**	**52**	**78**	**71**	**77**	**196**	**933**

1997-98 CRA Taulbee Survey

Table 5. Gender of Bachelor's and Master's Recipients

	Bachelor's			Master's		
	CS	CE	Total	CS	CE	Total
Male	6,761 (76%)	1,012 (78%)	7,773 (77%)	3,316 (76%)	432 (76%)	3,748 (76%)
Female	1,396 (16%)	172 (13%)	1,568 (15%)	961 (22%)	133 (24%)	1,094 (22%)
Unknown	703 (8%)	117 (9%)	820 (8%)	92 (2%)	0 (0%)	92 (2%)
Total	**8,860**	**1,301**	**10,161**	**4,369**	**565**	**4,934**

Table 6. Ethnicity of Bachelor's and Master's Recipients

	Bachelor's			Master's		
	CS	CE[3]	Total	CS	CE	Total
Nonresident Alien	505 (6%)	94 (7%)	599 (6%)	1,935 (44%)	281 (50%)	2,216 (45%)
African American, Non-Hispanic	204 (2%)	47 (4%)	251 (2%)	46 (1%)	5 (1%)	51 (1%)
Native American or Alaskan Native	37 (--%)	2 (--%)	39 (--%)	13 (--%)	0 (0%)	13 (--%)
Asian or Pacific Islander	1,302 (15%)	174 (13%)	1,476 (15%)	573 (13%)	155 (27%)	728 (15%
Hispanic	233 (2%)	54 (4%)	287 (3%)	38 (1%)	3 (1%)	41 (1%)
White, Non-Hispanic	3,854 (44%)	707 (54%)	4,561 (45%)	1,164 (27%)	96 (17%)	1,260 (26%)
Other/Not Listed	146 (2%)	13 (1%)	159 (2%)	29 (1%)	6 (1%)	35 (--%)
Subtotal	**6,281**	**1,091**	**7,372**	**3,798**	**546**	**4,344**
Ethnicity Unknown	2,579 (29%)	210 (16%)	2,789 (27%)	571 (13%)	19 (3%)	590 (12%)
Total	**8,860**	**1,301**	**10,161**	**4,369**	**565**	**4,934**

Table 7. New Students in Fall 1998

	Bachelor's Full Time			Dept. Average	Master's Full Time			Dept. Average	Ph.D. Full Time			Dept. Average
	CS	CE	Total		CS	CE	Total		New Admit	MS to Ph.D.	Total	
US CS Ranked 1-12	1,518	58	1,576	143.3	459	0	459	41.8	294	34	328	27.3
US CS Ranked 13-24	1,084	356	1,440	120.0	492	6	498	41.5	250	28	278	23.2
US CS Ranked 25-36	1,430	0	1,430	119.2	199	0	199	16.6	221	24	245	20.4
US CS Other	9,868	1,789	11,657	135.5	2,374	136	2,510	31.1	648	101	749	8.4
Canadian CS	1,898	0	1,898	172.6	268	0	268	22.3	69	14	83	6.9
US CE	305	667	972	162	191	98	289	41.3	83	14	97	13.9
Total	**16,103**	**2,870**	**18,973**	**137.5**	**3,983**	**240**	**4,223**	**30.2**	**1,565**	**215**	**1,780**	**12.4**

Table 8. Prior Education of New Ph.D. Students

Bachelor's in CS or CE		Ratio
US CS Ranked 1-12	246 of 328	75%
US CS Ranked 13-24	156 of 278	56%
US CS Ranked 25-36	146 of 245	60%
US CS Other	475 of 749	63%
Canadian CS	65 of 83	78%
US CE	48 of 97	50%
Total	**1,136 of 1,780**	**64%**

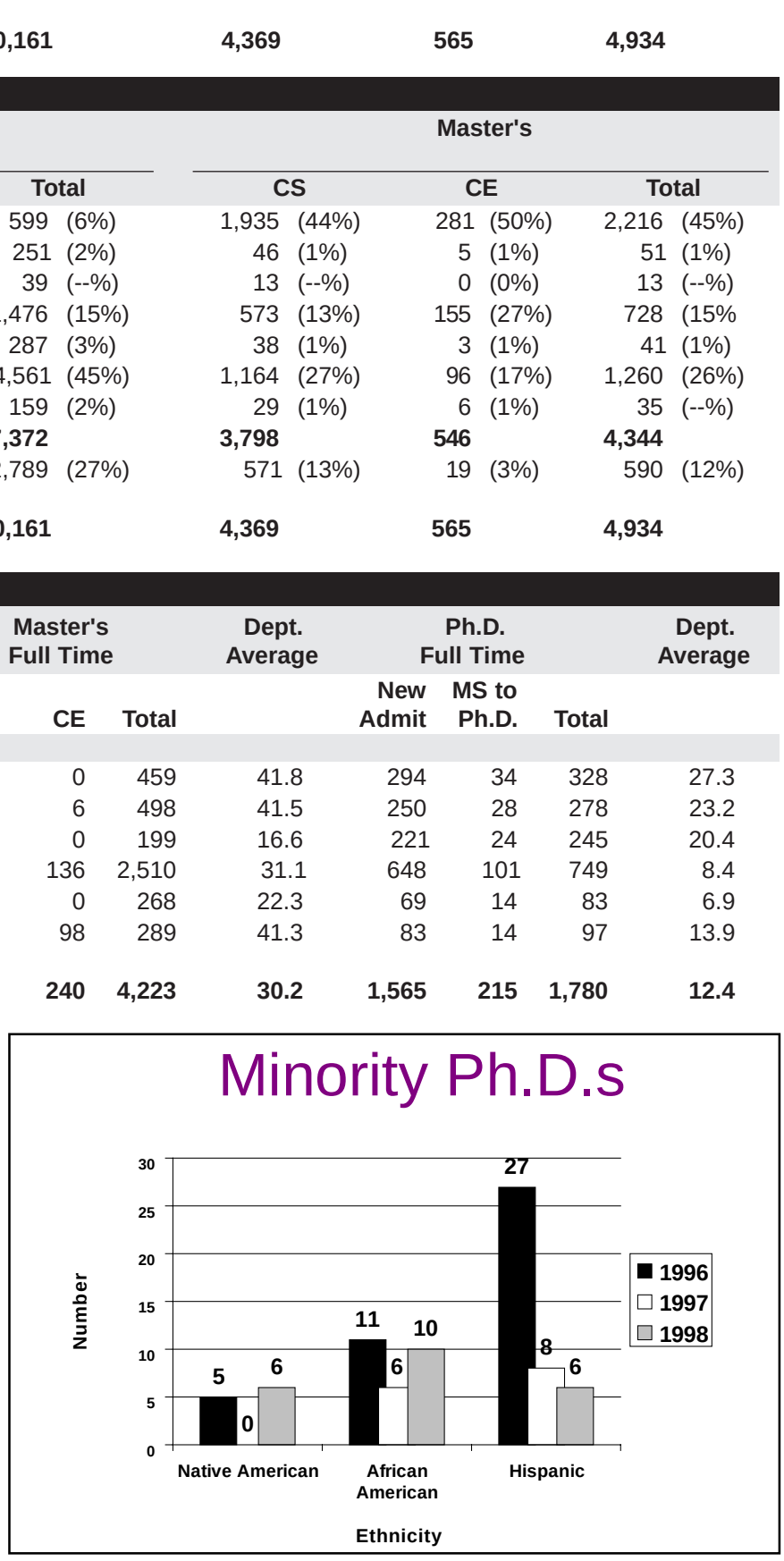

Figure 2

Taulbee from page 4

turn from 915 the previous year, but still short of the record 1,113 in 1992. The prediction from last year's survey that 1,037 Ph.D. degrees would be awarded in 1998 was, as usual, overly optimistic, but this year the discrepancy was only 10% as opposed to 20% last year. Using an optimism factor of 0.85, next year's prediction of 1,128 translates to approximately 959 new Ph.D.s in 1999 (Figure 1).

Table 4 shows areas of specialization versus types of first appointments for last year's Ph.D. recipients. The breakdown is quite similar to last year with no discernable new patterns.

As predicted, the explosive growth in undergraduate enrollments over the past two years has begun to translate into a significant increase in the number of new Bachelor's degrees awarded. There were 10,161 awarded in 1998 by the 138 responding departments, up 26% from the 8,063 awarded by the 129 responding departments in 1997. The number of Master's degrees, which was essentially flat between 1995 and 1996 with 130 departments reporting, rose about 4.3% in 1997 with 131 departments reporting, and rose again about 11.1% in 1998 with 140 departments reporting.

The ethnicity statistics for bachelor's and Master's degree recipients remained relatively static. Although the absolute numbers of Bachelor's, Master's, and Ph.D. degrees awarded were significantly higher than last year, the percentage awarded to women in all three categories remained constant.

Last year we noted an alarming drop in the number of Ph.D. degrees awarded to Native Americans (from 5 in 1996 to 0 in 1997), African Americans (from 11 in 1996 to 6 in 1997), and Hispanics (from 27 in 1996 to 8 in 1997). This year these trends were reversed in the first two categories, but not in the last: there were only 6 Ph.D. degrees awarded to Hispanics in 1998 (Figure 2).

Student Enrollment

(Tables 7-14) New enrollment in Ph.D. programs is up significantly this year: 1,780 in Fall 1998, up 23.6% from 1,440 in Fall 1997. This is the third straight year of increase, indicating a sustained trend. These numbers bode well for a long-term increase in Ph.D. production. Total enrollment in Ph.D. programs is 7,119, up 4.86% from 6,789 last year. New enrollment in Master's degree programs shows a similar gain from 3,410 in 1997 to 4,223 in 1998, an increase of 23.8%.

The recent precipitous rise in undergraduate enrollments appears to have leveled off, at least for the moment (Figure 3). After doubling in the two years between 1995 and 1997, new undergraduate enrollments in CS and CE are off 4.2% this year.

The percentage of women enrolled in Ph.D. programs has shown a gradual but steady increase over the past three years: 16.2% in 1996, 17.0% in 1997, 18.8% in 1998. There were no significant changes in the ethnicity of Ph.D. students.

Faculty Demographics

In 1998, about 10.8% of professors were women, up slightly from 10.2% in 1997. Although this is not

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Table 9. Bachelor's Degree Program Total Enrollment

	CS	CE	Total
US CS Ranked 1-12	6,114	175	6,289 (9%)
US CS Ranked 13-24	4,636	1,659	6,295 (9%)
US CS Ranked 25-36	4,981	0	4,981 (8%)
US CS Other	33,400	6,045	39,445 (59%)
Canadian CS	7,805	0	7,805 (12%)
US CE	816	1,223	2,039 (3%)
Total	**57,752**	**9,102**	**66,854**

Table 10. Master's Degree Program Total Enrollment

	CS	CE	Total
US CS Ranked 1-12	1,016	0	1,016 (8%)
US CS Ranked 13-24	923	11	934 (8%)
US CS Ranked 25-36	495	0	495 (4%)
US CS Other	7,524	636	8,160 (67%)
Canadian CS	842	0	842 (7%)
US CE	415	328	743 (6%)
Total	**11,215**	**975**	**12,190**

Table 11. Gender of Ph.D. Program Total Enrollment

	CS	CE	CS & CE
Male	5,287 (81%)	477 (82%)	5,764 (81%)
Female	1,247 (19%)	93 (16%)	1,340 (19%)
Unknown	6 (--%)	9 (2%)	15 (--%)
Total	**6,540**	**579**	**7,119**

Table 12. - Ethnicity of Ph.D. Program Total Enrollment

	CS	CE	CS & CE
Nonresident Alien	2,811 (43%)	291 (50%)	3,102 (45%)
African American, Non-Hispanic	134 (2%)	5 (1%)	139 (2%)
Native American or Alaskan Native	13 (--%)	1 (--%)	14 (--%)
Asian or Pacific Islander	592 (9%)	60 (10%)	652 (9%)
Hispanic	103 (2%)	12 (2%)	115 (1%)
White, Non-Hispanic	2,380 (36%)	130 (23%)	2,510 (35%)
Other/Not Listed	109 (2%)	50 (9%)	159 (2%)
Subtotal	**6,142**	**549**	**6,691**
Ethnicity Unknown	398 (6%)	30 (5%)	428 (6%)
Total	**6,540**	**579**	**7,119**

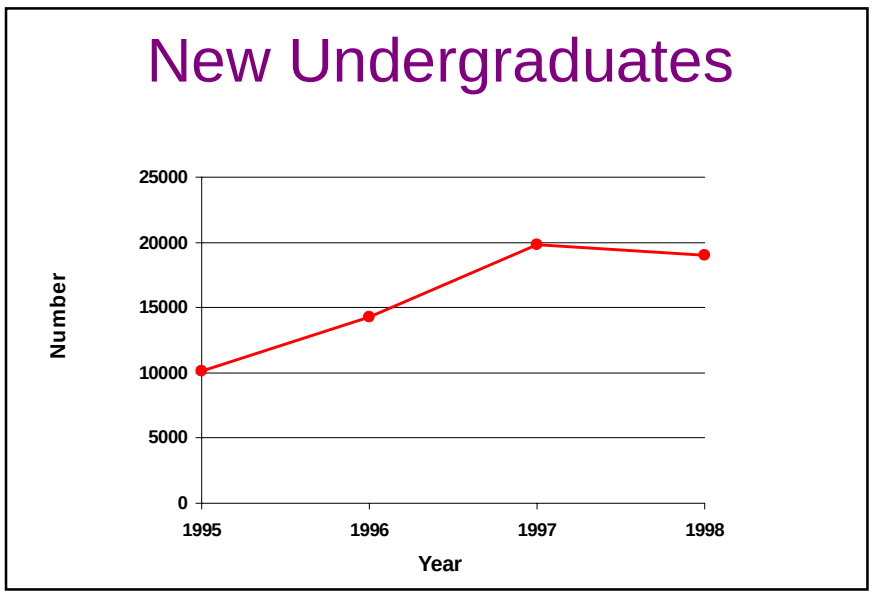

Figure 3

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much of a change, women have shown significant gains in seniority. For men, the percentage of tenure-track faculty who were associate or full professors was 79.9% in 1996, 82.2% in 1997, and 81.0% in 1998, essentially a steady state. Women, on the other hand, went from 58.0% in 1996 to 61.6% in 1997 to 69.1% in 1998.

Faculty Salaries

Average salaries at U.S. institutions rose 3.7-4.8% with the smallest increase at the full professor level and the largest at the associate professor level (Table 31). This is slightly higher than last year. Canadian salaries posted more modest 3.9% and 2.2% increases at the assistant and associate professor levels, respectively, and actually dropped 0.6% at the full professor level (Table 30). Salaries for U.S. institutions are 9-month salaries and are reported in U.S. dollars; those for Canadian institutions are 12-month salaries and are reported in Canadian dollars.

The salary figures in the first column of Table 25, which appear to be inverted, are correct. This phenomenon was also observed last year.

The overall mean salaries reported in the center column in Tables 24-32 are unweighted means, calculated by averaging the mean salaries as reported by each department. They are not weighted by the number of CS & CE faculty at each institution.

Rankings

For tables that group computer science departments by rank, the rankings are based on information collected in the 1995 assessment of research and doctorate programs in

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Table 13. Bachelor's Degree Candidates for 1998-99

	CS	CE	Total
US CS Ranked 1-12	1,484 (16%)	53 (4%)	1,537 (14%)
US CS Ranked 13-24	1,029 (11%)	366 (25%)	1,395 (13%)
US CS Ranked 25-36	904 (9%)	0 (0%)	904 (8%)
US CS Other	4,470 (47%)	856 (58%)	5,326 (48%)
Canadian CS	1,300 (14%)	0 (0%)	1,300 (12%)
US CE	310 (3%)	192 (13%)	502 (5%)
Total	**9,497**	**1,467**	**10,964**

Table 14. Master's Degree Candidates for 1998-99

	CS	CE	Total
US CS Ranked 1-12	579 (13%)	0 (0%)	579 (12%)
US CS Ranked 13-24	483 (11%)	5 (1%)	488 (10%)
US CS Ranked 25-36	323 (8%)	0 (0%)	323 (7%)
US CS Other	2,587 (60%)	283 (54%)	2,870 (59%)
Canadian CS	223 (5%)	0 (0%)	223 (5%)
US CE	118 (3%)	234 (45%)	352 (7%)
Total	**4,313**	**522**	**4,835**

Table 15. Anticipated Faculty Growth by Position

	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	Five-Year Increase
Tenure-Track	2,693	2,977	3,027	3,151	3,250	3,349	620 (23%)
Researcher	347	363	392	418	434	447	98 (28%)
Postdoc	245	265	292	314	330	346	101 (41%)
Instructor	248	246	265	275	280	288	40 (16%)
Lecturer	299	305	299	307	316	320	21 (7%)
Other/Not Listed	115	116	117	118	131	122	7 (6%)
Total	**3,947**	**4,272**	**4,352**	**4,543**	**4,702**	**4,834**	**887 (23%)**

Table 16. Anticipated Faculty Growth by Ranking

	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	Five-Year Increase
US CS Ranked 1-12	599	642	682	712	727	740	141 (24%)
US CS Ranked 13-24	513	549	542	568	583	598	85 (17%)
US CS Ranked 25-36	358	395	426	444	465	485	89 (25%)
US CS Other	1,960	2,118	2,164	2,248	2,320	2,383	423 (22%)
Canadian CS	383	418	418	446	472	490	107 (28%)
US CE	134	150	160	165	174	176	42 (31%)
Total	**3,947**	**4,272**	**4,352**	**4,543**	**4,702**	**4,834**	**887 (23%)**

1997-98 CRA Taulbee Survey

Table 17. Gender of Newly Hired Faculty

	Tenure-Track	Researcher	Postdoc	Instructor	Lecturer	Other	Total
Male	164	36	64	44	57	32	397
Female	24	8	13	12	12	7	76
Unknown	--	--	--	1	--	--	1
Total	**188**	**44**	**77**	**57**	**69**	**39**	**474**

Table 18. Ethnicity of Newly Hired Faculty

	Tenure-Track	Researcher	Postdoc	Instructor	Lecturer	Other	Total
Nonresident Alien	26	4	30	0	6	13	79
African American, Non-Hispanic	2	0	0	2	1	1	6
Native American or Alaskan Native	0	1	0	0	0	1	2
Asian or Pacific Islander	34	3	9	7	8	4	65
Hispanic	4	5	1	1	1	1	13
White, Non-Hispanic	116	29	36	47	52	18	298
Other/Not Listed	2	0	0	0	1	0	3
Subtotal	**184**	**42**	**76**	**57**	**69**	**38**	**466**
Did Not Indicate	4	2	1	0	0	1	8
Total	**188**	**44**	**77**	**57**	**69**	**39**	**474**

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the United States conducted by the National Research Council.

The top 12 schools in this ranking 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 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

Stacy Cholewinski and Jean Smith assisted with the data collection. Stacy also handled the data tabulation and Jean helped follow up with the institutions. We thank them for their assistance. ▮

Table 19. Gender of Professors

	Assistant	Associate	Full
Male	467 (84%)	861 (88%)	1,125 (92%)
Female	92 (16%)	114 (12%)	92 (8%)
Total	**559**	**975**	**1,217**

Table 20. Ethnicity of Professors

	Assistant[3]	Associate	Full[3]
Nonresident Alien	72 (13%)	4 (--%)	2 (--%)
African American, Non-Hispanic	8 (1%)	5 (--%)	2 (--%)
Native American or Alaskan Native	1 (--%)	6 (1%)	5 (--%)
Asian or Pacific Islander	108 (19%)	228 (24%)	186 (15%)
Hispanic	12 (2%)	11 (1%)	16 (1%)
White, Non-Hispanic	337 (60%)	690 (71%)	969 (80%)
Other/Not Listed	14 (3%)	8 (1%)	13 (1%)
Subtotal	**552**	**952**	**1,193**
Ethnicity Unknown	7 (1%)	23 (2%)	24 (2%)
Total	**559**	**975**	**1,217**

Table 21. Gender of Other Faculty

	Lecturer	Instructor
Male	317 (78%)	187 (73%)
Female	88 (22%)	70 (27%)
Unknown	3 (--%)	0 (0%)
Total	**408**	**257**

Table 22. Ethnicity of Other Faculty

	Lecturer	Instructor
Nonresident Alien	11 (3%)	3 (1%)
African American, Non-Hispanic	4 (1%)	5 (2%)
Native American or Alaskan Native	9 (2%)	0 (0%)
Asian or Pacific Islander	37 (9%)	22 (9%)
Hispanic	4 (1%)	1 (--%)
White, Non-Hispanic	335 (82%)	206 (80%)
Other/Not Listed	0 (0%)	0 (0%)
Subtotal	**400**	**237**
Ethnicity Unknown	8 (2%)	20 (8%)
Total	**408**	**257**

Table 23. Faculty Losses

	Total
Died	2
Retired	42
Took Academic Position Elsewhere	90
Took Nonacademic Position	52
Remained, Changed to Part Time	5
Other	9
Unknown	5
Total	**205**

Footnotes

In Table 1, the "Ph.D.s Produced" column shows the number of CS and CE degrees produced throughout the rankings.

* Includes 35 CE degrees granted by these CS departments
@ Includes 1 CE degree granted by these Canadian departments
\# Includes 18 CS degrees granted by these CE departments
\+ Includes 62 CE degrees granted by these CS departments
& Includes 20 CS degrees granted by these CE departments

[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] In some instances, departments only answered selective questions within a table or a section. Therefore, for individual fields within tables the response rate may vary ± 3.

[3] Indicates that the percentage only totals 99.

[4] 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.

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

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

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

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Table 24. Nine-Month Salaries,122 Responses of 145 US CS Departments

		Reported Salary Minimum				Reported Salary Maximum		
Faculty Rank	# Faculty	Minimum	Mean	Maximum	Average of all salaries	Minimum	Mean	Maximum
Assistant	498	$29,150	$57,497	$70,900	$60,417	$45,000	$63,642	$83,600
Associate	806	$40,758	$63,328	$90,000	$69,851	$54,535	$77,184	$109,260
Full	999	$43,300	$76,033	$110,00	$93,189	$59,747	$118,467	$223,569

Table 25. Nine-Month Salaries, 12 Responses of 12 US CS Departments Ranked 1-12

		Reported Salary Minimum				Reported Salary Maximum		
Faculty Rank	# Faculty	Minimum	Mean	Maximum	Average of all Salaries	Minimum	Mean	Maximum
Assistant	72	$60,000	$63,059	$70,000	$66,425	$63,860	$70,487	$78,100
Associate	89	$49,050	$71,158	$90,000	$77,997	$77,009	$84,674	$91,400
Full	201	$43,300	$80,493	$110,000	$106,352	$126,400	$146,358	$170,000

Table 26. Nine-Month Salaries, 12 Responses of 12 US CS Departments Ranked 13-24

		Reported Salary Minimum				Reported Salary Maximum		
Faculty Rank	# Faculty	Minimum	Mean	Maximum	Average of all Salaries	Minimum	Mean	Maximum
Assistant	58	$33,000	$60,594	$69,700	$65,021	$63,000	$68,830	$81,000
Associate	75	57,349	$67,707	$75,850	$75,697	$73,300	$84,475	$98,300
Full	153	$64,672	$78,375	$97,200	$104,073	$125,500	$148,611	$223,569

Table 27. Nine-Month Salaries, 12 Responses of 12 US CS Departments Ranked 25-36

		Reported Salary Minimum				Reported Salary Maximum		
Faculty Rank	# Faculty	Minimum	Mean	Maximum	Average of all Salaries	Minimum	Mean	Maximum
Assistant	58	$56,250	$60,146	$68,000	$63,206	$59,614	$66,844	$75,000
Associate	74	$58,472	$67,761	$79,000	$72,878	$64,793	$78,303	$92,100
Full	134	$67,574	$77,013	$90,000	$96,879	$92,619	$128,768	$180,000

Table 28. Nine-Month Salaries, 86 Responses of 109 US CS Departments Ranked Higher than 36 or Unranked

		Reported Salary Minimum				Reported Salary Maximum		
Faculty Rank	# Faculty	Minimum	Mean	Maximum	Average of all Salaries	Minimum	Mean	Maximum
Assistant	310	$29,150	$55,910	$70,900	$58,529	$45,000	$61,495	$83,600
Associate	568	$40,758	$61,149	$83,500	$67,607	$54,535	$75,066	$109,260
Full	511	$48,978	$74,935	$104,300	$89,273	$59,747	$108,824	$185,234

Table 29. Nine-Month Salaries, 7 Responses of 19 US CE Departments

		Reported Salary Minimum				Reported Salary Maximum		
Faculty Rank	# Faculty	Minimum	Mean	Maximum	Average of all Salaries	Minimum	Mean	Maximum
Assistant	19	$50,908	$58,059	$66,199	$59,635	$53,263	$60,999	$70,000
Associate	37	$59,700	$64,852	$76,669	$68,472	$62,800	$74,280	$81,296
Full	43	$63,000	$75,967	$84,921	$87,929	$78,686	$107,189	$138,000

Table 30. Nine-Month Salaries, 129 Responses of 168 US CS and CE Departments

		Reported Salary Minimum				Reported Salary Maximum		
Faculty Rank	# Faculty	Minimum	Mean	Maximum	Average of all Salaries	Minimum	Mean	Maximum
Assistant	517	$29,150	$57,528	$70,900	$60,373	$45,000	$63,493	$83,600
Associate	843	$40,758	$63,412	$90,000	$69,775	$54,535	$77,024	$109,260
Full	1,042	$43,300	$76,030	$110,000	$92,901	$59,747	$117,853	$223,569

Table 31. Nine-Month Salaries for New Ph.D's, Responding US CS and CE Departments

		Reported Salary Minimum				Reported Salary Maximum		
Faculty Rank	# Faculty	Minimum	Mean	Maximum	Average of all Salaries	Minimum	Mean	Maximum
Tenure-Track	78	$50,000	$60,054	$74,000	$60,320	$50,000	$60,707	$75,000
Researcher	10	$40,000	$51,651	$70,000	$54,311	$40,000	$56,257	$70,000
Postdoc	15	$25,000	$39,090	$60,000	$39,772	$30,000	$40,454	$60,000
Other	7	$41,000	$51,328	$61,500	$52,528	$45,000	$53,728	$61,500

Table 32. Twelve-Month Salaries, 12 Responses of 18 Canadian CS Departments (Canadian Dollars)

		Reported Salary Minimum				Reported Salary Maximum		
Faculty Rank	# Faculty	Minimum	Mean	Maximum	Average of all Salaries	Minimum	Mean	Maximum
Assistant	35	$40,000	$57,288	$75,215	$59,217	$40,000	$62,030	$85,000
Associate	188	$46,350	$64,697	$82,175	$71,990	$46,350	$83,060	$126,703
Full	134	$58,520	$75,767	$95,474	$90,823	$58,520	$111,357	$162,075

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issues presented by the emerging new technologies.

New opportunities of this kind now exist to design, experiment with, model, and analyze the important computational problems encountered in building telecommunications networks, designing large software systems, data management and searching, planning, optimization, distributed computing, scientific computing, and many other areas. Some members of the academic and industrial research communities have discovered these opportunities and have obtained important results on topics such as secure cryptographic systems, web searching algorithms that identify authoritative sites, data caching algorithms that operate with much smaller queues, and scientific computing algorithms that more intelligently allocate work.

In the future we can expect many improvements in all aspects of computation through better modeling and analysis. We can expect the throughput of computer networks to

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Argonne National Laboratory
Mathematics and Computer Science Division

Postdoctoral Appointee

The Mathematics and Computer Science (MCS) Division of Argonne National Laboratory invites outstanding candidates to apply for a postdoctoral position in the area of developing and applying automatic differentation technology to large-scale scientific toolkits.

In particular, the successful candidate will participate in a project involving the automatic differentation of PVODE, a parallel ordinary differential equation system solver. This project is multidisciplinary in nature and involves the development of automatic differentation tools, the differentation of PVODE, and working with application codes that use these technologies. Information on automatic differentation and the Computational Differentation Project can be found at http://www.mcs.anl.gov/autodiff/.

Candidates must have a Ph.D. in Computer Science, Computational Science, or a related discipline. Candidates should have the ability to work in a collaborative, interdisciplinary research environment. Experience with the development of scientific tools or applications is strongly desired; C/C++ and parallel programming experience is also preferred. The Mathematics and Computer Science Division supports an excellent computational environment that includes access to high-performance scientific workstations, a scientific visualization and virtual reality laboratory, and state-of-the-art parallel computers.

Argonne is located in the southwestern Chicago suburbs, offering the advantages of affordable housing and good schools, as well as easy access to the cultural attractions of the city.

The renewable one-year term appointment is available immediately. Resumes should be addressed to Sue Walker, Box mcs-201623, Employment and Placement, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439, and must include the names and addresses of three references. To submit resumes electronically, please send e-mail to griffin@mcs.anl.gov. For further information, contact Lucas Roh (roh@mcs.anl.gov)or Paul Hovland (hovland@mcs.anl.gov).

Argonne is an Equal Opportunity/Affirmative Action employer.

California Institute of Technology
Computer Science Department

Caltech invites applicants for tenure-track or tenured faculty positions in Computer Science with possible joint appointments in Electrical Engineering and other disciplines. Faculty searches have been approved for positions in the broad area of Computer Science, including, but not restricted to:

* Computer Systems: VLSI, Architecture, and Operating Systems
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The principal requirements include demonstrated excellence in innovative research and the potential for high-quality teaching and mentoring. Completion of a Ph.D. in Computer Science or a related field is required. The initial appointment term for tenure-track positions is four years.

Interested persons should send a one-page summary of their future research and teaching plans, a resume, names of at least three references, a list of publications, and a URL of a personal webpage that includes pre/reprints of publications. Applications should be mailed to: CS Search, Caltech, MC 256-80, Pasadena, CA 91125.

In addition, applicants are requested to fill out an online summary of their application at http://www.cs.caltech.edu/csfsearch/appsumm.html.

Questions about the application process may be directed to: search@cs.caltech.edu.

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

Clemson University
Department of Computer Science

The Department of Computer Science seeks applications for two Assistant or Associate Professor tenure-track positions for Fall 1999. For one of the tenure-track positions, the research interest should be in the area of visualization. This person will participate in the research program of the NSF-funded Engineering Research Center. The application of the research is the visual simulation of continuum or molecular models. For the second position, strong preference will be given to applicants in the area of software engineering. Applicants in graphics or networking are also encouraged to apply.

Applicants should hold or expect to receive the Ph.D. degree in Computer Science by the appointment date. Evidence of accomplishment in both teaching and research is expected.

The department has more than 450 undergraduate majors and more than 125 graduate students, and offers BA, BS, MS, and Ph.D. degrees. Clemson University is the land-grant university of South Carolina and has an enrollment of more than 17,000. Clemson, SC is a small college town located on Lake Hartwell at the edge of the Blue Ridge Mountains. Additional information can be found starting at the department's website: http://www.cs.clemson.edu.

Applicants should send curriculum vitae and names of three references to: Faculty Search Committee, Department of Computer Science, Clemson University, Clemson SC 29634-1906

Screening will begin February 1, 1999 and continue until the positions are filled. Clemson University is an Equal Opportunity/Affirmative Action employer.

Francis Marion University
Computer Science and Computer Information Systems

Job Announcement

Francis Marion University is a state-supported institution of approximately 4,000 students, offering both graduate and undergraduate degrees, with a primary mission of teaching. Students are drawn largely from South Carolina, but with the expansion of student housing, the University attracts a greater number of students from throughout the nation, as well as internationally. The University is located in the northeast section of South Carolina, just east of Florence. The city and county constitute a large and growing urban area of 125,000. The University is fifty-five miles from Myrtle Beach and eighty miles from Columbia. For additional information about Francis Marion University, visit our website, http://www.fmarion.edu.

Assistant Professor of Computer Science

Tenure-track position #99-24. (Two positions) Earned doctorate or equivalent. ABD with definite completion date will be considered. Preference given to candidate who can demonstrate exemplary teaching abilities.

Assistant/Associate Professor of Computer Information Systems

Tenure-track position #99-25. Earned doctorate in Information Systems or equivalent. ABD with definite completion date will be considered. Preference given to candidate who can demonstrate exemplary teaching abilities.

IMPORTANT INFORMATION - PLEASE NOTE:

Successful candidates will be expected to demonstrate ability to integrate technology into the learning process, a commitment to foster global awareness, a willingness to participate in distance learning and an appreciation of cultural diversity. Successful candidates must demonstrate a commitment to teaching excellence, continuous improvement, close interaction with students, and the ability to prepare students to live and work in a technologically sophisticated and culturally diverse society. Academic advising, committee work, and involvement in scholarship/professional activities will be expected. Some night and off-campus teaching will be expected of all faculty positions.

MINORITIES AND WOMEN ARE STRONGLY ENCOURAGED TO APPLY. Initial screening of applicants will begin immediately and continue until the position is filled. (Starting date is August 16, 1999)

Applicants should send a letter of interest referencing position #, a resume, copies of transcripts of all graduate work (official ones will be requested of successful candidate), three current letters of reference, and three additional names, telephone numbers and addresses of references to: Mrs. Alice C. Baker, Assistant Vice President for Human Resources, Francis Marion University, PO Box 100547, Florence, SC 29501-0547; Tel. 843-661-1140; E-mail: abaker@fmarion.edu.;FAX: 843-661-1184

Computists International
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For careers beyond programming:
research jobs, competitions, AI/industry news, announcements.http://www.computists.com, laws@computists.com.

Illinois Institute of Technology, Chicago, IL
Computer Science Department

Chair of Computer Science

Applications and nominations are invited for the position, Chair of Computer Science whose mission is to lead the department to national prominence. Responsibilities include providing decisive leadership in research and education, and fostering interactions with government and industry. This growing department currently has fourteen faculty members, with plans for immediate expansion. Faculty research interests include software engineering, networking and telecommunications, distributed computing, artificial intelligence, databases, and computer architecture. The department offers BS, MS, and Ph.D. degrees, and joint educational programs with the Electrical and Computer Engineering Department. The department has established cooperative research activities with local research and government agencies such as IIT Research Institute, Argonne National Laboratory, FermiLab, Motorola, Lucent, AT&T, and Andersen Consulting.

IIT is a private, Ph.D. granting institution, which offers programs in engineering, science, architecture, psychology, law, and business. Considerable excitement has been generated by the recent announcement of a $120 million dollar challenge grant to IIT from the Pritzker and Galvin families.

Qualifications for the position include an earned doctorate in Computer Science or a related field, a well-established research record, a strong commitment to both research and education, and effective interpersonal skills.

Applications should be sent to: Professor Donald R. Ucci, Chair, CS Search Committee, Illinois Institute of Technology, Chicago, IL, 60616 (cssearch@ece.iit.edu). IIT is an Equal Opportunity/Affirmative Action employer.

Indiana University
Computer Science Department

Faculty Positions

The Indiana University Computer Science Department seeks outstanding applicants for a number of tenure-track faculty positions. We are also expecting to fill one non-tenure-track position.

The department is involved in establishing a new, multi-disciplinary School of Informatics involving cognitive science, computer science, library and information science, information systems, and scientific and biomedical informatics. The positions we seek to fill are intended to strengthen the school's planned emphasis in systems, artificial intelligence and cognitive science, computer graphics, and programming languages. These positions will be at the assistant professor level, but strong senior candidates in the area of programming languages will also be considered.

A Ph.D. in Computer Science is required. In addition to research, a strong contribution to the educational mission of the department is expected.

The non-tenure-track position is for an Assistant Professor (*Lecturer) Part-time/Director of Educational Development. We are looking for a vigorous computer scientist with interest in teaching, developing, and administering undergraduate courses. Research interest in computer science pedagogy is an advantage. *Title will be dependent on background and qualifications.

The department occupies a recently renovated spacious limestone building, and has extensive state-of-the-art computing facilities. The attractive wooded campus of Indiana University is located in Bloomington, voted one of the most cultural and livable small cities in the United States, and only forty-five minutes from the Indianapolis airport. To learn more about the department please visit our website at www.cs.indiana.edu.

Please send a detailed curriculum vitae and a list of references to: Faculty Search, Computer Science Department, Indiana University, Lindley Hall 215, Bloomington, IN 47405-4101; E-mail: search@cs.indiana.edu

Indiana University is an Affirmative Action/Equal Opportunity Employer.

Iowa State University
Department of Computer Science

We seek outstanding applicants for tenure-track faculty positions at the Assistant Professor level. We are looking for individuals in all areas, but preference will be given to computer scientists in the areas of networks, databases, artificial intelligence, parallel processing, and programming languages. Interdisciplinary research is a plus, but not required. The position requires a Ph.D. in Computer Science or a related field, strong evidence of research scholarship and funding potential, and interest and ability in teaching graduate and undergraduate students.

The department currently consists of fifteen full-time faculty and offers BS/MS/Ph.D. programs. There are approximately 660 undergraduate and 110 graduate majors. Established research and educational programs in our department include software engineering, OS, theory of computation, VLSI, design and analysis of algorithms, database, parallel and distributed computing, programming languages, AI, computer architectures, and communication networks. We place strong emphasis on research, support a high quality graduate program and provide a teaching load of three courses per year. Research collaboration opportunities exist with other research units at ISU, such as Ames Laboratory (US Dept. of Energy) and Visualization Laboratory (College of Engineering).

ISU is located in Ames, a city with a population of 50,000 and a secondary school system that ranks as one of the best in United States. For more information, please refer to our WWW page at http:// www.cs.iastate.edu.

Applicants should send a curriculum vitae, including names of three references, to: Chair of Search Committee, Department of Computer Science, Iowa State University, Ames, IA 50011. Fax: 515-294-0258, Tel. 515-294-4377, Email: lmiller@cs.iastate.edu.

The deadline for applications is March 31, 1999, or until the position is filled. ISU is an Equal Opportunity/Affirmative Action Employer. Women and minorities are particularly encouraged to apply.

Mississippi State University
Department of Computer Science

The Department (http://www.cs.msstate.edu) has openings for tenure-track faculty. A Ph.D. in Computer Science or a closely related field is required. Areas of particular interest are: (a) software engineering; (b) graphics, scientific visualization, geometric modeling, and/or virtual

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Professional Opportunities

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reality; and, (c) high performance computing. However, applicants with outstanding credentials in other areas are encouraged to apply.

The Department has nineteen faculty positions. The doctoral program, now in its tenth year, includes twenty Ph.D. students. Four new faculty have received NSF CAREER awards. Department research expenditures for the past two years were about $1,000,000, exclusive of involvement at associated research centers.

Faculty and graduate students work with several on-campus research centers, including an NSF Engineering Research Center (http://www.erc.msstate.edu) specializing in high-performance scientific computing, and the Diagnostic Instrumentation and Analysis Laboratory (http://www.msstate.edu/Dept/DIAL), specializing in complex instrumentation problems for severe environmental situations. Additional funding comes from NASA, NSF, ONR, DARPA, USDA, government laboratories and centers, and industries. MSU is among the top 100 universities receiving federal funding for research in science and engineering and is ranked third in the Southeast for engineering research funding.

For more information, see http://www.cs.msstate.edu/ANNOUNCEMENTS/facpos.html. MSU is an AA/EO employer.

New Jersey Institute of Technology
Department of Computer and Information Science

Faculty Positions Available

Outstanding candidates sought in all areas of Computer and Information Systems for multiple tenure-track Assistant, Associate, and Full Professor positions. We're particularly looking for candidates working in areas that will complement or build upon our existing strengths. NJIT, a public, technological research university serving nearly 8,200 students, has a rapidly growing research culture and funding record. The university is located in northeastern New Jersey, just a short distance from New York City. The area provides excellent opportunities for contact with industry - from Wall St. to high technology telecommunications. With total enrollment over 1,800 (including eighty Ph.D. students), the Department of Computer and Information Science offers BS, MS, and Ph.D. degrees in both computer science & information systems. The new department head, Joseph Leung, has the commitment of the administration to provide the resources and increase in faculty needed to help the department achieve the next level of excellence. Send curriculum vitae and three letters of reference to: New Jersey Institute of Technology, Personnel Box AAF-CIS, University Heights, Newark, NJ 07102-1982. The university reserves the right to substitute equivalent education and/or experience at its discretion. EOE

Additionally, send e-mail copy to recruit@njit.edu. See http://www.cis.njit.edu for more information on the dept. Applications will be considered continuously through the end of April 1999.

North Dakota State University
Department of Computer Science

The Computer Science Department seeks to fill a tenure-track position, any rank, any area (Assistant Professor, Network/Systems preferred). Starting date is Fall 1999.

Competitive salary. Department offers all degrees. Research and teaching excellence is expected, normal teaching loads are light. Successful candidate will be awarded a significant startup package for enhancements such as equipment and summer salary. The department has twelve faculty in diverse areas; three lecturers; eighty-one graduate students (15 Ph.D., 66 MS), and 330 BS/BA students.

Fargo is a small, clean, growing city that consistently ranks near the top in national quality-of-life surveys. We have low levels of crime and pollution, easy commutes, and proximity to the Minnesota lake country. The community has a symphony, an opera, a domed stadium, community theater, three colleges, and many opportunities for recreation and entertainment. See www.cs.ndsu.nodak.edu/position/ for more information and application details. NDSU is an Equal Opportunity institution.

Northeastern University
College of Computer Science

Boston, Massachusetts

The College of Computer Science invites applications for a tenure-track faculty position at the Assistant/Associate Professor level. Candidates will be considered from all major disciplines of computer science. A Ph.D. in Computer Science or a related field is required.

The College has a diverse full-time faculty of twenty. There are 425 undergraduates, 120 Master's students and forty Ph.D. students. The faculty has significant external support and is engaged in a broad range of successful research programs. Research seminars draw upon computer science talent from the greater Boston area.

The College maintains a state-of-the-art computing environment which includes a large network of UltraSparc and Alpha workstations, specialized laboratories for research in networking and distributed computing, a switched ethernet network, and Windows NT and Macintosh teaching laboratories. In addition, the College has major research facilities in a new Engineering Science Research Center.

Please send a resume, statement of research interests, and three letters of recommendation to: Faculty Hiring Committee; College of Computer Science; 161 Cullinane Hall; Northeastern University; Boston, Massachusetts 02115.

Screening of applications begins on February 15, 1999. For further information, send e-mail to hiring@ccs.neu.edu or see the College's homepage http://www.ccs.neu.edu/.

Northeastern University is an Equal Opportunity/Affirmative Action Employer. We strongly encourage applications from women and minorities.

Oakland University
Department of Computer Science and Engineering

Rochester, Michigan

Chair

The Department of Computer Science and Engineering invites applications and nominations for the position of chair. Qualifications for the position include an earned Doctorate in Computer Science or Engineering or a related field, an excellent record of scholarly accomplishments, a demonstrated ability to attract external research funding, and strong leadership skills.

Starting date: August 1999 or earlier. Applications will be reviewed beginning February 1, and will be accepted until the position is filled.

Nominations and applications should be submitted to: Professor Fatma Mili, CSE Search Committee Chair, c/o Office of the Dean, School of Engineering and Computer Science, Oakland University, Rochester MI 48309-4478; E-mail: mili@oakland.edu

Oakland University is an Equal Opportunity/Affirmative Action ADA-compliant employer. Women and minorities are especially encouraged to apply.

More information about the position can be found at: http://www.secs.oakland.edu/cse-search.

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

The department anticipates at least one position in the immediate future of open rank. Our hiring goals include the continued development of our existing research groups and the establishment of a new research group in an area of national and regional importance. Existing areas include database systems, distributed computing, functional programming, computational finance, neural networks, human computer interaction, and spoken language systems. Potential growth areas include networking, computer architecture, software engineering, scientific visualization, verification, and electronic commerce. Applicants should have prior faculty or postdoctoral research and teaching experience, although exceptional candidates who are anticipating completion of a Ph.D. may also be considered.

Located near Portland, in Oregon's high-tech corridor, OGI provides outstanding graduate and professional education and conducts internationally acclaimed research in science and technology. This combination of world-class research and education is significant in its impact on local and global industry — creating new standards of excellence in both familiar and evolving areas of study. OGI is a private graduate school with no undergraduate programs. Faculty are responsible and rewarded for their contributions to relevant research and education. OGI offers career faculty appointments but does not subscribe to academic tenure.

More information about our department can be found at http://www.cse.ogi.edu. To find out why the Portland area is a great place to live go to http://www.portland.citysearch.com.

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

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

Purdue University
School of Electrical and Computer Engineering

Purdue University School of Electrical and Computer Engineering seeks outstanding candidates in computer engineering for research and teaching in the following areas: artificial intelligence, computer architecture, computer networks, operating systems, software engineering, VLSI, and CAD. Strong candidates in other areas of computer engineering are also encouraged to apply. Openings are for tenure-track faculty at all levels.

Send a resume, including a statement of research and teaching interests and a list of at least three references, to: Head, School of Electrical and Computer, Engineering, Purdue University, 1285 EE Building, West Lafayette, IN 47907-1285

Applications will be considered as they are received. Purdue University is an Equal Opportunity/Affirmative Action employer.

Queen's University
Department of Computing and Information Science

The Department of Computing and Information Science invites applications for several open tenure-track and term positions at the Assistant and Associate Professor levels. Queen's University is one of the top universities in Canada and is well-known for the high quality of its students and faculty. Queen's University is situated in Kingston, a beautiful and historic city, which is located on Lake Ontario within easy travelling distance of Toronto, Montreal, Ottawa, and Syracuse. Kingston offers the amenities of a large city and the comfort of a small city.

The Department of Computing and Information Science, which has nineteen faculty, twenty-one staff and approximately seventy graduate students, is committed to excellence in both research and teaching. The faculty are doing research in a number of areas of computer science including computational imagery, molecular scene analysis, robotics and perception, software technology, database systems, computational geometry, parallel computation and computational linguistics.

Applicants for the tenure-track positions should have a Ph.D. degree in Computer Science or a related field. The Department will consider applicants in software engineering, artificial intelligence, computer architecture, computer networks and all related areas. The successful candidate will be expected to develop an active research program and to teach effectively at the undergraduate and graduate levels. Salary is commensurate with qualifications and experience.

Applicants for the term positions should also have a Ph.D. degree in Computer Science or a related field. The focus of the term positions is on undergraduate teaching. The successful candidates will be expected to teach introductory-level computing science courses as well as advanced undergraduate courses in their areas of expertise.

Applicants are requested to send a curriculum vitae, including a list of publications, and the names of three references, and copies of up to three recent papers to: Dr. Janice Glasgow, Chair, Department of Computing and Information Science, Queen's University, Kingston, Ontario, Canada K7L 3N6. Openings are for July 1999 and beyond. Screening of applicants will begin immediately and continue until all positions are filled. Queen's University is committed to employment equity and welcomes applications from all qualified men and women, including visible minorities, aboriginal people, persons with disabilities, gay men and lesbians.

Slippery Rock University
Department of Computer Science

Information Technology Faculty

Tenure-track position available beginning Fall 1999 or Spring 2000 at the Assistant/Associate Professor Level.

Earned Doctorate in Computer Science/Information Systems or closely related field is required. Successful performance in an on-campus interview, including a teaching session, is required. Perceived ability to work productively with students and colleagues is required. Preference will be given to candidates demonstrating familiarity with a broad range of continuous assessment techniques, the use of instructional technology in the teaching-learning process, and the role of faculty in student success, recruitment, and retention. Preference will also be given to candidates with expertise in Web programming, systems security and management, scripting languages, and human-computer interface design.

Duties may include committee work at departmental, college, and university levels; involvement in student activities; research that may involve undergraduate students; community service; as well as academic advisement, scholarly activities, related service; and other duties as assigned. Teaching assignment may include courses from computer science and information systems programs.

The department has eight fulltime faculty members and offers a BS program both in Computer Science and in Information Systems. This additional position will assist the department with a new degree program in Information Technology. Computing facilities include DEC-Alpha Unix and NT workstations. Slippery Rock University is located an hour north of Pittsburgh and offers a picturesque rural setting with easy access to the city.

Send letter of application, resume, graduate and undergraduate transcripts (official transcripts will be necessary before hiring) and the names, addresses, and phone numbers of three references to: Screening Committee, Department of Computer Science, Slippery Rock University, Slippery Rock, PA 16057; Fax: 724-738-4513; E-mail: robin.hovis@sru.edu

Review of applications will begin April 15, 1999. Slippery Rock University is a member of the State System of Higher Education and is an Equal Opportunity/Affirmative Action Employer building a diverse academic community and encourages minorities, women, veterans, and persons with disabilities to apply. You can learn more about us on our webpage at www.sru.edu.

Tulane University
Department of Electrical Engineering and Computer Science

Tenure-Track and Visiting Faculty Positions

The Department of Electrical Engineering and Computer Science invites applications for tenure-track and visiting faculty positions in Computer Science and Computer Engineering for the Fall Semester 1999. Candidates should have a Ph.D. in Computer Science or Computer Engineering, a strong commitment to both research and teaching, a publication record in their area, and demonstrate potential for obtaining external research funding.

Applicants should send a letter of intent, a statement of research and teaching interests, a resume, and the names, addresses, and phone numbers of at least three references by email to: cs-recruiting@eecs.tulane.edu, or postal: Dr. Boumediene Belkhouche, Search Committee Chair, Department of Electrical Engineering and Computer Science, Tulane University, New Orleans, LA 70118

Applications will be accepted until the positions are filled. Tulane University is an Equal Opportunity/Affirmative Action employer. For more information visit our site www.eecs.tulane.edu.

University of Central Arkansas
Computer Science Department

Faculty position beginning Fall 1999. All areas of computer science considered. Rank commensurate with experience. Ph.D. in computer science or related field required. Appointment will be

Professional Opportunities

traditional tenure-track or renewable three-year, twelve-month contract.

The CS Department offers majors and minors in Computer Science and is committed to excellence in teaching and research. Current active research areas include robotics, medical imaging, and computer education. The department was established in 1995 and currently has eight faculty members; it enjoys strong support from the administration and is growing rapidly. We have excellent relationships with industry. It is anticipated that graduate programs will be developed soon.

UCA has approximately 9,000 students and is located in Conway, a town of 40,000 about twenty-five miles from Little Rock and a few hours drive from Dallas and Memphis. It is a wonderful town and growing steadily. It has mild winters, delightful springs, balmy summers, and cool falls.

Send a letter of application, resume, and the names and addresses of three references to: Search Committee, Computer Science Department, UCA, Conway, AR 72035.

Electronic submission is encouraged (fsearch@cs.uca.edu). Women and minorities are strongly encouraged to apply. UCA is an Equal Opportunity employer.

University of Illinois at Urbana-Champaign
Beckman Institute for Advanced Science and Technology

Research Scientist

The Artificial Intelligence Group of the Beckman Institute for Advanced Science and Technology is seeking two full-time research scientists, with expertise in knowledge-based expert systems, uncertain reasoning, and machine learning. Of particular interest are applicants with expertise in Bayesian networks, artificial neural networks, and blackboard systems. The Beckman Artificial Intelligence Group is the primary center of artificial intelligence research at the University of Illinois, with twelve faculty members from departments across campus and over fifty graduate students. We seek someone who will be an active researcher and can assist with leading a research group.

Candidate must have a Ph.D. in computer science or a related field. This is a full-time, 12-month, academic professional position. The University of Illinois has a comprehensive benefits package. Salary is competitive and commensurate with experience. These positions are grant-funded; reappointments are contingent on continued funding. The current funding in place is for three and a half years.

The positions are open until filled. Starting date is as soon as possible. If interested, please send a description of background and interests, curriculum vitae, and the names of three references to: Professor David Wilkins, Search Committee Chair, Beckman Institute, University of Illinois, 405 North Mathews, Urbana, IL 61801; Phone: 217-333-2822

Applications by e-mail in Word, ASCII, or PostScript are preferred. Please e-mail: ai-search@odysseus.ai.uiuc.edu.

The University of Illinois at Urbana-Champaign is an Affirmative Action / Equal Opportunity Employer.

University of Manitoba
Department of Computer Science

Winnipeg, Manitoba, Canada

Applications are invited for four full time tenure-track positions, subject to final budgetary approval, at the Assistant Professor level, commencing January 1, 1999 or as soon as possible thereafter. Minimum qualifications are a Ph.D. in Computer Science or allied discipline (complete or nearing completion) and evidence of a strong research potential in computer science. Prior teaching experience will be considered an asset. A Faculty of Science startup research grant will be awarded to all newly appointed faculty members.

For one of these positions, applicants are principally sought in the area of theoretical computer science, though ability to teach in a breadth of areas will be considered an asset. For the remaining positions, applicants are principally sought in the areas of software engineering, programming languages and compilers, operating systems, networks, and parallel systems, though truly outstanding candidates in other areas may be considered. Duties will include undergraduate and graduate teaching and supervision, research, and service-related activities.

The Department currently has twenty-three full time tenure-track faculty members and a number of sessional appointments, and offers a full range of both undergraduate and graduate programs, including cooperative programs. We currently have over sixty graduate students.

The Department is a well-established one, which has recently been in an expansionary phase. Both the undergraduate and graduate curricula have been extensively revised and extended. The Department provides good technical support for both teaching and research. Current and planned departmental facilities include numerous UNIX based Workstations, a parallel computing laboratory, a software development and testing laboratory, and numerous other research laboratories and personal machines, all of which are networked. The Department has well equipped UNIX and object-oriented teaching labs. The university Computer Centre provides virtually unlimited access to UNIX based workstations and other personal and mainframe computing facilities, as well as Internet connections. This is an excellent opportunity for good researchers and teachers to get in on the ground floor of an exciting Department.

Winnipeg has a great deal to offer, both culturally and recreationally, with a number of professional and other ethnic arts groups, professional sports teams, and many opportunities nearby for all types of outdoor activities in all seasons. The Winnipeg housing market is one of the most favorable in Canada to the homebuyer.

The University of Manitoba encourages applications from qualified women and men, including members of visible minorities, aboriginal peoples, and persons with disabilities. Priority consideration will be given to Canadian citizens and permanent residents.

Further information concerning the Department and the University may be obtained from http://www.cs.umanitoba.ca/.

Applicants should send a curriculum vitae and the names of three referees to the address below. Qualified women are particularly encouraged to apply. Consideration for the positions will commence on November 15, 1998 and will continue until June 1, 1999, or until the positions are filled.

Chair of Search Committee, Department of Computer Science, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2; E-mail: search@cs.UManitoba.ca; Telephone: 204-474-8313; Fax: 204-474-7609.

University of Michigan
Computer Science and Engineering

Ann Arbor, Michigan

Applications and nominations are solicited for several junior and senior faculty positions in all areas of computer science and engineering. Qualifications include an outstanding academic record, a doctorate or equivalent in Computer Engineering or Computer Science, and a strong commitment to teaching and research. Particular areas of interest include: databases, computer networks, computer security, distributed systems, programming languages, computer architecture, and artificial intelligence.

Please send resume and names of three or more references to: Professor Kang G. Shin, Chair of the Faculty Search Committee, CSE Division, Department of Electrical Engineering and Computer Science, University of Michigan, 1301 Beal Avenue, Room 3402, Ann Arbor, MI 48109-2122

A Non-Discriminatory/Affirmative Action Employer, URL: http://www.cse.umich.edu

University of Michigan
Department of Electrical Engineering and Computer Science

Ann Arbor, Michigan

Applications and nominations are invited for the James R. Mellor Professorship of Engineering in the Department of Electrical Engineering and Computer Science at The University of Michigan. Candidates for this endowed chair professorship are expected to have an outstanding record of research and leadership in computer science and engineering, and a strong commitment to teaching at both the undergraduate and graduate levels.

The primary interest is in candidates of international stature in the general area of software systems including computer networks, security, database and information systems, distributed systems, graphics, operating systems, and programming languages. Exceptional candidates in the other areas of computer science and engineering may also be considered.

Applications and nominations should be sent to Prof. Kang Shin, CSE Search Committee Chair, Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI 48109-2122. The University of Michigan is an Equal Opportunity/Affirmative Action Employer.

University of Missouri-Columbia
Department of Computer Engineering & Computer Science

Applications are invited for multiple tenure-track positions beginning January or August 1999.

We are seeking multiple candidates with research and teaching interests in all aspects of computer science. All professorial levels will be considered, although assistant professor level will be given preference. Applicants for junior positions should have a Ph.D. in Computer Science or a related field by the start of the appointment, and should show evidence of excellent research and teaching promise. Applicants for senior positions should have an outstanding research and excellent funding record. Successful applicants will be expected to establish a quality research program and teach both graduate and undergraduate courses.

Please send a curriculum vitae, a statement of teaching, a statement of research goals, and three references to:Faculty Search Committee, Computer Engineering and Computer Science, 201 Engineering Building West, University of Missouri-Columbia, Columbia, Missouri 65211-2060

Immigration status of non-U.S. citizens should be stated. The University of Missouri is an Equal Opportunity/Affirmative Action/ADA Institution.

The University of Missouri-Columbia, MU, is the largest and oldest campus of the state's major public research institution. With a student population of 23,000, MU serves diverse undergraduate and graduate students, offering strengths in biological and biomedical sciences, physical and engineering sciences, social and behavioral sciences, journalism, and agriculture.

The CECS Department is the focal point of activities in computer science, computer engineering, and information technology on the MU campus. Six degree programs are offered through the department: three undergraduate degrees, two master's degrees and a Ph.D. For more information, see our web page at http://www.cecs.missouri.edu.

MU is located in the town of Columbia, situated between Kansas City and St. Louis. With a population of 75,000, Columbia is consistently ranked in the top "Best Places to Live" by national U.S. surveys.

University of Southwestern Louisiana
Institute for Cognitive Science

We invite applications for a tenure-track faculty appointment at the Assistant Professor level for a new Ph.D. program. Appointment is anticipated for the Fall of 1999. Applicants must have an earned doctorate in Cognitive Science or a closely related area, as well as demonstrated potential for research excellence. Focus areas of the new program are in cognitive processes, comparative cognition, computational models of mind, cognitive neuroscience, and language and thought.

Salary is competitive, depending on experience and qualifications.

Applicants should send a letter of application, statement of research interests, curriculum vitae, reprints, and three letters of reference to: Dr. Daniel Povinelli, Institute for Cognitive Science, P.O. Drawer 43772, University of Southwestern Louisiana, Lafayette, Louisiana 70504.

Review of applications will commence March 15, 1999.

The University is in compliance with Title IX of the Civil Rights Act, Section 504 of the Rehabilitation Act of 1973, and is an Equal Employment Opportunity/Affirmative Action Employer.

University of Texas at El Paso
Department of Computer Science

The University of Texas at El Paso seeks a tenure-track Assistant Professor of Computer Science. The successful candidate must show strong research potential and commitment to teaching. Applicants in any area of computer science are encouraged. Applicants must hold a Ph.D. in Computer Science or a closely related field.

UTEP's Computer Science Department is part of the College of Engineering. It currently consists of eight full-time and two part-time faculty members and offers MS and BS degrees in computer science. The Computer Science and the Electrical and Computer Engineering departments jointly offer a Ph.D. in computer engineering. The department has an active research program. More information about this position and the department can be found at the following URL: http://cs.utep.edu/csdept/hiring.

Applicants should submit a detailed resume and the names of at least four references to: Luc Longpre, UTEP, Department of Computer Science, El Paso, Texas 79968 (e-mail: longpre@cs.utep.edu).

The University of Texas at El Paso does not discriminate on the basis of race, color, national

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Professional Opportunities

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origin, sex, religion, age, or disability in employment or the provision of services.

University of Texas at El Paso
Department of Computer Science

The University of Texas at El Paso seeks applications and nominations for the position of Chair of the Department of Computer Science. The successful candidate must have a distinguished research record and the ability to lead the department in its research and educational activities. Applicants must hold a Ph.D. in Computer Science or a closely related field.

UTEP's Computer Science Department is part of the College of Engineering. It currently consists of eight full-time and two part-time faculty members and offers MS and BS degrees in computer science. The Computer Science and the Electrical and Computer Engineering departments jointly offer a Ph.D. in computer engineering. The department has an active research program. More information about this position and the department can be found at the following URL: http://cs.utep.edu/csdept/hiring.

Applicants should submit a detailed resume and the names of at least four references to: Michael Gelfond, UTEP, Department of Computer Science, El Paso, Texas 79968 (e-mail: mgelfond@cs.utep.edu).

The University of Texas at El Paso does not discriminate on the basis of race, color, national origin, sex, religion, age, or disability in employment or the provision of services.

University of Utah
Department of Computer Science

The University of Utah's Department of Computer Science seeks applicants for tenure-track faculty positions at either the Assistant or Associate professor level. The department places a strong emphasis on interdisciplinary, multi-investigator research activities addressing large-scale problems of significant impact. Both research areas and course offerings benefit from the quality and breadth of our faculty and emphasize a balance of theoretical foundations and practical engineering.

Candidates are sought who will complement the current mix of faculty within the department: in the areas of computer graphics/scientific visualization/ scientific computing, systems/networking/languages, artificial intelligence, and databases. Applicants should have earned a Ph.D. in Computer Science or a closely related field.

The University of Utah is located in Salt Lake City, the hub of a large metropolitan area with excellent cultural facilities and unsurpassed opportunities for outdoor recreation only a few minutes drive away. Additional information about the department can be found at http://www.cs.utah.edu. Please send curriculum vitae and names and addresses of at least four references to: Faculty Recruiting Committee, c/o Shawn Darby, Department of Computer Science, 50 So. Central Campus Drive, Rm 3190 MEB, University of Utah, Salt Lake City, UT 84112-9205.

The University of Utah is an Equal Opportunity/ Affirmative Action Employer and encourages nominations and applications from women and minorities, and provides reasonable accommodation to the known disabilities of applicants and employees.

Virginia Polytechnic Institute
Department of Computer Science

Virginia Tech

The Department of Computer Science seeks applicants for a tenure-track appointment at the rank of Associate Professor or Professor for the position of Program Director for Computer Science at the Northern Virginia Center in Falls Church, Va. The Northern Virginia Center offers graduate education leading to the Master/Ph.D. of Computer Science, Master of Information Systems, and an interdisciplinary Master of Information Technology. In addition to the research opportunities that exist in the high-technology sector of Northern Virginia, expanded research opportunities are possible at Virginia Tech's Alexandria Research Institute. The Center also houses related programs in computer engineering, electrical engineering, and business. The four full-time computer science faculty at the Center work in collaboration with other faculty at the Center and with the approximately twenty-five full-time faculty at the Blacksburg campus through teleconferencing facilities over the University's Net.Work.Virginia.

The Program Director has major responsibilities for engaging in active research, publication, and grant activity; managing the resources, budget, and scheduling of the computer science program at the Center in close cooperation with the department in Blacksburg; coordinating with the Department Head on major policy issues; interacting with the Center's administration and other program directors on Center policy and resources.

Applicants should send a curriculum vitae, a 1-2 page statement of research plans and goals, and have at least three letters of reference sent to NVC Director Search, Dept. of Computer Science, 660 McBryde Hall, Virginia Tech, Blacksburg, VA 24061. Review of candidates will begin February 15, 1999, and continue until the position is filled. For more information, see http://www.cs.vt.edu and http://www.cs.nvgc.vt.edu.

Virginia Tech has a strong commitment to the principle of diversity and, in that spirit, seeks a broad spectrum of candidates including women, minorities, and people with disabilities.

Individuals with disabilities desiring accommodations in the application process should notify us at 540-231-6931.

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was chosen to lead this group since it is the only agency that will support research in all three thrusts of the initiative. The working group has been charged with preparing research plans and budgets for the entire effort, ensuring that the research projects funded through the initiative result in a sound and balanced research portfolio. High priority has been placed on ensuring that agency funds are distributed in an open, competitive process aimed at supporting the best possible ideas. Administration officials estimate that at least 60 percent of the funding will go to universities.

Funding for each agency's participation in the initiative will have to be approved by Congress in the appropriations process, which will culminate in passage of thirteen separate spending measures later in the year. Fiscal Year 2000 begins October 1, 1999.

The CRA Government Affairs website features pages on the IT^2 initiative and the FY 2000 budget request (www.cra.org/main/cra.gov.html), with additional information and links to related sites, including official federal budget documents and the final PITAC report when it's released. ∎

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voice interfaces and security, as well as selective, automated resupply.

Additional ideas included a 3-D learning environment; an electronic book for students; a reconfigurable house; smart plumbing to indicate leaks, freezes, and clogs; smart laundry equipment that reads clothing labels.

What's Next?

We are designing other workshops as well as mechanisms to flesh out the most promising ideas. We are seeking more corporate and foundation partnerships that may result in concrete development projects at the Institute or in partnerships or consortia.

Workshop topics for the coming year include:

◆ *Keeping Track of Women's Lives*. This workshop will look at the full range of technologies for managing one's time, and will specifically explore the future of the personal digital assistant.

◆ *CIOs Perspectives on Enterprise Computing*. Female CIOs will determine what changes and innovations they want to see in future systems.

◆ *Politics and Technology*. Together with the Kennedy School at Harvard, we are planning events that bring female politicians and candidates together with technologists to combine and share their expertise and develop visions and policies for the future.

In Conclusion

The ideas generated in our initial workshops represent technologies that could have a positive impact on women's lives. The workshops also impact on the participants. Exit surveys indicate that the non-technical participants see technology differently — in particular, as something in which they might participate more actively than they had ever imagined. The technologists saw a new way of connecting the work they do to real human needs. Both were encouraging outcomes. The possibility of change in the long-term is still to be determined, and will depend on both our own follow-up activities and on the willingness of the broad computing community to consider new ways to think "outside the box."

Anita Borg is the President of the Institute for Women and Technology and a member of the research staff in the Office of the Chief Technologist at Xerox PARC. She can be reached at aborg@parc.xerox.com or see www.parc.xerox.com/iwt.org. ∎

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working in concert with government science agencies and private sector users. There are many strategies and actions that could be taken. The community has to develop its own agenda reflecting its own style — here are two suggestions:

Create and promote a legislative package.

I know, I know. The agencies will say that they need no authorizing legislation, that any expansion of computing research support can be done within the framework of their current authorizations. And that is true. But there are several reasons why developing and pushing a legislative package could be useful:

It is a useful exercise for the community. It is one thing to say, "Our field needs more support" and quite another to specify what that means. For example, what five actions would the reader like to see written into law to support computing research?

It provides a focus for advocacy. Five minutes with a Member of Congress are better spent stating "We want you to support H. R. XXX," rather than "We want you to support computing research." In Congress, putting one's name on a bill and voting for it is concrete, and it helps develop congressional "champions" for computing research.

It's a rallying point. Coalitions are best organized and motivated around specific language. Empty statements of support for research in general are easy to come by, but it is quite different to support (or even oppose) a specific bill.

One might actually win! And even if a bill doesn't pass, small separable pieces could still be attached to other legislation that has a better chance of passing. That way, some useful legislation, however minor, is passed. Additionally, the political system gets used to voting positively on an issue. Don't underestimate the value of such momentum in politics. Finally, the appropriations committees are more likely to respond favorably when programs requesting funds have been debated and specifically voted for by Congress.

Build coalitions.

The computing research community is far too small to have much influence on legislation and the direction of spending of serious money. It needs the support of industry and the end-user communities—the beneficiaries of research. It also needs the continued goodwill and general support of the public.

Although coalitions require effort to build and sustain, they are essential. For the academic research community, it means broadening programs to encompass a wider range of concerns. It also means that others will want a voice in setting research priorities. The importance of computing research to society is both the great strength and weakness of the field. It is a powerful political and social argument for investment, and it means that lots of cooks want to stir the broth. Harnessing that political energy and engaging the broader community in the policy process, while sustaining a sound, long-term research agenda, is the tightrope to walk.

Facing the Challenge

Never before has public and political support for the computing research and science policy been this high, and the field needs to step up its political and policy activities. CRA needs to do more. It now has a terrific full-time government affairs director, Lisa Thompson, but that is just the beginning. Its public education and advocacy program needs to keep growing. And the community needs to do more, from contacting and visiting representatives to spending time in Washington in agencies or as congressional fellows. Computing researchers have to be involved in decision making at all levels. It's part of the price of the field's success and a necessary investment in its future health. ∎

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be improved by studying the distribution of network traffic and developing better network management algorithms. Web-based applications will benefit greatly from modeling, experimentation, design, and analysis. Algorithms for large, compute-intensive tasks will allow scientists to perform much larger simulations of complex problems by focusing the computational work where it is needed. These and many other issues offer important opportunities for the academic and industrial research communities to advance our understanding of computation by refocusing our energies and talents on the challenging problems arising in the context of new applications. It is very much in the interest of the nation that the research funding agencies should support such interactions.

John Savage is a member of the computer science faculty at Brown University, a former member of the CRA Board of Directors, and the author of "Models of Computation," recently published by Addison Wesley. (See also www.cs.brown.edu/people/jes.) ∎