COMPUTING RESEARCH NEWS

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CRA Announces 2006 Service Award Winners

CRA is pleased to announce the winners of its 2006 service awards.

Distinguished Service Awards will be given this year to **Mary Jane Irwin,** Penn State University, and **David Patterson,** University of California, Berkeley.

Mary Lou Soffa, University of Virginia, will receive the A. Nico Habermann award for her outstanding contributions to increasing the numbers and/or successes of underrepresented members in the computing research community.

The Distinguished Service Committee also recommended that a special award be presented to **Stuart Zweben**, Ohio State University, for his long-term involvement and efforts on behalf of CRA's annual Taulbee Survey.

The awards will be presented at CRA's Conference at Snowbird, Utah, on June 25, 2006.

CRA Distinguished Service Awards

Mary Jane Irwin, A. Robert Noll Chair of Engineering and Co-director of the Embedded and Mobile Computing Center (emc^2) in the CSE Department at Penn State University, has served at high levels, with distinction, in three of the main computing research professional organizations. She was a long-time and active member of the CRA board and vice-chair for four years; a member of council and vice president of ACM; and a member of council of the IEEE Computer Society.

Irwin played a fundamental role in founding CRA-W, and has continued to be active in this leading organization for more than a decade. She has helped to set the future research agenda for the computer architecture community by co-chairing CRA's grand challenge conference in this area. Her record of participation in professional publications and conference activities is unusually rich.

David Patterson, Professor of Computer Science at the University of California, Berkeley, has a wide range of service activities in addition to being a leading computing researcher. He served for four years as CRA's board chair, during which he revitalized the membership of the board, greatly strengthened the financial abilities of the organization so it could better carry out work on behalf of the computing research community, and oversaw an expansion and strengthening of the programs, in particular in government affairs and representation of women.

As current president of ACM, Patterson has used his standing to speak out forcefully and effectively for improving the innovation climate in the United States through his efforts to return DARPA to a more basic research agenda, increasing federal funding for computing research and development, making the United States a more welcoming place to foreign students and researchers, and encouraging American students to pursue a computing research career.

CRA A. Nico Habermann Award

Mary Lou Soffa, the Owen R. Cheatham Professor and Chair of Computer Science at the University of Virginia, was the founder of CRA-W's Affiliate Distributed Mentoring Program and co-founder (with Jan Cuny) of the CRA-W Graduate Student Cohort and the Cohort for Associate Professors. The Graduate Student Cohort program is now bringing 200 women together annually for a two-day workshop. Soffa has consistently been responsible for finding funding for these programs, recently obtaining significant funding from industrial sources, even as the programs have grown. She is also extremely active in individual mentoring. She has graduated 21 PhD students and 54 MS students, and more than half of these are women. Eight are tenured or tenure-track faculty members.

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Inside CRN

Innovative, Competitiveness Plans Advance, But Hurdles Ahead

Washington Update

By Peter Harsha

Some high-profile legislative efforts to bolster U.S. competitiveness by fostering greater U.S.-based innovation have begun to move in Congress, putting the spotlight on the importance of increasing federal support of fundamental research, improving education efforts, and addressing needs in federal tax policy and workforce and immigration issues. But despite the positive action, there are a number of obstacles to enactment of these innovation plans including, most seriously, a perceived lack of support from the House Republican leadership.

Two legislative packages have received the most attention and the most action in the Senate. A bipartisan package of three bills called the "Protecting America's Competitive Edge" Acts (PACE), introduced by Senators Pete Domenici (R-NM), Jeff Bingaman (D-NM), Lamar Alexander (R-TN), and Barbara Mikulski (D-MD), has attracted 66 Senate co-sponsors. The PACE acts (S. 2197, 2198 and 2199) are based largely on a 2005 National Academies report, *Rising Above the Gathering Storm,* that included 20 recommendations—from increased research funding to immigration changes that would help the U.S. recruit and retain the world's best talent—aimed at ensuring that the U.S. retains its competitive edge.

The other package receiving attention is the "National Innovation Act" (NIA) (S.2109)—and a related piece dealing only with the commerce-related provisions (S. 2390)—which was introduced in December 2005 by Senators John Ensign (R-NV) and Joseph Lieberman (D-CT), and has since attracted 23 co-sponsors. The NIA is modeled on the conclusions of the December 2004 Council on Competitiveness report, *Innovate America: Thriving in a World of Challenge and Change*, in which a panel of preeminent academic and industry leaders offered 60 recommendations for improving America's competitiveness.

Though both packages of bills have been referred to the Senate committees with jurisdiction, it appears the PACE bills have the most momentum behind them. The PACE legislation is broken into three parts:

1. PACE Energy (S. 2197)—includes provisions for bolstering the federal investment in energy science, including doubling the DOE Office of Science budget over 7 years; creation of a new "DARPA-like" agency within DOE called ARPA-E; and support for math, science and engineering education through DOE.
2. PACE Education (S. 2198)—includes a series of provisions aimed at increasing the production and supporting the professional development of K-12 teachers in math and science; increases support for NSF and NASA's Early Career grants; directs federal research agencies to devote 8 percent of their budgets to "high-risk, high-payoff research;" authorizes the doubling of the NSF budget over 7 years; creates a new "F-4" visa category to encourage foreign students in the physical sciences, math, computing or engineering to

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Expanding the Pipeline

CRA-W and CDC Form an Alliance for NSF's New Program to Broaden Participation in Computing

By Carla Ellis, Margaret Martonosi, and Jeffrey Forbes

The National Science Foundation (NSF) has always been a major source of support for activities aimed at diversifying science and engineering fields. So when NSF launched a visionary new program aimed specifically at increasing the participation of women and underrepresented minorities in computing, CRA's Committee on the Status of Women in Computing Research (CRA-W) partnered with the Coalition to Diversify Computing (CDC) to submit a proposal. We saw this as a wonderful opportunity to improve some of our current programs and to create innovative new projects to encourage women and underrepresented minorities to participate in computing research. Our alliance is designed to share each other's programs and offer them to a wider range of people from underrepresented groups. We are anticipating that this NSF grant will be funded for $1.5M over three years. The award will allow us to extend some of our existing programs and offer new ones as well.

Extended Mentoring Program

One of our goals for improving the undergraduate research experiences of the Distributed Mentoring Program (DMP) and the Collaborative Research Experiences for Undergrads (CREU) is to support longer-term mentoring relationships. We want to encourage mentors and mentees who wish to continue their relationship beyond the original DMP or CREU project with support for visits and follow-up activities, possibly involving the student's advisor back home. This will allow the research project to go farther and build stronger and more successful application packages for graduate school admission and fellowship opportunities. This new option is called the Extended Mentoring Program (EMP).

Discipline-Specific Mentoring Tracks

We are also introducing a new concept called Discipline-Specific Mentoring Tracks (DSMTs) to enable researchers within a particular computing subfield to develop collaborations and mentoring relationships. We intend for these DSMTs to include participants ranging from advanced undergraduates through graduate students and all faculty ranks. The issues of how to focus a job search, how to embark on pre-tenure research, which funding agencies to approach, and how to interpret or write paper reviews all have subtly different answers and tradeoffs depending on the sub-area of computer science and engineering being pursued. To address these needs, we are planning Research Workshops or Summer Schools that will provide an intense immersion in a research area, its culture, and interactions with established researchers in the field. Throughout the events, there will be a mix of technical sessions and discussions of career development topics. The climate will be distinctly different from traditional technical workshops because of the significant diversity that will exist among the attendees and the invited speakers and panelists. Because of their research focus, DSMTs also foster the formation of research collaborations and career mentoring networks among participants. The first Summer School is being planned in Computer Architecture, and is slated to be held at Princeton University on July 19-21. Please see http://www.princeton.edu/~comparch06/ for details and registration information.

Tri-Mentoring Programs

Another new initiative called 'tri-mentoring' is aimed at improving the quality of the graduate school experience and the research outcomes for students from underrepresented groups by involving a third person in a mentoring triangle. In some cases, the third person may be an industry researcher; in others, the tri-mentoring may involve two academics from different universities or different fields of an interdisciplinary research topic. Including two mentors per student offers many potential benefits for both students and mentors. The tri-mentoring approach may increase collaboration between the mentors, and make persistent links between a student's dissertation research and the research activities pursued during a summer industrial internship. In some cases, it may also be a helpful step in alleviating tensions or improving communication between a student and her primary dissertation advisor. Tri-mentoring can also be of great value to the two mentors involved by fostering technical collaborations, and giving them a new voice to contribute to their own learning. These relationships may grow out of other programs such as DSMT or CDC programs such as Distributed Rap Sessions. We will facilitate tri-mentoring with travel funding and assistance in identifying potential members for a triangle.

Traveling Lecture Series

Finally, we want to explicitly reach talented undergraduates who are not being exposed to research at their home institutions. This outreach will continue to be a priority for the DMP. In addition, a Traveling Lecture Series is being redesigned around the lessons learned in a previous CRA-W lecture series to focus on the needs of undergraduates at schools where information about graduate school is more difficult to obtain and research role models are rare. The Traveling Lecture series will complement CDC's Traveling Academic Forum. The long-term goal of the revamped Traveling Academic forum is to create a community of underrepresented minority faculty to provide support and guidance for current and future faculty from underrepresented groups. Each workshop provides information that permits better understanding and navigation of the academic ladder, and offers encouragement to undergraduate students to pursue graduate studies and possible academic careers. The forum will conduct workshops at Minority-Serving institutions and conferences sponsored by organizations such as the National Society of Black Engineers, Society for Advancement of Chicanos and Native Americans in Science, and Black Data Processing Association.

For More information

As the different new programs move from "anticipated" to reality, the best sources of information on status and deadlines will be the CRA webpage www.cra.org, the CRA-W webpage (http://www.cra.org/Activities/craw/) and the CDC webpage (http://www.cdc-computing.org/). We look forward to the launch of these programs, and hope that they will be helpful to a range of colleagues from undergraduates to senior faculty!

Carla Schlatter Ellis *is a professor in the Computer Science Department at Duke University. She is the former co-chair of CRA-W and currently serves as fundraising co-chair for the organization. She serves on the Board of CRA. She is Editor-in-Chief of the* ACM Transactions on Computer Systems. *She was formerly Chair of SIGOPS.*

Margaret Martonosi *is a professor in the Electrical Engineering Department at Princeton University, where she also serves as Associate Dean for Academic Affairs for the School of Engineering and Applied Science. She serves as a member of CRA-W, and is currently editor for the CRA newsletter's Pipelines column.*

Jeffrey Forbes *is an assistant professor of the practice in the Computer Science Department at Duke University. He serves as a member of the Coalition to Diversify Computing.* ∎

CRA Welcomes New Board Members

CRA recently elected four new members to its board of directors. **Annie Antón** (North Carolina State University), **Eric Grimson** (MIT), **Andrew Chien** (Intel), and **Robert Sproull** (Sun Microsystems Laboratories) will serve three-year terms beginning July 1, 2006.

Five current board members were re-elected to three-year terms: **William Aspray** (Indiana University), **Carla Ellis** (Duke University), **Marc Snir** (University of Illinois, Urbana-Champaign), **Jeffrey Vitter** (Purdue University), and **Bryant York** (Portland State University).

Past Chair Jim Foley retires June 30 after ten years of extraordinary service on the CRA board, including three years as Treasurer and four as Chair. His contributions have helped make CRA the active organization it is today, and he will be greatly missed.

Also completing terms on the board on June 30, 2006 are Randy Bryant (Carnegie Mellon University), John King (University of Michigan), Alfred Spector (IBM), and Wim Sweldens (Lucent Technologies, Bell Labs). All have been active members of the board, and we thank them for their service to CRA and the community.

Newly Elected

Annie I. Antón, a graduate of the Georgia Institute of Technology with a Ph.D. in computer science, is an Associate Professor of Computer Science at North Carolina State University. Among her awards and honors are: CSO (Chief Security Officer) *Magazine* "Woman of Influence in the Public Sector" Award (2005); Member of the 9th IDA/DARPA Defense Science Study Group (2004-05); IEEE Senior Member (2003); and NSF CAREER Award (2000-04).

Professor Antón is a Member of the NSF CISE Advisory Committee. She is a Member of CRA-W, and since 1999 has mentored six students in its Distributed Mentor Project. She has been both a participant and a speaker in CRA-W's Cohort of Associate Professors Project (CAPP). In 2002, Antón was appointed a CRA Digital Government Fellow. She was an active participant in CRA's Grand Research Challenges in Information Security & Assurance Conference in 2003, accompanying the briefing team to Capitol Hill and the National Press Club. She serves on several committees and boards.

Eric Grimson is Head of the EECS Department, Professor of Computer Science and Engineering, and since 1998 the Bernard Gordon Professor of Medical Engineering at MIT. He is a Ph.D. graduate of MIT in Mathematics (Artificial Intelligence).

Professor Grimson is an AAAI Fellow and an IEEE Fellow. In 2001 he won the Bose Award for Excellence in Teaching from the School of Engineering at MIT. He has served as general chair or program chair of major computer vision and medical image analysis conferences (CVPR 2000, ICCV 1995, MICCAI 1998). Grimson was Associate Director of the MIT AI Lab from 1998 to 2003 and Education Officer for the EECS Department from 2001 to 2004. He brings to the board his experience as part of a long tradition of innovation and engagement in initiatives in CS research and education in MIT's EECS department.

Andrew Chien is Vice President and Director of Intel Research. His awards and honors include Fellow, Association of Computing Machinery (2004); endowed Chair in Computer Science and Engineering, UCSD (1998); Xerox Outstanding Senior Faculty Award (1996); NSF Young Investigator Award (1994); and numerous Best Paper/Finalist Awards (1992-2004). He is a graduate of MIT with a Ph.D. in Computer Science. Dr. Chien was Founding Director of the UCSD Center for Networked Systems (2003-05); Chair and Member, Steering Group, IEEE Conference on High Performance Distributed Computing (2002-05); Member, Steering Group, Global Grid Forum (2003); Chair, Peer to Peer Working Group (industry association) (2001-03); and Member, Steering Group, ACM SIGPLAN Principles and Practice of Parallel Programming (1999-present). He brings to the board an interest in sustaining and supporting investment in computing research, encouraging the development of young research leaders, and continuing the increase in diversity of the computing research community.

Robert F. Sproull is a Fellow at Sun Microsystems Laboratories. He is a Fellow of the American Academy of Arts and Sciences (2002) and a Member of the National Academy of Engineering (1997). Sproull was a member of the organizing committee for CRA's Grand Challenges in Information Systems Conference in 2002.

Prior to joining Sun in 1990, Dr. Sproull was an Associate Professor of Computer Science at Carnegie Mellon University, and before that a Member of the Research Staff at Xerox Palo Alto Research Center. He has been a Technology Partner of Advanced Technology Associates since 1981. His research interests include computer graphics, distributed computing and VLSI design. Sproull received a Ph.D. in Computer Science from Stanford University. ▮

Musings from the Chair

Research: On Being the Right Size

By Dan Reed, CRA Board Chair

In 1928, the British geneticist J.B.S. Haldane wrote a now famous essay entitled *On Being the Right Size*, where he noted, "The most obvious differences between different animals are differences of size … it is easy to show that a hare could not be as large as a hippopotamus, or a whale as small as a herring. For every type of animal, there is a most convenient size, and a large change in size inevitably carries with it a change of form." It was a cogent argument about surface area to volume ratios, structures, respiration and energy.

Similar arguments can be made for right-sizing research project resources to challenges and opportunities. The continuum of research opportunities in computing is deep and broad, yet we have often tended to focus on those best attacked by small teams and local infrastructure. Many other disciplines, most notably physics, regularly pursue projects much larger than those common in computing. Such projects often require both substantial intellectual resources (faculty, staff and students) and major infrastructure (e.g., accelerators, telescopes and other instruments).

They address fundamental, large-scale problems—sometimes nothing less than the very nature of the universe—and they require multi-institutional teams willing to take risks. I believe we can learn from our peers in the physical sciences: that to address our most fundamental issues and have broad, transforming impact we must "right-size" our research investment portfolio. This means balancing risk, from projects with smaller, though highly likely returns, to those that could have a transformative effect, but involve higher risk.

In an accompanying column in this issue, Peter Freeman, NSF's Assistant Director for the Computer and Information Science and Engineering Directorate, discusses the proposed Global Environment for Network Innovations (GENI) initiative, which would seek up to $300M in appropriations for NSF's Major Research Equipment and Facilities Construction (MREFC) budget. If this project is funded, and many steps remain along the funding path, it would tap a set of NSF resources that have heretofore not been accessible to computing, with broad research benefits beyond networking. Equally importantly, the overarching Computing Community Consortium (CCC) would provide a framework to define other computing funding priorities and projects.

We all know the transformative effect computing has had on society, the economy, science and engineering, and the arts and humanities. This realization is now shaping science policy in industry, academia and government. Two recent examples illustrate both our reach and the opportunities. CRA recently organized a session on computing's impact on science at the recent American Association for the Advancement of Science (AAAS) meeting in St. Louis, and the February 23, 2006 issue of *Nature* discusses the impact of computing on scientific discovery.

In this spirit, I would like to share some new developments regarding the political ecosystem surrounding information technology. I just returned from the first meeting of the President's Council of Advisors on Science and Technology (PCAST) since PCAST's mission was expanded to include an examination of IT. As a new member, I am participating in the IT subcommittee, whose goal is to produce an assessment of research investments in computing. I welcome any ideas and insights you might have about this topic, as the committee deliberates.

Finally, in my previous column, I mentioned the American Competitiveness Initiative (ACI) which, if funded, would double federal investment in basic research in the physical sciences, which includes information technology. The ACI was also a major discussion topic at the PCAST meeting. Multiple bills have been introduced in Congress, and the ACI continues to evolve. By the time you read this, all of us will have a much clearer indication of likely outcomes; watch the CRA blog (www.cra.org/govaffairs/blog) for details.

Dan Reed *(Dan_Reed@unc.edu), CRA's Board Chair, is the Chancellor's Eminent Professor and Vice-Chancellor for Information Technology at the University of North Carolina at Chapel Hill. He also directs the interdisciplinary Renaissance Computing Institute (RENCI).* ▮

Are Computer Scientists *Timid*?

By Peter A. Freeman
Assistant Director of NSF for CISE

No!

But, we've become too timid in many of the ambitions we collectively and individually have for our field.

I start to come to that conclusion when I hear from our Program Directors that too few of the proposals they see offer truly innovative ideas that excite panels or themselves. While confirmatory or incremental work is essential, we must also have a continuous flow of exciting, innovative ideas (and the community must ensure they are well received, and then we must ensure they are funded).

I am even more convinced that we need to regain the excitement that brought many of us to the field when I hear the incessant—but clearly important in the *near* term—discussion of why CS enrollments are falling, focusing on whether there is too much math required (probably not, IMHO) or whether we need a big ad campaign (probably, but to advertise *what*?) or worse, whining about why field X is getting more funding than field Y (both within CS and in comparing us to other fields).

I definitely conclude that we need to regain our grand aspirations when I review the entire NSF portfolio in detail each year and see the deep and often grand quests of other fields—quests with no discernible practical result that may take decades of dedicated and fundamental work, involving theoretical work that will break entirely new ground, or requiring grand experimental projects that may total billions of dollars.

I absolutely *know* that there is something fundamentally different about the tenor of much research today when I think about the visions of even a few of the giants of our field like Doug Engelbart, Alan Kay, Herbert Simon, Carver Mead, Gordon Bell, or Juris Hartmanis—just to name a few from among a good many more that had (and still do!) truly grand and audacious ideas.

Where are the BHAGs (Big Hairy Audacious Goals) of today?

As we are developing the Computing Community Consortium[1] and as I talk with many computer scientists at all levels, the question of the vitality of our field springs out. That question should concern every one of us, most especially those of us in positions of leadership. It is a question for which there are multiple answers and multiple rejoinders—all of which deserve to be heard and explored.

Let me comment briefly on the current national focus on "innovation." I believe all of you would agree that it is a long-overdue and very important step. Whatever disagreements one might have with the American Competitiveness Initiative (ACI)[2] I hope that you will join me in applauding, supporting, and strengthening it.

Computer science and the applications it has spawned can rightly claim to have been the engine of much of the innovation that has been driving the U.S. economy in recent years. While the "irrational exuberance" of the late 1990s led to the crash of many ventures, the underlying theme of innovation in the IT industry—and those industries whose operations are now enabled or enhanced by IT products—has continued more or less unabated. Likewise, utilizing CS as a *peer* in a number of research activities is leading to fundamental innovations throughout science and engineering.

Doesn't this demonstrate the vitality of our field? Doesn't this deny my assertion that we may be too timid in our goals? At one level it does—until you ask what *fundamental* concepts and research these innovations depend on when you trace back their developmental history.

More to the point, where are the fundamental changes in computer science?

If you ask that question, then I believe that you will agree with those who are now successfully pushing for more fundamental research in science in general.[3] The basic message is that we are in danger of losing the kind of edge we have in end-result innovation in this country because we are not asking deep enough questions and pursuing the BHAGs.

We need to explore entirely new concepts and we need to do that in new ways, whether in theoretical and small-scale research or large-scale experimental projects. Fundamental results typically start in relatively small, even individual, efforts. We must not forget that, but just because a project is small-scale doesn't mean that it will result in entirely new concepts. As an example, the Science of Design effort[4] is intended to break us out of a box regarding how to develop software.

At the same time, it is essential to employ experimentation wherever possible to enable the kind of future usage of CS concepts that the world is madly rushing toward, but won't be able to reach solely with today's stock of fundamental ideas. Further, experimentation need not be limited to the systems builders. If you draw parallels to physics—where huge experiments are carried out to validate a theory—or astronomy— where observations lead to theorizing—and note that in both cases there is then a "virtuous cycle" between the two modalities, then I hope you see the opportunity for computer science. Indeed, some already have.[5]

A new modality of experimental research in a number of CS fields may be possible, and it may require substantial instrumentation (in NSF lingo) to carry out. We should not be timid in conceiving of, planning for, and requesting such research infrastructure, just as other sciences routinely do. The Computing Community Consortium described elsewhere in this issue is expected to do exactly that over time for all areas of computer science.

An example of this kind of instrumentation is the Global Environment for Networking Innovations (GENI) initiative. It is an instrument for use by CS researchers in doing their fundamental, experimental research. This demands that it be open and accessible for measurement and for *ad hoc* changes at all levels and in all aspects. We are currently seeking community input to make sure that this is the case. This is essential to experimentation, and is a fundamental requirement that we are placing on the design.

Another way to look at such instrumentation-intensive projects is as prototypes for future practical and operational IT-based artifacts. We have ample precedents in our field in which research artifacts ultimately turn into products that turn the world upside down. Do you remember what SUN stands for, or know where Google developed, or understand the role that TheoryNet/CSnet/NSFnet played in creating today's Internet?

But, our primary objective should remain to push forward our scientific understanding of computation and the devices/systems that instantiate our theories.

While that may happen in the case of an infrastructure-intensive project—and then again, may not—it often begs an important set of questions from those who pay for research along the lines of: "How are you going to transition results into the practical world?" There are two answers to that question: one short term and one deeper, but both important.

The short-term answer is that as important as "technology transfer" is, our mission is to advance fundamental research. Given that there are any number of fundamental things we don't understand about the structure and operation of complex IT systems, we believe that attempting to develop such an understanding is valuable in its own right. Just as other fundamental scientific questions engage legions of people and tons of money for decades, we believe these questions stand on their own as worthy of investigation.

Nonetheless, as a practical matter, we must pay close attention to the issue of how we can enhance the ultimate transfer of results into more practical results. Our field and the industries it has spawned have a rather good record, in fact, of rapidly making money and improving lives with ideas and theories and prototypes that were in the lab or being talked about at academic meetings only a few years ago—the examples are abundant.

The deeper answer is one that is important to understand as we collectively try to advance our field. Computer science is not science, not engineering, not math—but a combination of all three. That is hardly an original observation, but the rub is that because we are a new field (yes, *new* even though some of us have been in the field almost half a century) we are still working out just what that answer means in terms of what we do as researchers and educators. Do some of us belong to just one of those fields, but still call ourselves computer scientists? Do we do math or science at one phase of research and engineering at another? Do we do something that is somehow a bit of all three and we just can't describe how that works? Did we originate in one field and are moving toward another?

When I think about the vitality of our field, I'm less interested in an abstract answer to these questions than I am in helping determine what we should be *doing*. In that context, I believe we have lost some of the original vision and vitality of the founders of our field who were not afraid to ask big and deep questions, and to experiment where appropriate to find the answers to their questions. To some extent I think we have lost our way as scientists and let the inner engineer (and entrepreneur!) in each of us become too ascendant.

The questions our field truly faces are not questions of why students don't love us or why decision makers don't give us enough money—they are the exciting, compelling questions of understanding some of the most complex artifacts ever created (or discovered, for that matter) and of attempting to create new theories, understandings, and artifacts that far transcend anything we have today.

As a professor, dean, and now research funder, I well understand many of the factors that push us toward the safe, rather than the innovative, path in research and education. If there was ever a time to overcome and ignore those factors—at all levels—it is now.

We all have an important role: Those of us at funding agencies and research labs must set higher expectations and educate our colleagues on the importance of our research and education; academic and lab administrators must reward true advances, not just incrementalism; and, most importantly, each researcher and educator must continually strive to contribute to the advance of our field in fundamental ways.

Don't be timid!

I look forward to hearing from you. Please send general comments to me at pfreeman@nsf.gov.

Notes:

[1] See the March 2006 issue of *CRN*, as well as the article on the Computing Community Consortium in this issue.

[2] www.whitehouse.gov/stateoftheunion/2006/aci/aci06-booklet.pdf

[3] See *Rising Above the Gathering Storm* www.lab.nap.edu/books/0309100399/html/11.html

[4] www.nsf.gov/funding/pgm_summ.jsp?pims_id=12766&org=CISE

[5] See www.cs.yale.edu/homes/jf/tonc-agenda-draft.pdf for what the CS theory community is doing and www.nsf.gov/funding/pgm_summ.jsp?pims_id=13679&org=CCF&from=home for what part of the communications community is doing. ■

Foreigners and Graduate-Level Computer Science in the U.S.

By Jay Vegso

Many science and engineering (S&E) fields in the United States rely heavily on foreign students and workers. Two concerns that have been raised in the press and elsewhere are that improved educational and economic opportunities in other countries might cause both fewer students to choose to study in the US and encourage others to leave after they receive their degrees. While there is new evidence to support these concerns, it is still too early to judge its significance.

Graduate-level CS programs depend on non-US citizens. According to data from the National Science Foundation (NSF), 54 percent of CS doctorate recipients in 2004 held visas.[1] Most of these (95 percent) were temporary visas. Forty-six percent of master's degrees awarded in 2002 were to temporary residents.[2] Among enrollments, 58 percent of full-time graduate students held temporary visas in 2003,[3] as did over half of those enrolled in doctoral programs in 2004/2005.[4]

Most foreigners who receive US doctorates remain in the country: 74 percent of those on temporary visas who graduated with CS PhDs in 2001 were still in the US in 2003. Among all S&E doctorates, 68 percent of the 2001 class was in the US in 2003—compared to a two-year stay rate of 41 percent in 1989. Stay rates for doctorate recipients from China and India, the two countries cited most frequently by those concerned with global competition, are very high. The five-year stay rate for Chinese students with temporary visas who received S&E doctorates in 1998 was 90 percent. It was 86 percent among Indian students.[5]

Where are these PhDs employed? Forty-four percent of CS doctorates working in academic institutions in 2003 were born outside the US, including 46 percent of full-time senior faculty and 53 percent of junior faculty. Tracking foreigners in the overall workforce is more difficult. The NSF estimates that in 2003, 30 percent of those in the workforce who had their highest degree in CS were foreign-born, including 46 percent of those with master's degrees and 57 percent of those with doctorates.[6]

There are hints that the foreign share of graduate-level CS education and employment will level off or decline somewhat in coming years.

About 70 percent of full-time, first-time graduate students enrolled in CS were foreigners in 2000 and 2001. By 2003, however, their representation had declined to 52 percent—a drop of one-third since 2001 in numerical terms (to 4,232). As a result, the number of full-time graduate students in CS with temporary visas fell nearly 13 percent between fall 2002 and 2003, to 18,029. This was in contrast to an average annual growth rate of 16 percent over the previous six years. While the number of foreign students on temporary visas studying CS full time in 2003 was still more than twice what it was in 1996, CS was the only large field to see a significant decline between 2002 and 2003: its losses accounted for two-thirds of the drop in temporary visa holders in S&E fields that had declining enrollments.[7]

Furthermore, survey results from the Institute of International Education indicate that foreign enrollments in computer and information sciences at all degree levels fell by about one-third between 2003/2004 and 2004/2005, to 38,966.[8] It would seem that most of the losses at the graduate level were among master's programs as the CRA Taulbee Survey has not yet revealed a drop in numbers among foreigners studying towards a PhD.

Turning to post-graduation employment, it is only recently that there has been evidence that more degree recipients are seeking jobs outside the US. About 15 percent of the 2004 class of CS PhD recipients had definite plans for employment abroad, compared to roughly 9 percent in each year since 1997. Among those with temporary visas, 25 percent of the 2004 class left the US for employment, compared to less than 20 percent in each of the previous four years.[9] In addition, after several years of increases, the one- and two-year stay rates of the most recent S&E doctorates has leveled off or declined slightly.[10]

As can be seen, there is some evidence of a drop in the share of foreign students who are coming to study in the US and who stay for employment. Nevertheless, it is still too early to tell whether this will have a significant impact on degree production and employment.

Send comments or questions to jvegso@cra.org.

Notes:

1 NSF, Division of Science Resources Statistics, *Science and Engineering Doctorate Awards: 2004*, NSF 06-308, Project Officer, Susan T. Hill (Arlington, VA, 2006).
2 National Science Board, *Science and Engineering Indicators 2006*, NSB 06-01 and NSB 06-01A (Arlington, VA: NSF, 2006).
3 NSF, Division of Science Resources Statistics, *Graduate Students and Postdoctorates in Science and Engineering: Fall 2003*, NSF 06-307, Project Officer, Julia Oliver (Arlington, VA, 2006).
4 CRA Taulbee Survey: http://www.cra.org/statistics.
5 Finn, M., *Stay Rates of Foreign Doctorate Recipients From U.S. Universities*, 2003, (Oak Ridge, TN: Oak Ridge Institute for Science and Education, 2005).
6 National Science Board.
7 NSF, *Graduate Students and Postdoctorates in Science and Engineering: Fall 2003*.
8 *Open Doors 2005: Report on International Educational Exchange*, Hey-Kyung Koh Chin, ed. (New York: Institute of International Education, 2005).
9 NSF, *Science and Engineering Doctorate Awards: 2004*.
10 Finn, op. cit. ■

CRA Announces 2006 Service Award Winners from Page 1

Soffa is active in minority enrollment issues as well. As Dean of Arts and Sciences at University of Pittsburgh she doubled the enrollment of minority students. Since 1992 she has been an active advisor to Florida A&M, a historically black university, where she substantially helped both the university administration and their ABET accreditation. In 1999, Soffa won the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring.

Special Award

On the recommendation of the Distinguished Service Committee, the CRA board approved a special award for **Stuart Zweben** to recognize his outstanding service to the computing research community, with particular attention drawn to the CRA Taulbee Survey. Over many years, this survey has been exceptionally helpful both as a policy-making tool and in improving the conditions of employment of academic computing researchers, thus helping with recruitment and retention in our community.

Zweben is Professor and Associate Dean for Academic Affairs and Administration at Ohio State University's College of Engineering. He served as one of ACM's representatives on the CRA board of directors from 1997-2004, and continues to take a leadership role in the Taulbee Survey. In addition, Professor Zweben has a strong record of involvement in undergraduate education, particularly with ABET, the organization that accredits college and university programs in applied science, computing, engineering, and technology. ■

Transitions, Appointments, and Awards

Congratulations to **Jon Eisenberg** who recently became the new Director of the National Academies Computer Science and Telecommunications Board. Jon has been with CSTB for nearly 9 years, recently serving as Acting Associate Director and previously as study director exploring Internet and broadband policy and networking and communications technologies.

Congratulations to **Mary Jane Irwin**, who was recently appointed as the Evan Pugh Professor at Penn State University. This is considered the highest distinction the university can bestow upon a faculty member.

The University of Washington has announced the appointment of **Henry M. Levy** as Chair of the Computer Science & Engineering Department, effective April 1, 2006. He replaces David Notkin, who has held the position for the past five years.

Donald A. Norman, Professor, Departments of Electrical Engineering and Computer Science, Psychology, and Cognitive Science at Northwestern University, and Co-Founder and Principal, Nielsen Norman Group, Palo Alto, California, received a Benjamin Franklin Medal in Computer and Cognitive Science at a ceremony in Philadelphia on April 27, 2006.

CRA Board Chair **Dan Reed** has been appointed a member of the President's Council of Advisors for Science and Technology. Reed is Vice-Chancellor of IT and CIO for the University of North Carolina, and Director of the Renaissance Computing Institute.

Congratulations to recent winners of **ACM 2005 awards**, including:

Janice Cuny, University of Oregon, **ACM President Award**: For showing us how to help underserved populations as a computer scientist, a parent, a teacher, a civil servant, and a citizen.

Robert S. Boyer, J Strother Moore, and Matt Kaufmann, all at the University of Texas at Austin, **Software System Award**: For pioneering and engineering a most effective theorem prover (named the Boyer-Moore Theorem Prover) as a formal methods tool for verifying safety-critical hardware and software.

Gerard J. Holzmann, NASA's Jet Propulsion Laboratory; **Robert P. Kurshan,** Fellow at Cadence Design Systems**; Moshe Y. Vardi,** Rice University; and **Pierre Wolper**, Universite de Liege, Belgium, **Paris Kenellakis Theory and Practice Award**: For the development of automata-theoretic techniques for reactive-systems verification, and the practical realization of powerful formal-verification tools based on these techniques.

Mary Jane Irwin, Penn State University, **Distinguished Service Award:** for wide-ranging service to the computing community, especially in areas related to professional society leadership and governance.

Edward Lazowska, University of Washington, Seattle, **ACM President Award**: For showing us how to advocate effectively for IT research and advanced education.

Jack Minker, University of Maryland, **Allen Newell Award**: For his contributions to logic-based methods in Computer Science, and his role in organizing and stimulating scientific discourse. ■

Innovation, Competitiveness Plans Advance, But Hurdles Ahead from Page 1

stay in the U.S. after receiving their degrees; and authorizes the increase of DOD basic research (6.1) by 10 percent a year over the next 7 years.

3. PACE Finance (S. 2199)—provides a credit of up to $500,000 annually to employers who provide qualified education to maintain or improve employees' knowledge in science or engineering; doubles and makes permanent the research and development tax credit.

The Senate has begun consideration of the PACE bills. In February, both the Senate Energy and Natural Resources Committee and the Health, Education, Labor and Pensions Committee held hearings on the PACE bills under their jurisdiction (PACE Energy and PACE Education, respectively). In March, the Energy and Natural Resources Committee approved the PACE Energy bill in a markup, clearing the way for that bill's consideration by the full Senate. The PACE Finance bill, which includes the costliest provision of the PACE proposals, the R&D Tax Credit—extending the credit in FY 07 would cost $4.9 billion in federal revenue—is the only PACE bill that has not received consideration so far. Its cost, and the general unwillingness of the Finance Committee to consider making the R&D Tax Credit permanent, makes it the least likely to see further action.

Passage of the original NIA even through the Senate, where it finds many supporters, is likely hampered by its inclusion of a very broad array of legislative provisions covering everything from research funding to tax credits to workforce and immigration issues in one single bill. This "omnibus" approach presents some procedural difficulties, as every congressional committee that can claim jurisdiction over a particular provision receives the bill in referral. The bill cannot move to the full Senate without the approval of every committee to which it has been referred. The PACE bills sidestepped this issue by confining all provisions under a particular jurisdiction under separate bills, resulting in single referrals for each bill.

Nevertheless, the Senate Commerce Committee has begun hearings related to the NIA on the need for continued and increased federal funding for fundamental research. In March, Sen. Ensign used his Senate Commerce Subcommittee on Technology, Innovation and Competitiveness to highlight federally funded basic research, noting "basic research is the key to innovation." Even in tight budget years, Ensign said, policymakers need to fund basic research and infrastructure priorities, which are not a drain on the economy.

Both the NIA and PACE packages are primarily funding authorizations—not actual appropriations—so they will not necessarily result in any new funding. Unfortunately, there is great reluctance among the members of the House leadership to support "big ticket" authorization bills in the current budget climate. House leaders, feeling the need to protect the GOP majority in Congress in preparation for the 2006 congressional elections, are wary of any new "perceived" spending increases that might alienate the conservative voting base, which has been applying great pressure to the leadership to cut discretionary spending since Congress passed the massive emergency payouts in the wake of Hurricanes Katrina and Rita. House staffers have indicated that both bills are unlikely to get much consideration in the House.

Whether funding called for in any of the innovation plans will receive appropriations in FY 2007 is still an open question, however. The highest-profile endorsement of the belief that the Federal Government needs to act now to ensure that the U.S. maintains its dominant position in innovation came when President George W. Bush used his January 2006 "State of the Union" address to announce his American Competitiveness Initiative (see "President's Budget Includes Increases for Fundamental Research, Computing" in *Computing Research News*, vol. 18, No. 2, March 2006, for more details of the ACI). The President included funding for ACI—which would double the research budgets of NSF, NIST and the Department of Energy (DOE) Office of Science over ten years—in the budget he submitted to Congress in February.

The Senate responded favorably to the ACI, including the President's requested funding for ACI in its version of the FY 2007 Congressional Budget Resolution. The House Budget committee, however, was more parsimonious in its support, cutting the President's requested funding for General Science, Space and Technology by $300 million (from $26.3 billion to $26.0 billion) in their version of the budget resolution. [At press time, the full House had not yet considered the budget resolution—for the latest updates see: http://www.cra.org/govaffairs/blog.] In contrast, the Senate included $100 million more than the President requested for the same account.

Whether this slight by the House Budget Committee will impact the final appropriations levels enacted by the Congress is not yet clear. While the Congressional Budget Resolution does determine the total cap on discretionary spending for the appropriators—the President requested $873 billion for FY 2007, the House and Senate will have to agree on a number—its impact on specific appropriations accounts is less direct. Once the appropriators have the cap number (called the 302(a) allocation) they will work among themselves and with the House leadership to determine the share of the total to be distributed to each of the appropriations subcommittees (called the 302(b) allocation). That 302(b) allocation will either enable or hamper supporters of the ACI in appropriating the requested amounts to the key agencies.

Unfortunately for supporters of increased federal funding for basic research at NSF, NIST and DOE Office of Science, the House leadership has not been very vocal in supporting that aspect of the President's ACI. In fact, the leadership has had two opportunities to address the issue in recent days and has demonstrated a decided lack of enthusiasm for incurring any extra spending. First, in response to an event sponsored by House Democratic Leader Nancy Pelosi (D-CA) to highlight the Democratic Innovation Agenda—an agenda markedly similar to the President's ACI—House Majority Leader John Boehner (R-OH) released a statement slamming the Democrats' plan as "just more tax and spend" government. Then, in introducing their own plan, the entire House GOP leadership came together behind the House Republican High-Tech Task Force to announce an innovation plan focused on tort reform, reforms to education, and tax credits—without a mention of research funding.

There is a sense among supporters of the ACI that the House leadership, though outwardly unsupportive of the various "big-ticket" innovation authorizations, will come through with support for the President's request come appropriation time. House leadership staffers have suggested that "ultimately, we'll support the President's budget." Supporters of the ACI should get their first sign of the truth of that suggestion when the 302(b) allocations are made known in mid to late April (after this issue of *CRN* has gone to press). For the latest information on the outcome of this important appropriations milestone, check CRA's Computing Research Policy Blog at http://www.cra.org/govaffairs/blog. ■

Computing Community Consortium (CCC)

The time has come for the computing research community to unite in identifying and formulating large-scale research infrastructure needs that are critical to U.S. competitiveness in Information Technology.

On March 10, 2006 the National Science Foundation (NSF), Directorate for Computer and Information Science and Engineering (CISE) released a solicitation[1] calling for the computing research community to unite in the establishment of a Computing Community Consortium (CCC). The consortium is expected to be broad-based, with member institutions with strong research track records in computer science and engineering. CCC members are not individuals, but rather are comprised of higher education institutions, private and public sector organizations, and industry. CISE will support the CCC in facilitating the conceptualization and design of promising infrastructure-intensive projects identified by the computing research community as scientific "grand challenges" in computing. The CCC will solicit broad community engagement in the identification of compelling research agendas and related shared-use infrastructure requirements.

One of the first responsibilities of the CCC will be to guide the design of the Global Environment for Networking Innovations (GENI). The computing research community is already engaged in the conceptual design of GENI under the leadership of a planning group.[2] GENI is a facility concept[3] that will explore new networking architectures and distributed system services at scale. GENI complements ongoing CISE research investments in networking, distributed systems and other areas. The current "straw man" design of GENI is available at www.geni.net.

An informational meeting and webcast was held on April 3, 2006 at NSF to help clarify CISE's goals and expectations for the CCC. A number of workshops on GENI have taken place, and the first Town Hall meeting was held on March 10, 2006[4] in Arlington, VA. Additional Town Hall meetings are currently being planned. The NSF CISE web site will provide information on past and upcoming meetings.

Cheryl Albus *is a Staff Associate at NSF's CISE Directorate.*

Notes:

1 NSF Solicitation 06-551, entitled "Computing Community Consortium (CCC): Defining the Large-Scale Infrastructure Needs of the Computing Research Community."

2 The GENI Planning Group Members (http://www.geni.net/groups.php).

3 March 2006 *CRN* article entitled, "GENI and *Your* Research" (http://www.cra.org/CRN/articles/march06/freeman.html).

4 National Science Foundation First Town Hall Meeting on GENI – Global Environment for Networking Innovations (http://www.cra.org/nsf.geni/march10). ■

This happy group of first- and second-year grad students were among the 152 who recently attended the third CRA-W Grad Cohort workshop in San Francisco, sponsored by Google and Microsoft Research.

2004-2005 Taulbee Survey

Ph.D. Production at an All-Time High with More New Graduates Going Abroad; Undergraduate Enrollments Again Drop Significantly

By Stuart Zweben

This article and the accompanying figures and tables present the results of the 35th 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 the Computing Research Association to document trends in student enrollment, employment of graduates, and faculty salaries.

Information is gathered during the fall. Responses received by January 9, 2006 are included in the analysis. The period covered by the data varies from table to table. Degree production and enrollment (Ph.D., Master's, and Bachelor's) refer to the previous academic year (2004-2005). Data for new students in all categories refer to the current academic year (2005-2006). Projected student production and information on faculty salaries and demographics also refer to the current academic year. Faculty salaries are those effective January 1, 2006.

The data were collected from Ph.D.-granting departments only. A total of 232 departments were surveyed, three more than last year. As shown in Figure 1, 188 departments returned their survey forms for a response rate of 81%. This is down slightly from last year's ten-year record of 83%, but is still quite comprehensive. The return rate of 10 out of 31 (32%) for CE programs is very low, as has been customary. Many CE programs are part of an Electrical and Computer Engineering (ECE) department and do not keep separate statistics for CE vs. EE. In addition, many of these departments are not aware of the Taulbee Survey or its importance. The response rate for US CS departments (156 of 174, or 90%) again was very good, and there was a good response rate (22 of 27, or 81%) from Canadian departments.

The set of departments responding varies slightly from year to year, even when the total numbers are about the same; thus, we must approach any trend analysis with caution. We must be especially cautious in using the data about CE departments because of the low response rate. However, we continue to report CE departments separately because there are some significant differences between CS and CE departments.

The survey form itself is modified slightly each year to ensure a high rate of return (e.g., by simplifying and clarifying), while continuing to capture the data necessary to understand trends in the discipline and also reflect changing concerns of the computing research community. New features this year include some details about Ph.D. employment outside North America (Table 4), data about numbers of new graduate students from outside North America (Tables 5-1 and 13), information about gender and ethnicity of research faculty and postdocs (Tables 21 and 22), and data about part-time faculty (Table 22-1).

Departments that responded to the survey were sent preliminary results about faculty salaries in December 2005; these results included additional distributional information not contained in this report. The CRA Board views this as a benefit of participating in the survey.

We thank all respondents who completed this year's questionnaire. Departments that participated are listed at the end of this article.

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

During 2004-2005, a total of 1,189 Ph.D. degrees were awarded by the 188 responding departments (Table 1). This is an increase of more than 15% over last year, and represents the highest Ph.D. production reported in a single academic year in the history of the Taulbee Survey. The previous record of 1,113 was set in 1992.

Last year's prediction by the departments that 1,480 Ph.D. degrees would be awarded in 2004-2005 was, as usual, overly optimistic. However, the "optimism ratio," defined as the actual over the predicted, was 0.80, higher than last year's 0.76. Based on previous experiences, the departments' prediction of 1,599 graduates for next year is likely to

Continued on Page 8

Table 2. Gender of PhD Recipients by Type of Degree

	CS		CE		CS&CE	
Male	898	84.9%	100	89.3%	998	85.3%
Female	160	15.1%	12	10.7%	172	14.7%
Total have Gender Data for	**1,058**		**112**		**1,170**	
Unknown	13		6		19	
Total	**1,071**		**118**		**1,189**	

Table 3. Ethnicity of PhD Recipients by Type of Degree

	CS		CE		CS&CE	
Nonresident Alien	531	51.7%	73	70.2%	604	53.4%
African-American, Non-Hispanic	9	0.9%	3	2.9%	12	1.1%
Native American/ Alaskan Native	3	0.3%	0	0.0%	3	0.3%
Asian/Pacific Islander	112	10.9%	7	6.7%	119	10.5%
Hispanic	23	2.2%	0	0.0%	23	2.0%
White, Non-Hispanic	330	32.1%	20	19.2%	350	30.9%
Other/Not Listed	19	1.9%	1	1.0%	20	1.8%
Total have Ethnicity Data for	**1,027**		**104**		**1,131**	
Ethnicity/ Residency Unknown	44		14		58	
Total	**1,071**		**118**		**1,189**	

Figure 1. Number of Respondents to Faculty Salary Questions

Year	US CS Depts.	US CE Depts.	Canadian	Total
1995	110/133 (83%)	9/13 (69%)	11/16 (69%)	130/162 (80%)
1996	98/131 (75%)	8/13 (62%)	9/16 (56%)	115/160 (72%)
1997	111/133 (83%)	6/13 (46%)	13/17 (76%)	130/163 (80%)
1998	122/145 (84%)	7/19 (37%)	12/18 (67%)	141/182 (77%)
1999	132/156 (85%)	5/24 (21%)	19/23 (83%)	156/203 (77%)
2000	148/163 (91%)	6/28 (21%)	19/23 (83%)	173/214 (81%)
2001	142/164 (87%)	8/28 (29%)	23/23 (100%)	173/215 (80%)
2002	150/170 (88%)	10/28 (36%)	22/27 (82%)	182/225 (80%)
2003	148/170 (87%)	6/28 (21%)	19/27 (70%)	173/225 (77%)
2004	158/172 (92%)	10/30 (33%)	21/27 (78%)	189/229 (83%)
2005	156/174 (90%)	10/31 (32%)	22/27 (81%)	188/232 (81%)

Table 1. PhD Production by Type of Department and Rank

Department, Rank	PhDs Produced	Avg. per Dept.	PhDs Next Year	Avg. per Dept.	Passed Qualifier	Avg. per Dept.	Passed Thesis Ex. (# Depts)	Avg. per Dept.
US CS 1-12	231	21.0	262	23.8	265	24.1	153 (7)	21.9
US CS 13-24	147	12.2	191	15.9	281	23.4	156 (11)	14.2
US CS 25-36	129	10.8	177	14.8	189	15.8	119 (11)	10.8
US CS Other	522	5.2	742	6.2	1023	8.6	605 (98)	6.2
Canadian	112	5.1	152	6.9	209	9.5	165 (18)	9.2
US CE	48	6.9	75	7.5	92	9.2	42 (7)	6.0
Total	**1,189**	**6.4**	**1,599**	**8.6**	**2,059**	**11.1**	**1,240 (152)**	**8.2**

2004-2005 Taulbee Survey

yield an actual production in the neighborhood of 1,250. This still would result in another record crop of Ph.D.s.

The number of new students entering Ph.D. programs (Table 5) decreased from 2,887 to 2,749 (5%). This follows an 8% decrease last year and a 5% decrease the previous year. Again this year the decrease is entirely in the U.S. programs, whose new Ph.D. enrollments are down more than 7% (this statement is true even when the less reliable computer engineering data are removed from the U.S. totals). For the second straight year Canadian departments showed a 20% increase in new Ph.D. students. While last year the increase was due to the specific set of schools that reported (whereas individual departments mainly experienced *decreased* enrollments), this year there appears to be an increase in enrollment at most schools.

For the first time, we requested information about the number of new students who come from outside North America. Table 5-1 reports the data for the fall 2005 class. Top-ranked U.S. departments have a somewhat higher fraction of domestic students than do lower-ranked departments, and Canadian departments have a lower percentage of Ph.D. students from outside North America than do their U.S. counterparts. Trends from these data will not be visible for a while, but will be of interest to our community.

The number of students who passed qualifiers (Table 1) decreased during the past year from 2,318 to 2,059 (11%), which follows a 50% increase last year. On a per-department basis, the number passing qualifiers decreased from 12.3 to 11.1, but this still is well above the rate of 6.5 per department five years ago. The number who passed thesis proposal exams (Table 1) rose to 1,240 from 1,025 (21%), on the heels of a 16% increase last year. While the thesis proposal data in this table are less comprehensive than other data about the Ph.D. pipeline, they also suggest a continued increase in Ph.D. production for the short term. Total Ph.D. enrollment (Table 6) decreased slightly, from 14,234 to 13,958 (2%), following two consecutive years of increases in the neighborhood of 20%. If the decreases on the entrance end of the pipeline continue to balance or outweigh the increases at the exit, the increased production currently seen should end after a few years.

Figure 2. PhD **Production**

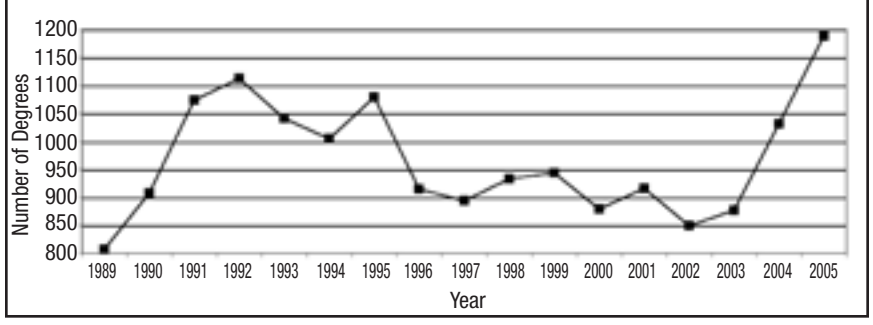

Table 4. Employment of New PhD Recipients By Specialty

	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	
North American PhD-Granting Depts.												
Tenure-track	34	15	1	6	34	19	22	15	20	13	**179**	17.5%
Researcher	10	1	3	1	5	7	7	4	3	4	**45**	4.4%
Postdoc	24	5	2	4	5	8	10	14	6	17	**95**	9.3%
Teaching Faculty	2	0	1	2	7	4	1	6	5	4	**32**	3.1%
											351	34.3%
North American, Other Categories												
Other CS/CE Dept.	12	6	1	5	9	8	9	9	9	4	**72**	7.0%
Non-CS/CE Dept.	3	2	2	0	3	1	2	2	1	1	**17**	1.7%
Industry	41	38	10	21	84	59	30	37	46	39	**405**	39.6%
Government	6	1	2	0	7	2	0	2	2	5	**27**	2.6%
Self-Employed	0	0	0	0	1	2	0	1	0	2	**6**	0.6%
Unemployed	4	0	0	1	1	0	3	3	1	2	**15**	1.5%
Other	0	0	0	0	2	0	1	2	1	4	**10**	1.0%
											552	53.9%
Outside North America												
Tenure-Track in PhD-Granting Depts.	6	1	1	3	6	5	4	2	4	6	**38**	3.7%
Researcher in PhD	3	0	0	1	1	0	2	0	0	0	**7**	0.7%
Postdoc in PhD	6	0	1	0	2	0	1	1	1	0	**12**	1.2%
Teaching in PhD	1	0	0	0	1	1	0	1	1	0	**5**	0.5%
Other Academic	2	0	0	1	2	0	1	0	2	1	**9**	0.9%
Industry	8	6	1	3	5	0	3	1	3	1	**31**	3.0%
Government	1	1	0	0	1	2	1	0	1	1	**8**	0.8%
Other	0	0	1	1	2	1	3	1	2	0	**11**	1.1%
											121	11.8%
Total in North America	**136**	**68**	**22**	**40**	**158**	**110**	**85**	**95**	**94**	**95**	**903**	88.2%
Total Outside North America	**27**	**8**	**4**	**9**	**20**	**9**	**15**	**6**	**14**	**9**	**121**	11.8%
Total have Employment Data for	163	76	26	49	178	119	100	101	108	104	**1,024**	100.0%
Unknown	9	3	1	2	18	8	9	12	9	94	**165**	
Total	**145**	**71**	**23**	**42**	**176**	**118**	**94**	**107**	**103**	**189**	**1,189**	

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Table 5. New PhD Students in Fall 2005 by Department Type and Rank

Department, Rank	CS				CE				CS&CE	
	New Admit	MS to PhD	Total	Avg. per Dept.	New Admit	MS to PhD	Total	Avg. per Dept.	Total	Avg. per Dept
US CS 1-12	336	18	354	32.2	0	0	0	0.0	354	32.2
US CS 13-24	239	33	272	22.7	7	9	16	1.3	288	24.0
US CS 25-36	264	25	289	24.1	0	0	0	0.0	289	26.3
US CS Other	1,074	257	1,331	11.2	121	32	153	1.3	1,484	12.2
Canadian	242	31	273	12.4	16	0	16	0.8	289	13.8
US CE	0	0	0	0.0	44	1	45	5.6	45	5.6
Total	**2,155**	**364**	**2,519**	13.5	**188**	**42**	**230**	1.2	**2,749**	**14.9**

Table 5-1. New PhD Students from Outside North America

Department, Rank	CS	CE	CS & CE	Total New	% Outside North America
US CS 1-12	170	0	170	354	48.0%
US CS 13-24	122	6	128	288	44.4%
US CS 25-36	162	0	162	289	56.1%
US CS Other	708	87	795	1,484	53.6%
Canadian	102	9	111	289	38.4%
US CE	0	31	31	45	68.9%
Total	**1,264**	**133**	**1,397**	**2,749**	50.8%
Total New	2,519	230	**2,749**		
% Outside North America	50.2%	57.8%	50.8%		

Table 6. PhD Degree Total Enrollment by Department Type and Rank

Department, Rank	CS		CE		CS&CE	
US CS 1-12	2,032	16.0%	0	0.0%	2,032	14.6%
US CS 13-24	1,644	13.0%	18	1.4%	1,662	11.9%
US CS 25-36	1,503	11.9%	0	0.0%	1,503	10.8%
US CS Other	6,266	49.5%	759	58.8%	7,025	50.3%
Canadian	1,222	9.6%	125	9.7%	1,347	9.7%
US CE	0	0.0%	389	30.1%	389	2.8%
Total	**12,667**		**1,291**		**13,958**	

Table 7. PhD Program Total Enrollment by Gender

	CS		CE		CS&CE	
Male	10,001	79.6%	1,061	82.5%	11,062	79.9%
Female	2,566	20.4%	225	17.5%	2,791	20.1%
Total have Gender Data for	**12,567**		**1,286**		**13,853**	
Unknown	100		5		105	
Total	**12,667**		**1,291**		**13,958**	

Figure 3 shows the longer-term trend of the number of CS Ph.D. graduates, normalized by the number of departments reporting to the Taulbee Survey. The figure also indicates the number of new students entering Ph.D. programs and the number of students who passed qualifiers. These also are normalized for the number of departments reporting. The graph offsets the qualifier data by one year from the data for new students, and offsets the graduation data by five years from the data for new students, to approximate the lag between student entrance into the pipeline and the qualifier and exit timeframe for the same cohort. This figure may be useful in predicting the timing of changes in Ph.D. production rates.

Table 4 shows employment for new Ph.D. recipients. Of those who reported employment, 43% took academic employment in North America (compared to 60% last year and 63% the year before). Most of these academic positions again were in Ph.D.-granting departments, and once again a smaller percentage went into tenure-track positions (17.5% vs. 27.5% last year and 34.2% the year before). There was a significant increase this year in the number who went to other CS/CE departments (72 vs. 31 in each of the past two years). Perhaps the increased total Ph.D. production, coupled with

Continued on Page 10

Figure 3. CS Pipeline corrected for year of entry

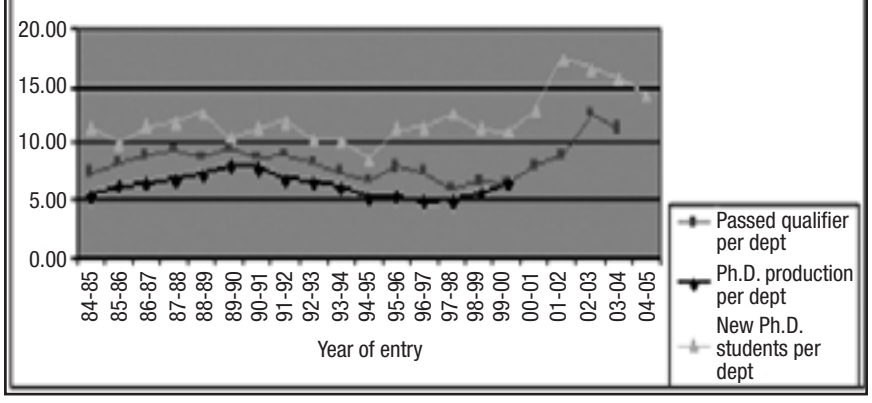

Figure 4. Employment of New Ph.D.s in U.S. and Canada

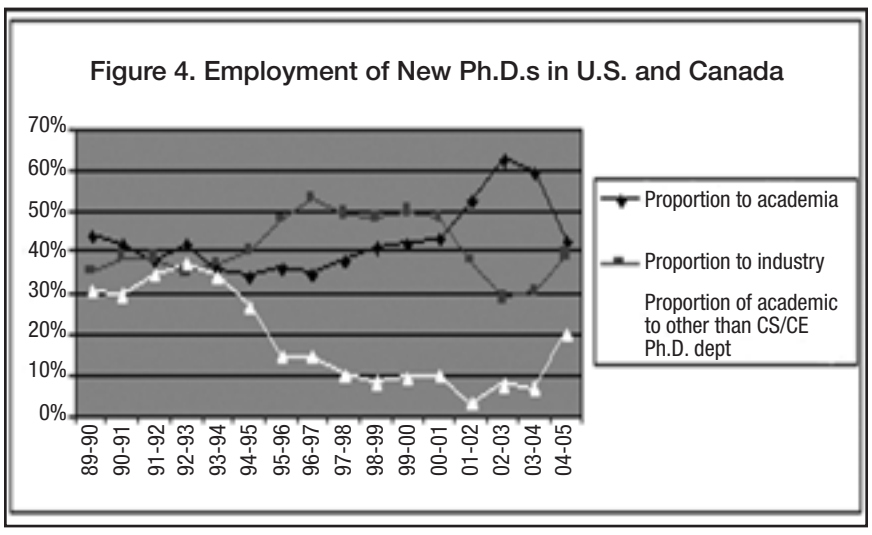

Figure 5. Nonresident Aliens as Fraction of Ph.D. Enrollments

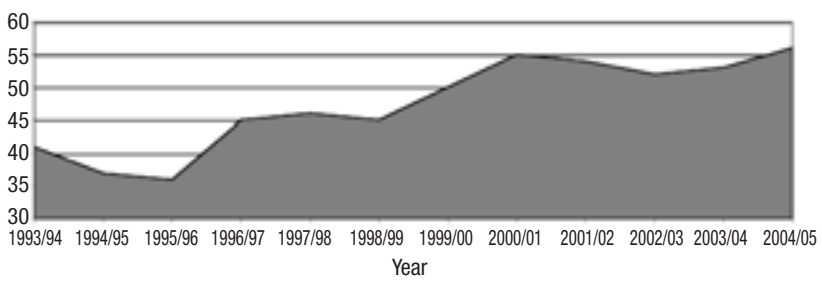

Figure 6. BS Production

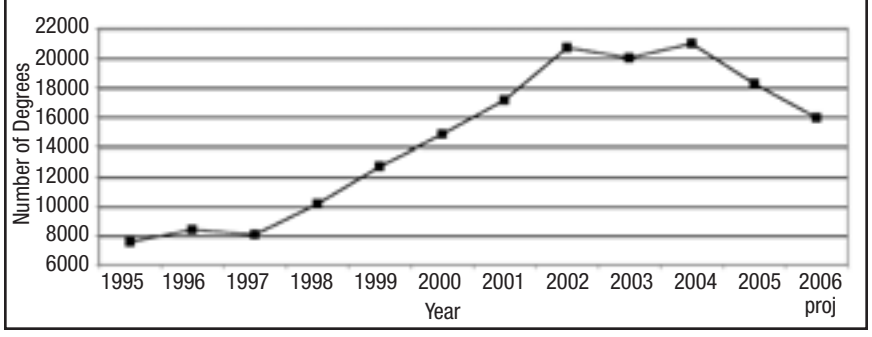

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Table 8. PhD Program Total Enrollment by Ethnicity

	CS		CE		CS&CE	
Nonresident Alien	6,295	53.7%	845	74.8%	7,140	55.6%
African-American, Non-Hispanic	160	1.4%	22	1.9%	182	1.4%
Native American/ Alaskan Native	33	0.3%	1	0.1%	34	0.3%
Asian/Pacific Islander	1,234	10.5%	39	3.5%	1,273	9.9%
Hispanic	131	1.1%	11	1.0%	142	1.1%
White, Non-Hispanic	3,663	31.2%	200	17.7%	3,863	30.1%
Other/Not Listed	206	1.8%	11	1.0%	217	1.7%
Total have Ethnicity Data for	**11,722**		**1,129**		**12,851**	
Ethnicity/Residency Unknown	945		162		1,107	
Total	**12,667**		**1,291**		**13,958**	

the modest growth rate of faculty in Ph.D.-granting departments (discussed later in this report), is making it possible for non-Ph.D.-granting CS/CE departments to obtain a larger share of the supply of new Ph.D.s.

This year there was a decrease (from 122 to 95) in the number of postdoctoral positions taken by new Ph.D.s. This is the opposite of the situation last year, and the number of new graduates taking postdoctoral positions this year is comparable to that of two years ago. Interestingly, the total number of postdocs in the academic departments (309, see Table 17) actually rose slightly (from 295 last year), suggesting a multi-year nature to most postdoctoral assignments.

Figure 4 shows the employment trend of new Ph.D.s to academia and industry, and the proportion of those going to academia who took positions in other than Ph.D.-granting CS/CE departments. During the past two years, the gap has been closed between those taking academic jobs and those taking industry jobs, as economic conditions in industry improve. The situation still is not what it was during the dot-com boom years when industry employment exceeded that of academia.

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

	Bachelor's						Master's					
	CS		CE		CS&CE		CS		CE		CS&CE	
Male	12,277	84.9%	2,548	87.6%	14,825	85.3%	6,175	74.5%	660	81.3%	6,835	75.1%
Female	2,186	15.1%	360	12.4%	2,546	14.7%	2,115	25.5%	152	18.7%	2,267	24.9%
Total have Gender Data for	**14,463**		**2,908**		**17,371**		**8,290**		**812**		**9,102**	
Unknown	674		187		861		176		8		184	
Total	**15,137**		**3,095**		**18,232**		**8,466**		**820**		**9,286**	

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

	Bachelor's						Master's					
	CS		CE		CS&CE		CS		CE		CS&CE	
Nonresident Aliens	1,082	9.9%	233	10.0%	1,315	9.9%	3,790	50.7%	414	56.9%	4,204	51.2%
African-American, Non-Hispanic	358	3.3%	106	4.5%	464	3.5%	151	2.0%	14	1.9%	165	2.0%
Native American/ Alaskan Native	31	0.3%	8	0.3%	39	0.3%	27	0.4%	3	0.4%	30	0.4%
Asian/Pacific Islander	2,279	20.9%	435	18.6%	2,714	20.5%	1,094	14.6%	79	10.9%	1,173	14.3%
Hispanic	479	4.4%	96	4.1%	575	4.3%	152	2.0%	11	1.5%	163	2.0%
White, Non-Hispanic	6,482	59.5%	1,406	60.2%	7,888	59.6%	2,112	28.2%	197	27.1%	2,309	28.1%
Other/Not Listed	189	1.7%	53	2.3%	242	1.8%	156	2.1%	9	1.2%	165	2.0%
Total have Ethnicity Data for	**10,900**		**2,337**		**13,237**		**7,482**		**727**		8,209	
Ethnicity/Residency Unknown	4,237		758		**4,995**		984		93		1,077	
Total	**15,137**		**3,095**		**18,232**		**8,466**		**820**		9,286	

Table 11. Bachelor's Degree Candidates for 2005-2006 by Department Type and Rank

Department, Rank	CS		CE		CS&CE	
US CS 1-12	1,414	10.7%	183	6.8%	1,597	10.0%
US CS 13-24	995	7.5%	259	9.6%	1,254	7.9%
US CS 25-36	1,495	11.3%	0	0.0%	1,495	9.4%
US CS Other	6,630	50.1%	1,413	52.4%	8,043	50.5%
Canadian	2,599	19.7%	253	9.4%	2,852	17.9%
US CE	88	0.7%	586	21.8%	674	4.2%
Total	**13,221**		**2,694**		**15,915**	

Table 12. Master's Degree Candidates for 2005-2006 by Department Type and Rank

Department, Rank	CS		CE		CS&CE	
US CS 1-12	767	10.4%	80	13.1%	847	10.6%
US CS 13-24	909	12.4%	6	1.0%	915	11.5%
US CS 25-36	499	6.8%	0	0.0%	499	6.3%
US CS Other	4,289	58.4%	367	59.9%	4,656	58.5%
Canadian	884	12.0%	55	9.0%	939	11.8%
US CE	2	0.0%	105	17.1%	107	1.3%
Total	**7,350**		**613**		**7,963**	

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Table 13. New Master's Students in Fall 2005 by Department Type and Rank

Department, Rank	CS Total	CS Avg. per Dept.	CE Total	CE Avg. per Dept.	CS&CE		Outside North America Total	Outside North America %
US CS 1-12	555	50.5	45	4.1	600	54.5	255	42.5%
US CS 13-24	712	59.3	6	0.5	718	59.8	369	51.4%
US CS 25-36	316	26.3	0	0.0	316	26.3	203	64.2%
US CS Other	3,161	26.6	255	2.1	3,416	28.7	1,605	47.0%
Canadian	744	32.3	67	2.9	811	35.3	288	35.5%
US CE	2	0.2	88	8.8	90	9.0	45	50.0%
Total	**5,490**		**461**		**5,951**	**31.8**	2,765	46.5%

Table 14. New Undergraduate Students in Fall 2005 by Department Type and Rank

Department, Rank	CS Pre-Major	CS Major	CS Avg. Major per Dept.	CE Pre-Major	CE Major	CE Avg. Major per Dept.	CS&CE Majors Major	CS&CE Majors Avg. Major per Dept.
US CS 1-12	192	834	69.5	3	152	25.3	986	82.2
US CS 13-24	125	533	48.5	0	200	28.6	733	66.6
US CS 25-36	251	1,107	123.0	0	0	0.0	1,107	123.0
US CS Other	2,208	5,478	51.2	1,013	1,257	21.3	6,735	62.9
Canadian	350	2,002	100.1	63	420	46.7	2,422	121.1
US CE	54	31	31.0	148	518	51.8	549	54.9
Total	**3,180**	**9,985**		**1,227**	**2,547**		**12,532**	**74.2**

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

Department, Rank	CS		CE		CS&CE	
US CS 1-12	1,276	6.9%	73	5.0%	1,349	6.7%
US CS 13-24	1,795	9.7%	7	0.5%	1,802	9.0%
US CS 25-36	684	3.7%	0	0.0%	684	3.4%
US CS Other	12,105	65.3%	853	58.3%	12,958	64.8%
Canadian	2,650	14.3%	219	15.0%	2,869	14.3%
US CE	25	0.1%	311	21.3%	336	1.7%
Total	**18,535**		**1,463**		**19,998**	

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

Department, Rank	CS Pre-Major	CS Major	CS Avg. Major per Dept.	CE Pre-Major	CE Major	CE Avg. Major per Dept.	CS&CE Majors Total	CS&CE Majors Avg. Major per Dept.
US CS 1-12	330	4,227	352.2	0	492	70.3	4,719	393.3
US CS 13-24	229	3,287	273.9	0	1,065	152.1	4,352	362.7
US CS 25-36	520	4,379	437.9	0	0	0.0	4,379	437.9
US CS Other	5,167	28,690	256.2	1,411	5,138	85.6	33,828	302.0
Canadian	442	15,684	746.9	202	1,225	136.1	16,909	805.2
US CE	132	183	183.0	252	2,026	202.6	2,209	220.9
Total	**6,820**	**56,450**	**318.9**	**1,865**	**9,946**	**56.2**	**66,396**	**375.1**

Despite increased Ph.D. production, the proportion of new graduates who are reported as unemployed is a very low 1.5% and the proportion reported as "employment unknown" is similar to that of earlier years. However, the proportion (11.8%) of Ph.D. graduates who were reported taking positions outside North America, among those whose employment is known, is considerably greater than at any time since the mid-90s (it was 4.5% last year, and ranged from 3.0% to 5.4% during the past eight years). This is the first evidence within the Taulbee Survey that globalization and offshoring is moving new graduates of Ph.D. programs away from the United States and Canada. It should be noted, however, that this survey question was changed this year to request more detailed information, and therefore some part of the reported increase in employment outside North America may be due to response differences.

The data in Table 4 also indicate the areas of specialty of new CS/CE Ph.D.s. Year-to-year fluctuations among these data are common. Multi-year trends are difficult to discern, though during the past decade the AI/robotics and programming languages/compiler areas generally have been on a declining trend, while the graphics/HCI area generally has been on an increasing trend.

The proportion of women among new Ph.D.s dropped from 18.0% in 2004 to 14.7% in 2005 (Table 2). The proportion of nonresident alien Ph.D.s rose from 48.2% in 2004 to 53.4% in 2005 (Table 3). There was an offsetting drop in the proportion of white, non-Hispanic and Asian/Pacific Islanders. African-American, Native-American/Alaskan Native, and Hispanics collectively accounted for only 3.4% of the total, up slightly from 2.6% last year. The difference is mainly attributable to an increase in the proportion of Hispanics.

Current Ph.D. enrollment proportions are almost the same this year as last. However, there is a slight increase in the proportion of nonresident aliens in the Ph.D. programs (55.6% vs. 52.8% last year), and a slight decrease in the proportion of Asian/Pacific Islanders. This is despite the reports of declining applications from abroad to Ph.D. programs, at least in the United States. African-American and Hispanic proportions remain dismal, in the 1% to 2% range, and the proportion of Native Americans is even lower.

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

Master's degree production (Tables 9, 10) totaled 9,286 students, a decrease of 6% (following an increase of 8% the previous year). This is reasonably consistent with the 8% drop in new Master's students two years ago. There also was a 17% drop in new Master's students reported in last year's survey. There was very little difference in gender and ethnicity characteristics of Master's recipients compared to last year's survey. Actual Master's degrees awarded exceeded last year's projections by only 10%, compared to a 21% underestimate the previous year. This year's enrollment figures for Master's programs (Table 13) are about 2.5% greater than those of last year, while expected Master's production (Table 12) is 5% to 6% below last year's expectations. As we did with new Ph.D. students, this year we are able to report (Table 13) the count and proportion of new Master's students coming from outside North America. Among the 36 top-ranked U.S. departments the same trend noted among new Ph.D. students was observed, with top departments having a greater proportion of new domestic Master's students than lower-ranked departments. However, this trend was not evident for departments not ranked in the top 36. Canadian departments had a smaller proportion of non-North American new Master's students than did their U.S. counterparts, consistent with the observations for new Ph.D. students.

There were 18,232 Bachelor's degrees awarded in 2004-05 (Tables 9 and 10), a 13% decrease compared to last year (following last year's 5% increase that was explained totally by the additional number of departments reporting compared to the previous year).

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2004-2005 Taulbee Survey

Table 17. Actual and Anticipated Faculty Size by Position

	Actual	Projected		Expected Two-Year Growth	
	2005-2006	2006-2007	2007-2008		
Tenure-Track	4,532	4,766	4,947	415	9.2%
Researcher	426	486	538	112	26.3%
Postdoc	309	368	424	115	37.2%
Teaching Faculty	728	747	828	100	13.7%
Other/Not Listed	105	108	115	10	9.5%
Total	**6,100**	**6,475**	**6,852**	**752**	**12.3%**

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

	Actual	Projected		Expected Two-Year Growth	
	2005-2006	2006-2007	2007-2008		
US CS 1-12	749	782	810	61	8.1%
US CS 13-24	552	605	643	91	16.5%
US CS 25-36	524	568	608	84	16.0%
US CS Other	3,130	3,329	3,493	363	11.6%
Canadian	961	982	1,070	109	11.3%
US CE	184	208	229	45	24.5%
Total	**6,100**	**6,474**	**6,853**	**753**	**12.3%**

Table 19. Gender of Newly Hired Faculty

	Tenure-track		Researcher		Postdoc		Teaching Faculty		Total	
Male	175	78.8%	31	77.5%	72	81.8%	37	68.5%	315	78.0%
Female	47	21.2%	9	22.5%	16	18.2%	17	31.5%	89	22.0%
Total	**222**		**40**		**88**		**54**		**404**	

Graduation figures are now starting to reflect the results of the significantly decreased enrollments in our undergraduate programs that have been observed in the past two surveys and reported widely in the media. On top of the decreased overall production, there was a decreasing proportion of female Bachelor's degrees, from 17.0% in 2003-04 to 14.7% in 2004-05. There also was an increase, from 54.4% to 59.6%, in the proportion of white, non-Hispanics receiving Bachelor's degrees, and a slight decrease in the proportion of Asian/Pacific Islanders receiving these degrees. These statistics indicate a continuing, and even increasing, diversity problem within our discipline.

Actual Bachelor's degree production in departments reporting this year was below the projection from last year's reporting departments by more than 7%. Projected Bachelor's production for this year (Table 11) would forecast another 13% decrease, which is believable given the continued drop in enrollment.

The number of new undergraduate majors dropped another 21%, from 15,950 to 12,532 (see Table 14 and Figure 7). This follows last year's 10% drop in new majors and a 23% drop the year before that. Accounting for the fact that more departments are reporting to the survey now than did three years ago, we effectively have seen a halving of the number of new majors entering our programs over a three-year period. Total enrollment in Bachelor's programs (Table 16) is down nearly 14% from last year and 30% compared to three years ago.

The number of new pre-majors in computer science is once again down considerably from last year (24%, following a 20% drop last year), although the number of pre-majors in computer engineering rose by 21% this year. Because computer science programs dominate our survey, the net effect of these two changes is a decrease of 15% in total pre-major counts. It therefore is likely that the decreases in the number of undergraduate majors, at least in our computer science programs, will continue for another year.

Faculty Demographics *(Tables 17-23)*

Total faculty sizes continued to grow, at a 3% rate during the past year. Almost all of this increase is due

Table 20. Ethnicity of Newly Hired Faculty

	Tenure-Track		Researcher		Postdoc		Teaching Faculty		Total
Nonresident Alien	54	25.8%	9	25.0%	40	48.8%	7	14.0%	**110**
African-American, Non-Hispanic	4	1.9%	0	0.0%	1	1.2%	0	0.0%	**5**
Native American/ Alaskan Native	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0**
Asian/Pacific Islander	55	26.3%	8	22.2%	14	17.1%	6	12.0%	**83**
Hispanic	3	1.4%	0	0.0%	0	0.0%	0	0.0%	**3**
White, Non-Hispanic	91	43.5%	19	52.8%	27	32.9%	37	74.0%	**174**
Other/Not Listed	2	1.0%	0	0.0%	0	0.0%	0	0.0%	**2**
Total have Ethnicity Data for	**209**		**36**		**82**		**50**		**377**
Ethnicity/Residency Unknown	13		4		6		4		**27**
Total	**222**		**40**		**88**		**54**		**404**

Table 21. Gender of Current Faculty

	Full		Associate		Assistant		Teaching Faculty		Research Faculty		Postdocs		Total	
Male	1,724	90.2%	1,117	87.5%	1,127	82.7%	542	73.3%	325	84.2%	239	83.3%	**5,074**	**85.1%**
Female	187	9.8%	159	12.5%	236	17.3%	197	26.7%	61	15.8%	48	16.7%	**888**	**14.9%**
Total	**1,911**		**1,276**		**1,363**		**739**		**386**		**287**		5,962	

2004-2005 Taulbee Survey

Table 22. Ethnicity of Current Faculty

	Full		Associate		Assistant		Teaching Faculty		Research Faculty		Postdocs		Total	
Nonresident Alien	13	0.8%	29	2.6%	216	18.2%	21	3.1%	43	13.4%	117	45.3%	**439**	8.4%
African-American, Non-Hispanic	7	0.4%	12	1.1%	23	1.9%	11	1.6%	0	0.0%	3	1.2%	**56**	1.1%
Native American/ Alaskan Native	3	0.2%	3	0.3%	2	0.2%	0	0.0%	0	0.0%	0	0.0%	**8**	0.2%
Asian/Pacific Islander	361	21.8%	231	20.9%	316	26.6%	54	8.1%	44	13.8%	46	17.8%	**1,052**	20.2%
Hispanic	21	1.3%	20	1.8%	25	2.1%	17	2.5%	2	0.6%	5	1.9%	**90**	1.7%
White, Non-Hispanic	1,225	73.9%	799	72.3%	590	49.7%	547	81.8%	227	70.9%	75	29.1%	**3,463**	66.6%
Other/Not Listed	27	1.6%	11	1.0%	16	1.3%	19	2.8%	4	1.3%	12	4.65%	**89**	1.7%
Total Have Ethnicity Data For	**1,657**		**1,105**		**1,188**		**669**		**320**		**258**		**5,197**	
Ethnicity/ Residency Unknown	254		171		175		70		66		29		**765**	
Total	**1,911**		**1,276**		**1,363**		**739**		**386**		**287**		**5,962**	

Table 22-1. Part-Time Faculty

	Total
Full Professor	76
Associate Professor	26
Assistant Professor	28
Teaching Faculty	295
Research Faculty	19
Postdoctorate	6
Total	450

Table 23. Faculty Losses

	Total
Died	8
Retired	56
Took Academic Position Elsewhere	61
Took Nonacademic Position	39
Remained, but Changed to Part-Time	16
Other	25
Unknown	8
Total	**213**

Table 24-1. Total Expenditure from External Sources for CS/CE Research

Department, Rank	Total Expenditure			
	Minimum	Mean	Median	Maximum
US CS 1-12	$2,100,000	$19,558,466	$12,727,000	$81,813,953
US CS 13-24	$4,864,064	$9,698,921	$8,888,557	$16,455,614
US CS 25-36	$476,139	$5,654,788	$4,228,057	$14,882,518
US CS Other	$29,216	$2,435,166	$1,835,071	$16,976,756
Canadian	$81,885	$2,841,403	$2,253,827	$7,582,696
US CE	$319,449	$2,466,187	$2,567,185	$5,732,972

Making Waves

Grace Hopper Celebration of Women in Computing

2006 Conference

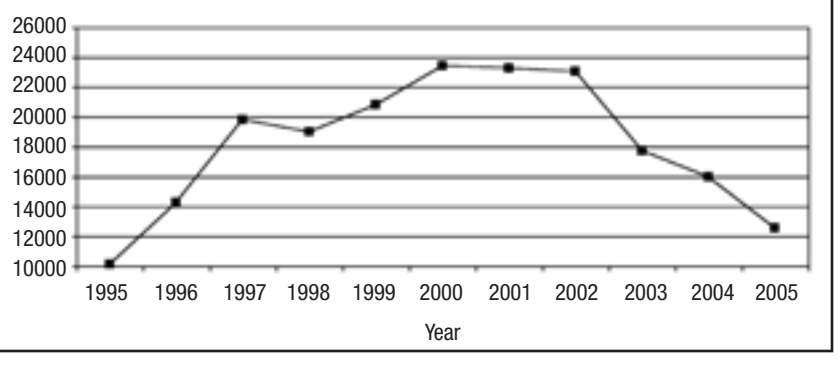
October 4-7, 2006—San Diego, California

Details: http://www.gracehopper.org/

Table 24-2. Per Capita Expenditure from External Sources for CS/CE Research by Department Rank and Type

Department, Rank	Per Capita Expenditure (Tenure-Track Faculty Only)				Per Capita Expenditure (Tenure-Track, Research, and Postdoctorate Faculty)			
	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum
US CS 1-12	$105,000	$390,215	$353,024	$1,038,248	$72,414	$300,890	$284,886	$608,187
US CS 13-24	$151,497	$327,558	$315,954	$806,170	$130,601	$246,914	$203,912	$571,037
US CS 25-36	$25,060	$167,700	$190,824	$311,111	$22,673	$137,601	$141,013	$246,940
US CS Other	$2,679	$118,205	$93,324	$679,070	$2,679	$103,185	$86,933	$585,405
Canadian	$2,641	$72,480	$68,432	$164,841	$2,641	$65,056	$62,062	$135,405
US CE	$19,310	$227,028	$112,538	$796,246	$18,667	$177,445	$111,617	$562,056

Figure 7. Newly Declared CS/CE Undergraduate Majors



to the 4% growth in tenure-track faculty, the dominant category. Other faculty categories are relatively flat compared to last year.

Table 4 shows 351 new Ph.D. graduates known to have taken faculty positions at CS/CE Ph.D.-granting departments. Tables 19 and 20 indicate that a total of 404 persons were hired during the past year. Thus, over 85% of the faculty hires made this past year by Ph.D.-granting CS/CE departments appear to have been new Ph.D.s (about 10% higher than last year), with the rest a combination of faculty who changed academic position, persons joining academia from government and industry, new Ph.D.s from outside of North America and from disciplines outside of CS/CE, and non-Ph.D.-holders (e.g., taking a teaching faculty appointment). As was the case last year, the fraction of tenure-track hires who were new Ph.D.s appears to be over 80% (179 new Ph.D.s taking tenure-track faculty positions at Ph.D.-granting programs, and 222 new tenure-track faculty members hired by these programs).

This year's 3% growth in total faculty size falls short of the 6% growth predicted by departments in last year's survey. After two

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

Department, Rank	Number on Institutional Funds										Number on External Funds									
	Teaching Assistants		Research Assistants		Full-Support Fellows		Graduate Assistants for Computer Systems Support		Other		Teaching Assistants		Research Assistants		Full-Support Fellows		Graduate Assistants for Computer Systems Support		Other	
US CS 1-12	354	18.6%	393	20.6%	130	6.8%	0	0.0%	18	0.9%	0	0.0%	823	43.2%	169	8.9%	0	0.0%	18	0.9%
US CS 13-24	262	18.5%	232	16.4%	105	7.4%	14	1.0%	11	0.8%	0	0.0%	768	54.2%	20	1.4%	0	0.0%	4	0.3%
US CS 25-36	298	24.7%	65	5.4%	49	4.1%	4	0.3%	6	0.5%	1	0.1%	728	60.4%	40	3.3%	0	0.0%	15	1.2%
US CS Other	1,806	36.1%	599	12.0%	149	3.0%	63	1.3%	55	1.1%	73	1.5%	2,101	42.0%	111	2.2%	16	0.3%	26	0.5%
Canadian	606	45.1%	439	32.6%	17	1.3%	15	1.1%	49	3.6%	9	0.7%	123	9.1%	83	6.2%	0	0.0%	4	0.3%
US CE	66	20.6%	21	6.6%	16	5.0%	4	1.3%	2	0.6%	0	0.0%	202	63.1%	7	2.2%	0	0.0%	2	0.6%
Total	**3,392**	30.3%	**1,749**	15.6%	**466**	4.2%	**100**	0.9%	**141**	1.3%	**83**	0.7%	**4,745**	42.4%	**430**	3.8%	**16**	0.1%	**69**	0.6%

Table 26-1. Fall 2005 Academic-Year Graduate Stipends by Department Type and Rank

Department, Rank	Teaching Assistantships				Research Assistantships			
	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum
US CS 1-12	$9,600	$15,570	$15,516	$19,238	$14,814	$17,846	$16,900	$25,800
US CS 13-24	$14,396	$19,013	$17,746	$30,166	$11,991	$19,782	$18,333	$35,326
US CS 25-36	$11,947	$15,353	$14,300	$21,174	$13,724	$16,052	$15,176	$21,366
US CS Other	$1,000	$13,261	$13,455	$26,100	$1,300	$14,234	$14,256	$26,100
Canadian	$3,500	$9,926	$9,800	$18,000	$5,100	$14,353	$14,242	$22,500
US CE	$1,672	$12,723	$14,750	$17,160	$1,527	$14,712	$15,800	$19,500

Table 26-2. Fall 2005 Academic-Year Graduate Stipends by Department Type and Rank

Department, Rank	Full-Support Fellows				Assistantships for Computer Systems Support			
	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum
US CS 1-12	$16,328	$19,151	$18,875	$25,800	*	*	*	*
US CS 13-24	$4,750	$18,783	$18,166	$30,000	$15,908	$22,602	$18,368	$37,764
US CS 25-36	$13,814	$17,216	$16,624	$25,000	*	*	*	*
US CS Other	$1,001	$17,911	$16,682	$60,000	$1,150	$11,974	$12,000	$26,100
Canadian	$12,500	$23,316	$21,000	$40,000	$11,806	$17,935	$20,000	$22,000
US CE	$1,944	$16,432	$18,375	$24,000	*	*	*	*

*Numbers not reported due to low number of respondents

Table 26-3. Fall 2005 Academic-Year Graduate Stipends by Department Type and Rank

Department, Rank	Other Assistantships			
	Minimum	Mean	Median	Maximum
US CS 1-12	$14,737	$20,279	$19,100	$27,000
US CS 13-24	$1,642	$15,109	$18,148	$22,500
US CS 25-36	*	*	*	*
US CS Other	$1,001	$10,515	$9,500	$22,992
Canadian	$1,125	$7,159	$6,000	$14,570
US CE	*	*	*	*

*Numbers not reported due to low number of respondents

consecutive years of good predictions in this regard, over-optimism has crept back in. Thus, this year's prediction of 6% growth in total faculty size should be viewed with an appropriate degree of realism.

Table 23 on faculty "losses" shows an increase, from 75 last year to 103 (though less than 2% of all faculty), in the number who left academia this past year through death, retirement, or taking nonacademic positions. The retirement number went from 45 to 56. The amount of "churn," the number of professors moving from one academic position to another, dropped from 87 to 61.

The percentage of newly hired women faculty rose to 22% from 17% last year. This compares favorably with the 15% proportion of new female Ph.D.s shown in Table 2. A similar situation is noted when considering only new tenure-track faculty hires. The percentage of newly hired postdoctoral students who are women rose to 18% this year from 15% last year.

Ethnicity data for newly hired faculty, in general, mirror the trends in the production of new Ph.D.s relative to the various ethnicity categories. The proportion of white, non-Hispanic hires decreased, while the proportion of nonresident aliens increased. However, the proportion of Asian/Pacific Islanders hired increased, while the proportion receiving Ph.D.s decreased. As has been observed for the past few years, disproportionally fewer nonresident aliens are being hired into tenure-track faculty positions (26%) compared to nonresident aliens' proportion of the new Ph.D.s produced (53.4%). The increased proportion of new Ph.D.s taking jobs abroad (reported earlier) no doubt is contributing to the widening of this gap from previous years.

This year, Tables 21 and 22 also show gender and ethnicity data of current research faculty and postdocs. Also new this year is Table 22-1, which reports data on part-time faculty.

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

Table 24-1 shows the department's total expenditure (including indirect costs or "overhead" as stated on project budgets) from external sources of support. Table 24-2 shows the per capita expenditure, where capitation is computed two ways. The first is relative to the number of tenured and tenure-track faculty members, which also was the method used prior to last year's survey. The second is relative to researchers and postdocs as well as tenured and tenure-track faculty. The higher the ranking, the more external funding is received by the department (both in total and per capita). Canadian levels are shown in Canadian dollars.

The data show some interesting and perhaps surprising features this year. Mean and median expenditures, both in total and on a per capita basis (no matter which capitation method is used), actually declined for the U.S. top 12 departments and for departments ranked 25-36. Double-digit percent decreases were frequent among these groups. Means and median expenditures for departments ranked 13-24 and Canadian schools typically showed double-digit increases in total and per capita (though the maximum value among the Canadian schools declined),

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Table 27. Nine-month Salaries, 156 Responses of 174 US CS Computer Science Departments

Faculty Rank, Tenured and Tenure-Track	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Full Professor	1,475	$68,757	$95,805	$140,996	$118,401	$115,376	$86,832	$154,800	$402,773
Associate Professor	973	$44,850	$81,176	$129,000	$91,131	$90,993	$69,353	$101,668	$161,490
Assistant Professor	1,076	$43,024	$77,077	$109,250	$82,303	$82,144	$69,870	$87,360	$141,833
Non-Tenure-Track									
Teaching Faculty	593	$22,000	$51,392	$110,705	$60,880	$60,246	$24,000	$71,646	$163,000
Research Faculty	271	$24,000	$61,544	$115,000	$74,947	$72,034	$30,000	$94,278	$200,000
Postdoctorates	185	$24,000	$44,145	$75,000	$47,817	$47,404	$24,000	$52,618	$80,000

Table 28. Nine-month Salaries, 10 Responses of 12 US CS Computer Science Departments Ranked 1-12

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Full Professor	237	$87,200	$102,486	$125,900	$135,260	$130,574	$150,960	$200,716	$229,500
Associate Professor	74	$71,000	$89,246	$115,800	$100,778	$101,728	$90,023	$110,505	$140,000
Assistant Professor	112	$58,800	$81,021	$94,500	$87,847	$87,182	$88,859	$94,671	$105,000
Non-Tenure-Track									
Teaching Faculty	70	$24,303	$54,811	$80,793	$76,723	$77,443	$69,945	$100,078	$163,000
Research Faculty	66	$60,000	$74,601	$82,800	$102,379	$102,627	$81,000	$130,580	$200,000
Postdoctorates	58	$25,000	$49,175	$61,900	$55,052	$54,929	$51,500	$61,529	$75,700

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

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Full Professor	212	$84,600	$99,785	$115,250	$142,685	$136,035	$168,199	$212,691	$402,773
Associate Professor	80	$69,697	$91,146	$107,100	$103,401	$103,486	$97,613	$115,781	$155,333
Assistant Professor	90	$63,900	$84,836	$109,250	$90,669	$89,596	$86,465	$99,018	$141,833
Non-Tenure-Track									
Teaching Faculty	40	$53,503	$66,132	$85,428	$74,860	$77,404	$65,849	$84,901	$104,976
Research Faculty	58	$42,755	$72,737	$115,000	$94,400	$91,248	$49,992	$128,427	$200,000
Postdoctorates	33	$31,500	$41,405	$56,649	$47,078	$46,487	$40,513	$55,068	$80,000

while departments ranked greater than 36 showed increases in total expenditures and median capitation expenditures, but decreases in mean capitation expenditures (with a large decrease in the maximum capitation expenditures). Computer engineering expenditures generally declined, though the median of total expenditures rose slightly. These mixed reports suggest that it has become harder for faculty to obtain and/or sustain funding for computing research in the U.S. CRA has reported on the funding story extensively through the years, and these data are consistent with the declining state of research funding that has been noted recently.

Table 25 shows the number of graduate students supported as full-time students as of fall 2005, further categorized as teaching assistants, research assistants, fellows, or computer systems supporters, and split between those on institutional vs. external funds. All categories of departments in the U.S. showed decreases in the number of teaching assistants (with higher-ranked departments showing the largest decreases), while Canadian departments showed increases. This is the first year where the U.S. figures show a consistent story in teaching assistant employment, and likely reflects the decreased demands in the undergraduate programs within these departments.

The support for research assistants is somewhat mixed. Top 12 departments showed a considerable decline (over 20%) in the number of externally supported research assistants, but this was somewhat offset by an increase in the number of research assistants supported on institutional funds. This pattern is consistent with the decline in research funding discussed above. In total, these departments supported 13.5% fewer research assistants compared to last year's survey. The number of full-support fellows declined by a similar amount.

For departments ranked 13-24, there were fewer externally funded research assistants and full-support fellows this year, but sufficiently more institutionally supported persons in these categories to compensate. It is interesting that external support of students declined for these departments although external research funding had increased last year. This may result from the different time periods reflected in these two sets of data. External funding covers the most recently completed fiscal year, while the student support data are for the fall 2005 term.

Departments ranked 25-36 reported a significant increase in the number of externally funded research assistants, offset slightly by a decline in the number of institutionally supported research assistants. This is surprising in view of the decline in externally funded research for these departments. The number of full-support fellows for these departments held steady during the past year.

Departments ranked greater than 36 showed increased numbers of research assistants receiving support from both external and institutional sources, with some offsetting decreases in the number of full-support fellows in both categories.

Canadian schools reported a significant increase in the number of full-support fellows. Institutionally supported research assistants also increased greatly, while externally supported research assistants declined by a comparable amount. Computer engineering departments reported a significant decline in externally funded research assistants. However, the small number of such programs and their frequent combination with electrical engineering programs within these departments make these data less reliable.

Respondents were asked to "provide the net amount (as of fall 2005) of an academic-year stipend for a first-year doctoral student (not including tuition or fees)." The results are shown in Table 26. Canadian stipends are shown in Canadian dollars. Again this year, some median values increased while others decreased compared to last year's report. In strata showing a decrease, it appears to be because some departments within the stratum reported this information one year and not the other. With the exception of departments ranked 13-24, where median salaries for teaching assistants rose more than 7%, any increases in graduate student salaries were modest.

Faculty Salaries *(Tables 27-34)*

Each department was asked to report individual (but anonymous) faculty salaries if possible; otherwise,

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

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Full Professor	178	$70,250	$96,355	$123,000	$127,839	$125,002	$128,905	$171,300	$200,613
Associate Professor	98	$66,131	$84,128	$129,000	$95,100	$95,513	$89,445	$105,770	$129,000
Assistant Professor	108	$59,060	$78,738	$84,000	$84,081	$84,254	$82,602	$88,253	$95,310
Non-Tenure-Track									
Teaching Faculty	56	$41,660	$55,992	$80,808	$68,961	$65,894	$63,900	$86,132	$141,050
Research Faculty	44	$25,000	$52,311	$84,075	$68,188	$62,115	$59,500	$90,295	$140,400
Postdoctorates	30	$25,000	$40,548	$60,000	$43,807	$43,646	$35,568	$48,214	$69,100

Table 31. Nine-month Salaries, 122 Responses of 138 US CS Computer Science Departments Ranked Higher than 36 or Unranked

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Full Professor	848	$68,757	$94,795	$140,996	$113,583	$111,081	$86,832	$143,534	$263,135
Associate Professor	721	$44,850	$79,263	$110,000	$88,744	$88,389	$69,353	$99,162	$161,490
Assistant Professor	766	$43,024	$75,817	$100,000	$80,826	$80,780	$69,870	$85,511	$126,659
Non-Tenure-Track									
Teaching Faculty	427	$22,000	$48,868	$110,705	$57,084	$56,587	$24,000	$66,242	$125,000
Research Faculty	103	$24,000	$59,606	$112,356	$68,857	$66,253	$30,000	$83,481	$194,670
Postdoctorates	64	$24,000	$44,570	$75,000	$47,199	$46,698	$24,000	$50,744	$75,000

Table 32. Nine-month Salaries, 10 Responses of 31 US Computer Engineering Departments

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Full Professor	77	$60,000	$90,950	$114,300	$115,607	$111,649	$85,048	$157,281	$201,036
Associate Professor	43	$54,288	$78,900	$101,470	$86,323	$85,555	$81,458	$94,969	$112,556
Assistant Professor	53	$68,472	$78,852	$94,900	$81,831	$81,547	$75,530	$85,106	$95,400
Non-Tenure-Track									
Teaching Faculty	10	$48,840	$58,237	$70,191	$64,391	$62,073	$50,000	$72,885	$114,839
Research Faculty	7	*	*	*	*	*	*	*	*
Postdoctorates	11	$31,044	$38,104	$57,375	$40,837	$40,804	$31,044	$43,504	$57,375

Table 33. Twelve-month Salaries, 22 Responses of 27 Canadian Computer Science Departments (Canadian Dollars)

Faculty Rank	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Full Professor	304	$60,000	$101,632	$137,011	$123,840	$120,924	$106,416	$159,780	$311,797
Associate Professor	225	$61,600	$87,428	$121,820	$100,338	$99,746	$88,288	$115,244	$146,594
Assistant Professor	227	$44,816	$78,179	$115,876	$87,189	$87,065	$67,474	$95,042	$124,181
Non-Tenure-Track									
Teaching Faculty	84	$24,600	$63,231	$95,460	$74,493	$75,243	$54,810	$84,456	$117,802
Research Faculty	11	$42,000	$50,833	$62,000	$55,404	$54,167	$42,000	$63,505	$81,515
Postdoctorates	32	$22,800	$29,400	$36,000	$41,616	$40,447	$40,000	$55,371	$74,600

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

Employment Position	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Tenure-Track Faculty	99	$69,000	$79,913	$103,889	$80,197	$80,194	$70,000	$80,485	$103,889
Non-Tenure-Track									
Researcher	10	$28,980	$52,042	$80,100	$52,931	$52,931	$28,980	$53,820	$80,100
Postdoc	10	$24,000	$60,850	$80,000	$60,850	$60,850	$24,000	$60,850	$80,000
Non-Tenure Teaching Faculty	48	$25,000	$45,951	$75,000	$47,925	$47,983	$27,000	$49,629	$75,000

Table 34a. Nine-month Salaries for New PhDs, Responding Canadian Departments

Employment Position	Number of Faculty	Reported Salary Minimum			Overall Mean	Overall Median	Reported Salary Maximum		
		Minimum	Mean	Maximum			Minimum	Mean	Maximum
Tenure-Track Faculty	10	$61,142	$81,587	$93,000	$81,814	$81,814	$64,308	$82,040	$93,000

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the department was requested to provide the minimum, median, mean, and maximum salaries for each rank (full, associate, and assistant professors and non-tenure-track teaching faculty) and the number of persons at each rank. The salaries are those in effect on January 1, 2006. For U.S. departments, nine-month salaries are reported in U.S. dollars. For Canadian departments, twelve-month salaries are reported in Canadian dollars. Respondents were asked to include salary supplements such as salary monies from endowed positions.

Here we report tables comparable to those used in previous Taulbee surveys. The tables contain data about ranges and measures of central tendency only. Those departments reporting individual salaries were provided more comprehensive distributional information in December 2005. A total of 162 departments (86% of those reporting salary data) provided salaries at the individual level.

The minimum and maximum of the reported salary minima (and maxima) are self-explanatory. The range of salaries in a given rank among departments that reported data for that rank is the interval ["minimum of the minima," "maximum of the maxima"]. The mean of the reported salary minima (maxima) in a given rank is computed by summing the departmental reported minimum (maximum) and dividing by the number of departments reporting data at that rank.

The median salary at each rank is the middle of the list if you order its members' mean salaries at that rank from lowest to highest, or the average of the middle two numbers if there is an even number of items in the set. The average salary at each rank is computed by summing the individual means reported at each rank and dividing by the number of departments reporting at that rank. We recognize that these means and medians are only approximations to the true means and medians for their rank.

Overall U.S. CS average salaries (Table 27) increased between 3.7% and 4.1%, depending on tenure-track rank, and 4.8% for non-tenure-track teaching faculty. These increases compare favorably with the 2.5% to 3.3% levels experienced last year for tenure-track faculty and the 4.0% level for non-tenure-track teaching faculty. Departments ranked 13-24 gave the highest average increases at the assistant and full professor level (5.4% each), while departments not ranked in the top 36 gave the highest increases to associate professors (4.0%). Canadian salaries (shown as 12-month salaries in Canadian dollars) rose 3.1% to 4.4% with the greater increase at the full professor rank and the smaller at the assistant professor rank.

Median salaries for new Ph.D.s (those who received their Ph.D. last year and then joined departments as tenure-track faculty) increased 3.4% from those reported in last year's survey (Table 34). This level of increase is more in line with the average increases for continuing faculty, after two years of very small increases for new Ph.D.s.

Concluding Observations

As predicted last year, our field is producing Ph.D.s at a record rate, and the short-term forecast is for continued record production. While there is no evidence in our employment statistics that the increased production is resulting in an inability of Ph.D. graduates to find work, an increasing fraction of new Ph.D.s appear to be taking positions outside of North America. In the wake of accelerating globalization of the marketplace, this is not surprising.

Three consecutive years of decreasing numbers of new Ph.D. students, and a sharply reduced pipeline at the Bachelor's level, will make it difficult to sustain this production rate in the longer term. Moreover, it is not yet clear when the decline in our undergraduate program enrollments will end. The double-digit percent decrease in bachelor's production observed this year is likely to continue for the next several years. Coupled with the declining representation of women in our undergraduate programs, our ability to produce a workforce that is sufficiently educated technically to meet the needs of the job market in computing is being severely challenged. The declining enrollments at the Bachelor's level also will increasingly challenge the ability of CS/CE departments to grow their faculty as they desire.

Rankings

For tables that group computer science departments by rank, the rankings are based on information collected in the 1995 assessment of research and doctorate programs in the United States conducted by the National Research Council [see http://www.cra.org/statistics/nrcstudy2/home.html].

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

CS departments ranked 13-24 are: Brown, Yale, University of California (Los Angeles), University of Maryland (College Park), New York University, University of Massachusetts (Amherst), Rice, University of Southern California, University of Michigan, University of California (San Diego), Columbia, and University of Pennsylvania.[2] All schools in this ranking participated in the survey this year.

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

CS departments that are ranked above 36 or that are unranked that responded to the survey include: *Arizona State University, Auburn, Boston University, Brandeis, Case Western Reserve, City University of New York Graduate Center, Clemson, College of William and Mary, Colorado School of Mines, Colorado State, Dartmouth, DePaul, Drexel, Florida Institute of Technology, Florida International, Florida State, George Mason, George Washington, Georgia State, Illinois Institute of Technology, Iowa State, Johns Hopkins, Kansas State, Kent State, Lehigh, Michigan State, Michigan Technological, Mississippi State, Montana State, Naval Postgraduate School, New Mexico State, North Carolina State, North Dakota State, Northeastern, Northwestern, Nova Southeastern, Ohio, Ohio State, Oklahoma State, Old Dominion, Oregon State, Pace, Pennsylvania State, Polytechnic, Portland State, Rensselaer Polytechnic, Southern Methodist, State University of New York (Albany and Binghamton), Stevens Institute of Technology, Syracuse, Texas A&M, Texas Tech, Toyota Technological Institute (Chicago), Tufts, Vanderbilt, Virginia Polytechnic, Washington State, Washington (St. Louis), Wayne State, West Virginia, Western Michigan, Worcester Polytechnic, and Wright State.*

University of: *Alabama (Birmingham and Tuscaloosa), Arkansas (Little Rock), Buffalo, California (at Davis, Riverside, Santa Barbara, and Santa Cruz), Central Florida, Cincinnati, Colorado (at Boulder, Colorado Springs, and Denver), Connecticut, Delaware, Denver, Florida, Georgia, Hawaii, Houston, Illinois (Chicago), Iowa, Kansas, Kentucky, Louisiana (Lafayette), Maine, Maryland (Baltimore Co.), Massachusetts (at Boston and Lowell), Minnesota, Mississippi, Missouri (at Columbia, Kansas City and Rolla), Nebraska (Lincoln and Omaha), Nevada (Las Vegas and Reno), New Hampshire, New Mexico, North Carolina (Charlotte), North Texas, Notre Dame, Oklahoma, Oregon, Pittsburgh, South Carolina, South Florida, Tennessee (Knoxville), Texas (at Arlington, Dallas, El Paso, and San Antonio), Toledo, Tulsa, Utah, Wisconsin (Milwaukee) and Wyoming.*

Computer Engineering departments participating in the survey this year include: *Georgia Institute of Technology, Northwestern, Princeton, Purdue, Rensselaer Polytechnic, and the Universities of Tennessee (Knoxville), California (Santa Cruz), Central Florida, Houston, and Southern California.*

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

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Betsy Bizot once again provided valuable assistance with the data collection, tabulation, and analysis for this survey. Jean Smith suggested many valuable improvements to the presentation of this report.

Endnotes

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 until 1984, with retrospective annual data going back to 1970.
2. 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.
3. 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.
4. All ethnicity tables: Ethnic breakdowns are drawn from guidelines set forth by the U.S. Department of Education.
5. All faculty tables: The survey makes no distinction between faculty specializing in CS vs. CE programs. Every effort is made to minimize the inclusion of faculty in electrical engineering who are not computer engineers. ■

CRA Welcomes New Members

Academic

McMaster University (CE&S)

Union College (CS)

Lab/Center Members

CA Labs

Professional Opportunities

CRN Advertising Policy

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

D. E. Shaw & Co., L.P.

Software Developer

The D. E. Shaw group, a specialized investment and technology development firm with approximately US $19 billion in aggregate capital, is looking for top-notch, innovative software developers to help it expand its tech venture and proprietary trading activities. We offer a casual work environment populated by some of the brightest graduates from the strongest computer science programs in the world. In fact, the firm was founded by David E. Shaw, who received his Ph.D. in computer science from Stanford and served on the CS faculty at Columbia before launching the D. E. Shaw group in 1988.

Our activities center on various aspects of the intersection between technology and finance, and are guided by a senior management team whose members hold advanced degrees in a variety of technical and quantitative fields. The firm combines many of the best traits of academia and the corporate world, promoting a focused but informal company culture, which is reflected in our casual dress, relatively flat management structure, and flexible vacation policy, as well as in the high degree to which new employees work closely with senior staff on key initiatives. We strongly emphasize personal ownership of projects, and new hires are given substantial responsibility from their first day on the job.

If you're interested in applying your talents to challenging problems of software architecture and engineering in an intellectually stimulating environment, then we'd love to see your resume.

To apply, e-mail your resume to:
CRA-SNowak@career.deshaw.com. EOE.

Indiana University

Pervasive Technology Labs – Community Grids Lab

Postdoctoral Researcher – RSP (00001121 & 00001122)

The Community Grids Laboratory at Indiana University invites qualified applications for Postdoctoral Researcher positions. Successful applicants will participate in application-driven basic and applied Grid research. Applicants should possess a Ph. D. in Computer/Computational Science or a related field with a background in one of these areas: basic Grid and Web Service architecture research; distributed data and information management with an emphasis on Semantic Web and ontology research; Earth Science including Geographical Information System service development; chemical and bioinformatics; real time streaming data systems; and grid Web portal and other client development.

Please send CV material, including educational background, publications, links to software products and projects, and the contact information for three professional references to:

Dr. Marlon E. Pierce
Community Grids Laboratory
501 N. Morton St, Ste 224
Bloomington, IN 47404
Ph: 812-856-1212
Fax: 812-856-1537
Or send in electronic form to:
dsiefert@indiana.edu
http://grids.ucs.indiana.edu/ptliupages/

Indiana University is an Affirmative Action/Equal Opportunity Employer.

Montana Tech

Department of Computer Science

Tenure-Track Positions

The Department of Computer Science at Montana Tech is seeking qualified applicants for tenure-track positions at the Instructor, Assistant or possibly Associate Professor level with expertise in software engineering, computer science, and/or information sciences/systems starting in August 2006.

Responsibilities include teaching software engineering and computer science at all undergraduate levels, active scholarship, and service to the department and college. An earned Ph.D. in Software Engineering, Computer Science, Information Sciences/Systems, and /or a closely related field with significant experience in the aforementioned areas is preferred, but an ABD or M.S. will be considered. Preference will be given to candidates having prior university level teaching experience and evidence of ongoing scholarly activity. The Department of Computer Science in the College of Mathematics and Sciences has 5 full-time faculty and approximately 70 majors. The department offers undergraduate degrees in Software Engineering and Computer Science.

Montana Tech is a small science, engineering, and technical college with a reputation for excellence located in the heart of the Rocky Mountains offering outstanding outdoor recreational opportunities. In the 2005 edition of The Princeton Review, Best 357 Colleges, Tech was rated the "4th best value in public education" in the United States (visit www.mtech.edu). Salary is commensurate with qualifications and experience.

Send a letter of application, brief statement of professional goals and current scholarly activity, statement of teaching philosophy, curriculum vitae, graduate transcripts, and the names of three professional references to:
Cathy Isakson
Montana Tech Personnel Office
1300 West Park Street
Butte, MT 59701

Applications will be accepted until the positions are filled.

EEO/AA

NEC Laboratories America

Robust & Secure Systems Group

Research Staff Member

NEC Laboratories America conducts research in support of NEC US and global businesses. Our research program covers many areas - reflecting the breadth of NEC business - and maintains a balanced mix of fundamental and more applied research. Ranked as one of the world's top patent-producing companies, the NEC Group employs more than 144,000 people across 195 subsidiaries in 27 countries and had net sales of approximately $47 billion in the fiscal year that ended March 2004.

Please see more information about NEC Labs at http://www.nec-labs.com.

Member to work on projects related to system and software reliability. Candidates must have a PhD in CS/CE with solid background and research/publication record in autonomic system/service management or system and software reliability. Candidates must be proactive in developing innovative technologies and always have a "can-do" attitude. Expert-level skills in one or more of the following disciplines are required:

- Autonomic computing
- Distributed system and network
- Fault-tolerant systems/system reliability
- Data mining and machine learning
- Self-management systems and services
- Software reliability and testing
- Computer security

Extra knowledge in information theory, signal processing, system and control theory is a big plus.

Interested applicants can send their resume to:

recruit@nec-labs.com and reference RSS-ASDS in the subject line.

Pomona College

Computer Science Department

Visiting Professor

Anticipated openings for two visiting professor positions, one full time and one part-time, starting August 2006. Candidates should be excellent teachers, have a Ph.D. in computer science (ABD considered), and be able to teach an ethnically diverse student body. Successful candidates will have the ability to teach an upper-division undergraduate course in either algorithms or AI.

Send CV; 3 letters of recommendation (at least one on teaching); statement of teaching philosophy; transcripts by email (preferred) to:

search@cs.pomona.edu (plain text or PDF)
or by mail to:
Search Committee
Computer Science Program
Pomona College
610 North College Avenue
Claremont, CA 91711-6348

Review of applications will begin April 15 and will continue until the positions are filled.

Pomona College is an equal opportunity employer and especially invites applications from women and under-represented groups. More information: www.cs.pomona.edu/search06.html.

Rochester Institute of Technology

B. Thomas Golisano College of Computing And Information Sciences

Associate Dean

The B. Thomas Golisano College of Computing And Information Sciences (GCCIS) at RIT is seeking a dynamic individual to lead the success of its new, innovative, and multidisciplinary Ph.D. program in Computing and Information Sciences. The successful candidate will demonstrate:

- Academic, administrative, and research leadership.
- Strong commitment to graduate education, particularly at the doctoral level.
- Broad knowledge of computing and its application to a wide variety of domains.
- Comprehensive record of scholarly achievement and a strong commitment to research. - Proven record of acquiring research funding.
- Ability to contribute to RIT's commitment to cultural diversity and pluralism.

Candidates must have the credentials, experience, and achievements appropriate for appointment as a tenured, Full Professor, including an earned Ph.D. in a computing-related discipline. The start date for this full-time 12-month position is not later than September 1, 2006, preferably July 1, 2006. The committee will begin accepting applications immediately. The position will remain open until filled.

GCCIS is RIT's newest college at the 1,300-acre suburban university located south of Rochester, New York. The College, housed in a new 126,500 square foot state-of the-art facility, is home to the Computer Science, Information Technology, Software Engineering, and Networking, Security, and Systems Administration departments. GCCIS currently has 90 full-time faculty, over 2,300 undergraduate students and over 400 Master's level graduate students. The faculty is engaged in scholarly activities that include both discovery and applied research with a focus on data mining and discovery informatics; intelligent systems; complexity theory and cryptography; software engineering; cybersecurity; networking and distributed systems; and human-computer interaction. The new Ph.D. program will work in close collaboration with GCCIS departments as well as other colleges within RIT. Close collaboration in research activities is expected between the Center for Advancing the Study of Cyberinfrastructure, the research arm of the college, and the Ph.D. program.

Candidates are strongly encouraged to submit their applications electronically. Applications must include: summary of education and professional background; list of publications and research grants; summary of administrative, teaching and research experience; names of three references; and a brief statement on the future strategic vision of computer and information sciences.

Jorge Dìaz-Herrera, Dean
B. Thomas Golisano College of Computing and Information Sciences
Rochester Institute of Technology
20 Lomb Memorial Drive
Rochester, NY 14623
Email: assocdeansearch@gccis.rit.edu
Telephone: 585-475-4796
More information: http://www.gccis.rit.edu

Texas State University – San Marcos

Department of Computer Science

Department Chair

Applications and nominations are invited for the position of Chair of the department. The chair is responsible for leadership in the department in its efforts to recruit, retain and evaluate diverse and distinguished faculty and promote their professional development; to provide high quality instructional programs and maintain accreditation; to increase scholarly and externally funded activities; to advise, recruit and retain students; to carry out strategic planning, budget preparation and execution; to approve and recommend curriculum and student degree programs; and to collaborate with other internal and external entities to promote the CS programs. A detailed description of the chair position can be found at:

http://www.cs.txstate.edu/recruitment/chair_recruit.shtml

To apply please send a cover letter, statement of vision, a resume and contact information for at least four references, to:

Chair Search
Department of Computer Science
Texas State University – San Marcos
601 University Drive
San Marcos, TX 78666

More information about the department and Texas State can be found at http://www.cs.txstate.edu/. Inquiries about the position can be sent to chair_search@cs.txstate.edu. Review of applications will begin on receipt and continue until the position is filled.

Texas State is committed to achieving excellence through cultural diversity. The university strongly encourages applications and nominations of all qualified individuals. Texas State is an Equal Opportunity, Affirmative Action employer and a member of the Texas State University System.

Tufts University

Computer Science Department

Full-Time Lecturer

The Department of Computer Science seeks applications for a full-time Lecturer to teach computer science courses beginning in September 2006. A Lecturer is a full-time, non-tenure track, member of the faculty who is committed to teaching, advising, curriculum development and other departmental and university service and administration.

A Research I university, Tufts has extensive and highly regarded liberal arts, sciences, and engineering programs that draw outstanding students from around the world with the highest academic achievement and standing.

Tufts is widely respected for its excellent teaching and student-centered approach. The Lecturer position is a full-time partner in the Department of Computer Science's educational process. Candidates should hold a PhD and have an exceptional record of classroom instruction and curricular innovation with regard to computer science courses. The initial appointment is for one year with possibility of longer contracts and the promotion to Senior Lecturer over time.

Applicants should submit a resume, a letter of intent, a teaching statement and ensure that at least three confidential letters of recommendation are sent directly to:

Professional Opportunities

Chair of the Lecturer Search Committee
Computer Science
Tufts University
161 College Avenue
Medford, MA 02155

Review of applications will begin March 1, 2006 and will continue until the position is filled.

Tuft University is an affirmative action/equal opportunity employer. We are committed to increasing the diversity of our faculty and staff.

University of Kentucky

Department of Computer Science

Assistant Professor

The University of Kentucky Computer Science Department invites applications for a tenure-track position beginning August 15, 2006 at the assistant professor level. Candidates should have a PhD in Computer Science. Review of credentials will begin on March 1, 2006, and the search process will continue until a suitably qualified candidate is found.

We are especially interested in candidates with expertise in databases, preferably specializing in data mining, very large databases, networked databases, XML databases, image databases, or related topics. A successful candidate must be able to teach both undergraduate and graduate classes in databases and will be expected to conduct innovative research.

Potential candidates must apply online at: http://www.uky.edu/UKjobs/.

Click 'Online Employment for Job Seekers'. Then on 'Search Postings' then enter SL511481 under 'Requisition Number'.

For any questions related to the application process, please contact:

HR/Employment
112 Scovell Hall
Lexington, KY 40506-0046
Phone: 859-257-9555, press "2"

or by email at:

ukjobs@email.uky.edu

The University of Kentucky is the flagship graduate degree-granting institution in Kentucky, strongly committee to the goal of maintaining research and teaching excellence and high national visibility.

Application deadline is March 17, 2006 but may be extended if necessary.

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

University of Missouri-Columbia

Department of Computer Science

Faculty Positions

Due to substantial program growth, the Department of Computer Science (CS) at the University of Missouri–Columbia invites applications for two faculty positions at the level of assistant, associate, or full professor in the area of Bioinformatics. Areas of primary emphasis for the two positions will include, but not limited to, theoretical research and bioinformatic application of database, data mining, machine learning, computational biology, and algorithms. The position is a full-time academic year appointment. Salary is commensurate with credentials and experience.

Applicants must have a Ph.D. in Computer Science, Bioinformatics, or in a related field. If an applicant does not have a Computer Science Ph.D. degree, a demonstrated record of computational science research is required. For all applicants, publication in computational science and/or bioinformatics is essential. Some research experience in bioinformatics or computational biology is necessary. Experience with graduate bioinformatics programs and courses are preferred. More senior appointments will be considered for applicants with demonstrated scholarship and leadership, including a strong record of securing and leading externally funded research.

The successful applicant for the position will be expected to conduct bioinformatics research that is demonstrated by scholarly achievement and a record of publication, secure significant external funding, teach both undergraduate and graduate Computer Science courses, develop new graduate and undergraduate courses in the candidate's areas of expertise, advise graduate students in Computer Science, and be actively involved in the newly formed Informatics Institute at the University of Missouri - Columbia.

The University of Missouri-Columbia is a Doctoral/Research Extensive University and is a member of the Association of American Universities (AAU). Details about the Department of CS can be found at http://web.cs.missouri.edu. The starting date for these positions can be as early as September 2006, but the search will continue until these positions are filled. Interested individuals should send a detailed resume with names, addresses, and telephone numbers of at least three references to:

Search Committee Chair
Department of Computer Science
201 Engineering Building West
University of Missouri-Columbia
Columbia, MO 65211

The University of Missouri-Columbia is an equal opportunity/affirmative action employer. To request Americans with Disability (ADA) accommodations, please contact our ADA Coordinator at 573-884-7278.

University of Nebraska at Omaha

College of Information Science and Technology

Dean

The University of Nebraska at Omaha invites applications and nominations for Dean, College of Information Science and Technology. The college offers a doctorate in information technology, master's and bachelor's degrees in computer science and management information systems, and a bachelor's degree in bioinformatics. This key position will build on a base of outstanding cooperation and ongoing projects that are drawing the attention of corporations worldwide. The dean will have the opportunity to lead this dynamic partnership between research, business and government to the next level of excellence. The dean provides innovative leadership in program and resource evaluation and development, accreditation activities, budget management and sets the strategic direction for this successful college. The dean reports to the Vice Chancellor of Academic and Student Affairs and works closely with the Peter Kiewit Institute Policy Board of Advisors in areas related to student recruitment, student success, strategic directions, applied research, and technical assistance with and for the Institute's business partners.

Serving almost 15,000 students, UNO offers nearly 200 programs of study in a learning environment that features the best of both worlds—a beautifully landscaped, small school atmosphere within a thriving city. The university and the college have excelled in creating productive partnerships with the community. The candidate should have credentials commensurate for a tenured appointment at the rank of full professor in the college. Ability to qualify for commercial non-disclosure and government security clearance is required. The successful candidate will demonstrate a commitment to the metropolitan mission of UNO. Successful experience developing external grants and contracts, and productive business-research partnerships is required. Experience in multiple disciplines, including computer science, management information systems, business administration or computer engineering is preferred. Experience in guiding research agendas in a complex environment integrating commercial, academic and national defense interests is desired.

The university has a strong commitment to diversity and is particularly interested in receiving applications from members of underrepresented groups, women, and persons of color.

For further information see http://www.unomaha.edu/istdean. Applications must be submitted electronically at:

http://careers.unomaha.edu

Cover letter, resume/curriculum vitae, and professional references must be attached to the electronic application. Applications will be evaluated continuously as received and the position will remain open until filled. Confidential inquiries are welcome - contact John Fiene at 402-554-3670 or jfiene@mail.unomaha.edu.

University of New Orleans

Department of Computer Science

Assistant Professor

The Department of Computer Science invites applications for a tenure-track position at the Assistant Professor level effective Fall 2006. The department has a particular interest in specialists in bioinformatics and computer security.

Please visit:
http://www.cs.uno.edu/News/faculty_position.html for details.

University of Oklahoma

School of Computer Science

10 PhD Fellowships

The School of Computer Science at the University of Oklahoma has 10 fellowships available for highly motivated, new PhD students. Fellowships last up to 6 years and include annual stipends of at least $21,000, professional development funds for each year, full tuition waivers, and health insurance. Fellowships in theory, artificial intelligence, machine learning, robotics, data mining, programming languages, and other areas of CS are available.

The university and the College of Engineering are making substantial investments in the School of Computer Science. With seven faculty hires in the past six years, we are growing rapidly while retaining the highest quality. Our 15 faculty include two IEEE Fellows, an ACM Fellow, a Presidential Professor, a George Lynn Cross Research Professor, a Hitachi Chair, and an NSF Career Award Winner. In addition, our faculty have received recognition including a Provost's Award for Outstanding Academic Advising, a Distinguished Lectureship in Engineering, and membership in Tau Beta Pi, Eta Kappa Nu, and Phi Kappa Phi honor societies.

Fellows will be housed along with the School of Computer Science in the new state-of-the-art Devon Energy Hall when it is completed in 2007.

See: http://fellowships.cs.ou.edu/

University of Waterloo

Department of Electrical and Computer Engineering

Faculty Positions

The Department of Electrical and Computer Engineering invites applications for faculty positions in most areas of computer engineering, software engineering, and nanotechnology engineering, and in VLSI/circuits, information security, photonics, MEMS, control/mechatronics, signal/image processing, and quantum computing. The University has been named the "Best Overall" university by reputation in Canada.

For more information and online application, please visit:

https://eceadmin.uwaterloo.ca/DACA

CRA CONFERENCE AT SNOWBIRD 2006 ♦ JUNE 25 - 27, 2006
CLIFF LODGE, SNOWBIRD RESORT ♦ SNOWBIRD, UTAH

Preliminary Program

Program and Registration Information — http://www.cra.org/snowbird

Sunday, June 25

CRA Board of Directors Meeting (begins Saturday 6PM) **8:00AM - 2:45PM**
Conference Registration **2:00PM - 7:30PM**
Workshop for New Department Chairs **3:00PM - 6:00PM**
Co-Chairs:
J Moore (University of Texas at Austin)
Mary Lou Soffa (University of Virginia)
Welcome Reception **6:00PM -7:00PM**
Dinner **7:00PM - 9:30PM**
Presentations:
Distinguished Service Award
Habermann Award
Special Recognition Award
Keynote Address:
Genevieve Bell, PhD
Director
Domestic Designs and Technologies Research
Intel
Topic: Computing for Many Futures

Monday, June 26

Breakfast Buffet **7:00AM - 8:30AM**
Registration **7:30AM - 6:00PM**
Welcome **8:30AM - 8:40AM**
Speakers:
David Notkin, University of Washington (Academic Snowbird Chair)
Wim Sweldens, Lucent Technologies, Bell Labs (Labs/Centers Snowbird Chair)

PLENARY SESSION I **8:40AM - 10:00AM**
Computing Research Funding: Circling the Wagons or Expanding the Frontiers?
Chair: Craig Wills (Worcester Polytechnic Institute)
Speaker: Ed Lazowska (University of Washington)

Break **10:00AM - 10:30AM**

Workshop I (four parallel sessions) **10:30AM – Noon**
Interdisciplinary Courses
Co-Chairs: Ann Gates (University of Texas at El Paso)
Ann Sobel (Miami University)
Speakers:
Don Marinelli (Carnegie Mellon University)
W. Andrew Schloss (University of Victoria)
Olga Troyanskaya (Princeton University)
What's Going on Outside North America
Chair: Andy Bernat (CRA)
Speakers:
Rae Earnshaw (University of Bradford, UK)
Jenny Edwards (University of Technology, Sydney, Australia)
Willy Zwaenepoel (Ecole Polytechnique Federale de Lausanne)
Achieving Success in Interdisciplinary Research
Chair: Margaret Wright (New York University)
Speakers:
Steven Fortune (Bell Labs, Lucent Technologies)
Linda Petzold (UC Santa Barbara)
Michael Strayer (DOE Office of Advanced Scientific Computing Research)
Opportunities for Computing Research with Government Labs
Chair: Horst Simon (Lawrence Berkeley National Laboratory)
Speakers:
Bill Camp (Sandia National Laboratory)
Bill Gropp (Argonne National Laboratory)
George Michaels (Pacific Northwest National Laboratory)
Kathy Yelick (Lawrence Berkeley National Laboratory; and UC Berkeley CS)

Luncheon **Noon - 1:30PM**

PLENARY SESSION II **1:30PM - 3:00PM**
The Changing Dynamics of University/Industry Relations
Chair: J Moore (University of Texas at Austin)
Speaker: Robert Miller (University of California, Santa Cruz)

Break **3:00PM - 3:30PM**

Workshop II (four parallel sessions) **3:30PM - 5:00PM**
ACM Offshoring Study and Beyond
Chair: Moshe Vardi (Rice University)
Speakers:
William Aspray (Indiana University)
Seymour Goodman (Georgia Institute of Technology)
Richard Waters (Mitsubishi Electric Research Laboratory)
Rethinking CS101: Engaging Students from the Arts and Sciences in Computer Science
Chair: Anne Condon (University of British Columbia)
Speakers:
Duane Bailey (Williams College)
Kim Bruce (Pomona College)
Panagiotis T. Metaxas (Wellesley College)
Randy Pausch (Carnegie Mellon University)
Andy van Dam (Brown University)
Open Source as a Medium of Interaction between Corporations and the Academy
Chair: Chris DiBona (Google)
Panelists:
Bill Coughran (Google)
Jeff Jaffe (Novell)
Barton Massey (Portland State University)
Tony Wasserman (Carnegie Mellon University)
Federal Research Sources for Computing
Co-Chairs: Craig Wills (Worcester Polytechnic Institute)
Jeannette Wing (Carnegie Mellon University)
Speakers:
Fred Chang (National Security Agency)
Michael Foster (National Science Foundation)
Peter Highnam (National Institutes of Health, NCRR)

Dinner and State of the CRA Address **6:30PM - 9:00PM**
Speakers:
Dan Reed (CRA Board Chair)
Andrew Bernat (CRA Executive Director)

Tuesday, June 27

Breakfast Buffet **7:00AM - 8:30AM**

PLENARY SESSION III **8:30AM - 10:00AM**
The Image of Computing: How Do We Get the Romance Back?
Chair: Jeannette Wing (Carnegie Mellon University)
Speaker: Rick Rashid (Microsoft)

Break **10:00AM - 10:30AM**

Workshop III (four parallel sessions) **10:30AM - Noon**
Undergraduate Research: Best Practices in Universities, Colleges, and Industry
Chair: Ran Libeskind-Hadas (Harvey Mudd College)
Speakers:
Carolyn Ash (Caltech)
Jan Cuny (National Science Foundation)
Ann Gates (University of Texas at El Paso)
The Influence of Globalization on Computer Science Education
Chair: Jennifer Rexford (Princeton University)
Speakers:
Lester Gerhardt (Rensselaer Polytechnic Institute)
Bobby Schnabel (University of Colorado at Boulder)
Finding the Next $1B Opportunity
Chair: Wim Sweldens (Lucent Technologies, Bell Labs)
Speakers:
Frank Rimalovski (New Venture Partners LLC)
Francis Zane (Lucent Technologies, Bell Labs)
Filling in the Gap: Industrial Research Funding for Computing
Co-Chairs: Craig Wills (Worcester Polytechnic Institute)
Jeannette Wing (Carnegie Mellon University)
Speakers:
Andrew Chien (Intel)
Stuart Feldman (IBM Research)
Graham Holmes (Cisco Systems)
Jeff Walz (Google)

Luncheon: **Noon - 1:30PM**
[CRA Board Interaction with Conference Participants]

Workshop IV (four parallel sessions) **1:30PM - 3:00PM**
Alternative Entry Courses/Sequences That Work
Chair: Jim Foley (Georgia Institute of Technology)
Speakers: Lecia Barker (University of Colorado)
Randy Pausch (Carnegie Mellon University)
Robert Sloan (University of Illinois at Chicago)
Equal Access: Making your Department Accessible to Students with Disabilities
Chair: Richard Ladner (University of Washington)
Speakers: Sangyun Hahn (University of Washington, Seattle)
Christian Vogler (Gallaudet University)
Industrial Affiliate Programs
Chair: Valerie Taylor (Texas A&M)
Panelists:
Andrew Chien (Intel)
Eric Grimson (Massachusetts Institute of Technology)
Dan Marcek (Hewlett-Packard)
Publications in Computing
Chair: Azer Bestavros (Boston University)
Speakers:
Gerald L. Engel (IEEE Computer Society)
Michael Pazzani (Rutgers University, formerly NSF)
Jennifer Rexford (Princeton University)
Moshe Vardi (Rice University)
John White (ACM)

NSF GENI Town Hall Meeting (June 25) **8:30AM - 2:30PM**
http://www.cra.org/nsf.geni/

Workshop for IT Deans (June 27) **3:00PM - 9:00PM**
Chair:
Bobby Schnabel (University of Colorado, Boulder)

Wednesday, June 28 **8:30AM - Noon**

CRA Conference at Snowbird 2006 Sponsors: ACM, Avaya, Computer Associates International, Google, IBM, Intel, Lucent Technologies, Bell Labs, Microsoft, Mitsubishi Electric Research Labs, Panasonic, Sun Microsystems, USENIX