COMPUTING RESEARCH NEWS

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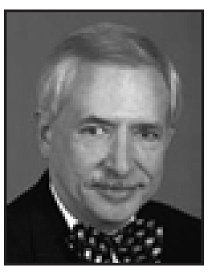
CRA Announces Three Service Award Winners

CRA is pleased to announce the winners of its 2007 Distinguished Service and A. Nico Habermann awards.

CRA Distinguished Service Awards



Peter A. Freeman, recently named a director at the Washington Advisory Group in Washington, DC, was selected for his service as Assistant Director of NSF for CISE over the past four years. He assumed the CISE position in 2002, following 12 years as Dean of the College of Computing at the Georgia Institute of Technology and a term as Chief Information Officer for the Institute.

During his tenure at NSF, Freeman brought about dramatic changes in the directions and support of computing research. He reduced the number of CISE divisions and programs, and clustered the remaining programs to create more effective and flexible program management and, ultimately, better service to computing researchers. He also shepherded the move of the Shared CyberInfrastructure Division (SCI) out of CISE and into the Office of the Director.

Peter Freeman was largely responsible for three additional major initiatives that will change the face of computing research over the next two decades. He introduced the Global Environment for Networking Innovations (GENI) initiative, which will redefine networking globally as we know it. The Computing Community Consortium (CCC) will bring together computing community leaders to determine research directions and infrastructure needs in a fashion that will allow the CISE community to compete effectively against other S&E disciplines for limited research and infrastructure funds. And the Broadening Participation in Computing (BPC) program (funded at unprecedented levels) will develop the diverse human capital necessary to sustain the U.S. computing research enterprise.

John E. Hopcroft, IBM Professor of Engineering and Applied Mathematics in Computer Science at Cornell University, was recognized for his remarkable record of service to the computing research community.

In the late 1960s and early 1970s he was involved in broadening SIAM's scope to include computing. When the IEEE and ACM started conferences such as FOCS and SIGACT, Hopcroft served on the program committees, first as a member and then as chair. He was one of the founding editors, and later managing editor, of SIAM's prestigious journal *SICOMP*. He subsequently served on the Board of Directors of SIAM (1989-97) and as chairman of the board (1992-93). At NSF, Hopcroft was active on various NSF advisory boards, including the National Science Board, where he chaired the Committee on Program and Plans that oversaw all major science funding, including computer science programs and the supercomputing centers. He was instrumental in this committee making the decision to privatize the Internet.

Hopcroft has served on many advisory boards, including NASA's SSAAC which helped prioritize space research missions after the Challenger disaster. He has served professional organizations such as AAAS where he chaired Section T on Information, Computing and Communications (1988-91) and was a council delegate. He has served as editor for a number of leading journals; on advisory boards for academic departments such as Princeton, Yale, CMU, USC, and UC Berkeley; and on numerous review committees. Hopcroft helped the Vietnam Educational Foundation build computer science education in Vietnam, and currently is working with the Millennium Foundation, with support from the World Bank, to help build science infrastructure in Chile.

CRA A. Nico Habermann Award

The CRA board selected **Janice E. Cuny** to receive the 2007 A. Nico Habermann Award for her dedication, effectiveness, national scope, breadth of impact, vision, and leadership in broadening the participation of all underrepresented groups in computing.

Cuny, a Professor of Computer and Information Science at the University of Oregon, is currently

Award Winners
Continued on Page 6

Inside CRN

Expanding the Pipeline.......2
New CRA Board Members.......3
Musings from the Chair.......3
CCC—The Way Forward.......4
Science Funding on Track.......4
Taulbee Survey Results.......7
Professional Opportunities.......23

Scientific Computing at the Forefront—Los Alamos National Laboratory

By Bill Feiereisen, Chief Technologist

Large laboratories like Los Alamos (LANL) provide the opportunity to apply high performance computing (HPC) to science problems at a scale scarcely matched elsewhere. But perhaps more importantly, they have the assignment to answer the questions posed by "missions," the major responsibilities that each lab is charged to answer.

In this article I want to show you some of the exciting computational science at Los Alamos, and then tell you about computing developments that make this possible. It's quite satisfying to know where your work is applied.

Designing and Maintaining the Nation's Nuclear Weapons

Los Alamos National Laboratory is the birthplace of nuclear weapons. Their care and feeding has been the mission for 63 years. During this time it has grown to encompass the basic science of high energy density physics and the issue of nuclear nonproliferation. Los Alamos is one of the originators of HPC for modeling and simulation. Our computing history begins at the end of World War II with Monte-Carlo methods on the Eniac at Pennsylvania, and ranges unbroken to the present-day quest for Petaflops (10^{15} floating point operations per second) in parallel computing.

Los Alamos, Livermore and Sandia have the responsibility to certify the quality of these weapons each year and take care of problems. However, since 1992 there have been no nuclear tests, so the task has fallen heavily to computation. This drove the founding of the Advanced Strategic Computing (ASC) program that has propelled so many of the developments in high performance computing these last ten years. Three-dimensional, time-dependent simulations of the complex physics in a nuclear weapon have become reliable enough for engineering judgments.[1]

Simulation of our Public Infrastructure—What Happens When Bad Stuff Happens?

Agent-based simulations are now widely used to model the response of people and their infrastructure to threats and disasters. Much of this work is concentrated within the National Infrastructure Simulation and Analysis Center (NISAC), which builds detailed models for most of the seventeen infrastructure sectors as defined by the Department of Homeland Security (DHS). As hurricanes Katrina and Rita bore down on the Gulf Coast in 2005, LANL was

Scientific Computing
Continued on Page 5

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Expanding the Pipeline

Tapia Conference to Focus on Passion, Diversity, and Innovation

Tapia and Hopper Celebrations Co-locating in Orlando in October

By Monica Martinez-Canales

This October 14-17, more than 400 students, professors, and researchers will gather at the Disney Hilton in Orlando, Florida for the fourth Richard Tapia Celebration of Diversity in Computing Conference. Held every two years, the Tapia Conference provides a welcoming and supportive setting for all participants and particularly for students from under-represented groups.

This year's theme is "Passion in Computing—Diversity in Innovation." The theme emphasizes our community's passion for computing, which fuels our dedication to education, discovery, creativity, innovation, and leadership in the national and global economies.

The 2007 Conference will include several successful aspects of past events, such as:

- *A robust technical program*, which includes papers, workshops, panels, and birds-of-a-feather sessions. It will feature talks by experts who will provide examples of their successes as well as their missteps. The overall program will emphasize challenges and successes within the fields of information security, intelligent systems, human-centered computing, and computational math and science.
- *Invited plenary talks* that feature the voices of our community members who have excelled across different benchmarks and will discuss how they have organized their scientific and non-scientific ideas to find their niche and become successful. This year's speakers include Shirley Malcolm, Head of the Directorate for Education and Human Resources Programs, AAAS, and John King, Vice Provost for Academic Information, University of Michigan.
- *A dynamic poster session, focused on students*, which provides those who are new to making presentations an opportunity to interact with people one-on-one and practice talking about their work in a supportive setting. Winners of the poster competition will be eligible for ACM's Student Research Competition Grand Finals.
- *The Doctoral Consortium*, a full-day sounding board to guide and encourage students working on their Ph.D.s. This provides an opportunity for graduate students to explore their research interests and career objectives, from graduate school and beyond, with a panel of established researchers.
- *Several opportunities to network*, including the poster session, breaks, and the gala awards banquet. These are designed to allow attendees time to learn from role models and peers, and to share their own experiences. The awards banquet has always been a highlight of the Tapia Conference. It allows students and national leaders to spend informal time together, and to recognize the winners of the Tapia Conference competitions and the winner of the Richard A. Tapia Achievement Award for Scientific Scholarship, Civic Science, and Diversifying Computing.

New this year, an exciting robotics competition will pit teams of students against each other as they send their programmed robots on 'search and rescue' tasks in simulated and physical disaster environments that have applications in homeland security and national defense.

The Tapia Conference will be co-located with the Grace Hopper Celebration of Women in Computing Conference, which will take place October 17-20, also at the Disney Hilton. The 2007 Hopper Celebration is the seventh in a series of conferences designed to bring to the forefront the research and career interests of women in computing. Leading researchers representing industrial, academic, and government communities present their current work, while special sessions focus on the role of women in today's technology fields. This year's Hopper Celebration theme, "I Invent the Future," emphasizes the impact women have on the computing and technology fields and celebrates the potential each attendee possesses.

The Steering Committees of both events are working together to provide a full week's worth of valuable experiences for attendees, and we look forward to the shared energy of the two events. October 17 will be an exciting 'Bridge Day' designed for attendees of both the Tapia and Hopper Celebrations, with a focus on students.

The Tapia Conference is organized by the Coalition to Diversify Computing, and is sponsored by the Association for Computing Machinery (ACM) and the IEEE Computer Society, in cooperation with the Computing Research Association (CRA). It honors the significant contributions of Richard A. Tapia, a professor in the Department of Computational and Applied Mathematics at Rice University in Houston, Texas. Not only is he internationally known for his research in computational and mathematical sciences, but he is also a national leader in education and outreach programs, an excellent mentor, and a strong advocate of training and education for under-represented minorities at an exceptional level.

The Tapia Conference series provides a welcoming environment where all participants can learn more to advance their careers and help others do the same. Although submission deadlines for panels, workshops, and papers have already passed, the deadlines for birds-of-a-feather sessions, the robotics competition, and the Doctoral Consortium are all coming up on *May 20*. Posters are due *July 6*. We hope you will join us in Orlando on October 14-17 and see the Tapia Conference for yourself!

For additional information:

Tapia Conference: http://www.richardtapia.org
Hopper Celebration: http://gracehopper.org/2007/
Coalition to Diversify Computing: http://www.cdc-computing.org/
CRA: http://www.cra.org
ACM: http://www.acm.org
IEEE-CS: http://www.computer.org

Monica Martinez-Canales is a Principal Member of the Technical Staff at Sandia National Laboratories in California. In addition, she is serving as General Chair for the Tapia Conference 2007. ■

GENI Science Council Members Announced

CRA and the interim Computing Community Consortium Council are pleased to announce the appointment of the GENI Science Council. Its purpose is to articulate a compelling rationale for GENI in the form of: 1) a comprehensive research plan that describes the scientific and engineering research questions that GENI will make it possible to address, 2) the educational opportunities that GENI will afford, and 3) the industrial collaborations that GENI will invite.

The appointment of the GSC became the responsibility of the CCC Council under the terms of the cooperative agreement with NSF, which established the CCC. We greatly appreciate the willingness of the newly appointment council to serve the community in this fashion. For the council's charter, see: http://www.cra.org/ccc/gsc.charter.pdf.

GENI Science Council

Chair: Scott Shenker, UC Berkeley
Vice Chair: Ellen Zegura, Georgia Tech
Tom Anderson, University of Washington
Hari Balikrishnan, MIT
Joe Berthold, CIENA
Charlie Catlett, Argonne National Laboratory
Mike Dahlin, University of Texas
Stephanie Forrest, University of New Mexico
Roscoe Giles, Boston University
Ed Lazowska, University of Washington
Peter Lee, Carnegie Mellon University
Helen Nissenbaum, New York University
Jennifer Rexford, Princeton
Stefan Savage, UC San Diego
Alfred Spector, IBM (ret.) ■

CRA Elects New Board Members; Re-Elects Officers

In recent elections, CRA elected three new members to its board of directors. They will begin three-year terms on July 1, 2007.

Laura Haas is the Director of Computer Science at IBM Almaden Research Center. In her 25 years at IBM she has made significant research contributions in SQL query processing, information integration, and schema mapping. She is an ACM Fellow (2006), and in 2002 received the IBM Corporate Award for Federated Database Technology and was named an IBM Distinguished Engineer. Dr. Haas is an active mentor and advocate for women and minorities, and has served on several executive committees and program committees. She received a Ph.D. in Computer Science from the University of Texas at Austin.

Martha Pollack is Professor and Associate Chair for Computer Science and Engineering at the University of Michigan. She has played many leadership roles ranging from serving as editor-in-chief of a major journal, to being a member of the NSF/CISE Advisory Committee, to chairing the CSE Division at the University of Michigan. She is an AAAI Fellow and served as a member of the Executive Committee of AAAI from 1994-97. Pollack's research interests include artificial intelligence; human-computer interaction; and assistive technology for cognitively and physically impaired people. She graduated from the University of Pennsylvania with a Ph.D. in Computer and Information Science.

Fred Schneider, Professor, Department of Computer Science at Cornell University, is an AAAS Fellow (1992) and ACM Fellow (1995). He has been active on a number of boards and committees, including the NSF CISE Advisory Committee (2002-06), and currently serves on the Computer Science and Telecommunications Board and the Department of Commerce Information Security and Privacy Advisory Board. His research interests include trustworthy computing systems—security and reliability; and distributed systems. Professor Schneider graduated from Stony Brook University with a Ph.D. in Computer Science.

Three current board members, **Philip Bernstein** (Microsoft), **Mary Jean Harrold** (Georgia Tech), and **Moshe Vardi** (Rice University) were re-elected to three-year terms.

Completing terms on the board on June 30, 2007 are Robert Constable (Cornell University), Robert Kahn (CNRI), and Leah Jamieson (Purdue University). Constable and Kahn served on the Government Affairs Committee during their board terms. Jamieson has had an impressive record of service since she was elected to the board in 1998, including terms as CRA Secretary, CRA-W Co-Chair and later a development officer, Co-Chair of CRA's Conference at Snowbird 2002, and participating in other CRA committees. We thank all for their service.

At its February meeting, CRA board members re-elected the current slate of officers for additional two-year terms (2007-09). Included are: **Chair, Dan Reed** (University of North Carolina); **Vice Chair, Lori Clarke** (UMass Amherst); **Treasurer, Phil Bernstein** (Microsoft Research); and **Secretary, Carla Ellis** (Duke University). The board also approved the appointment of board member **Eric Grimson** (MIT) to the Executive Committee. ∎

Musings from the Chair

Computing: It's Hip and It's Cool

By Dan Reed, CRA Board Chair

Each February, CRA organizes an annual summit of the presidents, executive directors and other senior policy leadership of CRA, its six affiliate societies—AAAI, ACM, CACS/AIC, IEEE-CS, SIAM, and USENIX—and the NRC's Computer Science and Telecommunications Board (CSTB) to discuss issues of common concern. Immediately following the summit, CRA's winter board meeting begins. This year the major topics of both the summit and board meeting were computing's image, research funding, the Computing Community Consortium (CCC), and education.

The most recent Taulbee survey of Ph.D.-granting departments shows a continued fall in undergraduate enrollments and degrees granted. This, together with negative stereotypes of computing, motivated the creation of the Image of Computing Task Force. At last year's summit, CRA and other members of the task force agreed to fund a position at the National Center for Women and IT (NCWIT), creating a national spokesperson for the computing discipline who would work with industry, academia and government to encourage more men and women of all backgrounds to study computing.

At this year's summit, Jill Ross, who now fills the spokesperson role, presented her initial ideas and approaches for improving the image of computing.[1] These include breaking down stereotypes, nurturing computing in other disciplines, personalizing computing, and clarifying computer science versus computing (i.e., a broad definition of computing as reflected in CRA's name and mission). If you have suggestions for Jill, I know she would be delighted to hear from you (jkross13@gmail.com).

Despite the recent leadership change in Congress, the competitiveness initiative continues to take shape, with bipartisan support for increases in physical science research funding. In 'Washington speak,' this means non-biomedical research (i.e., funding for NSF, the DOE Office of Science, and NIST). CRA and its partner organizations continue to advocate for this innovation agenda, and I encourage you to get involved as well. Ask your university or corporate legislative liaison to express support to your Congressional representatives.

The Computing Community Consortium (CCC) continues to gain momentum. The CRA board approved Ed Lazowska as the initial chair of CCC, based on your nominations and the work of the nominating committee for CCC chair. At the upcoming Federated Computing Research Conference (FCRC), there will be several sessions devoted to CCC, with opportunities for you to generate ideas and discuss strategic directions for computing research.

As I discussed at Snowbird last June, computing education is in flux, driven by changing job expectations, the evolution of computing, and our shifting image. Although the "R" in CRA is research, there is a continuum from introductory computing education to advanced computing research; tomorrow's researcher is today's undergraduate.

To understand what role CRA might play in undergraduate education, and to determine if there is an important niche for us to fill, CRA convened a small education summit. The recommendation of the summit attendees was clear—CRA can and should address some aspects of education, in partnership with our sister computing organizations. Based on this, the CRA board approved creation of CRA-E, a committee on education. I encourage each of you to participate in this new activity when asked.

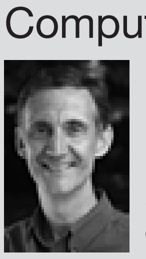
In the spirit of changing student expectations and multiple learning modes, I leave you with a parting anecdote. I recently gave a talk on the effect of computing technology on social interaction. The talk itself was in Second Life, the distributed role-playing environment, and it was hosted by the New Media Consortium. A lively discussion followed on how technology is shaping our cultural and social behavior. For more details, see my personal blog at www.renci.org/blog.

__Dan Reed__, CRA's Board Chair, is the Chancellor's Eminent Professor and Senior Advisor for Strategy and Innovation at the University of North Carolina at Chapel Hill. He also directs the interdisciplinary Renaissance Computing Institute (RENCI). Contact him at reed@renci.org.

Notes:

1. Jill Ross's presentation, including some illuminating video from a focus group interview, is posted on the CRA web site at www.cra.org/Activities/summit/home.html, along with other summit presentations. ∎

Lazowska Named Chair of Computing Community Consortium



The Computing Research Association is pleased to announce the appointment of Dr. Edward Lazowska, Bill & Melinda Gates Chair in Computer Science & Engineering at the University of Washington, as the inaugural Chair of the Computing Community Consortium (CCC) Council.

Department Chairs and Lab/Center Directors

Plan Ahead—Summer 2008

CRA Conference at Snowbird

July 13-15, 2008

The Computing Community Consortium—The Way Forward

By Andy Bernat and Ed Lazowska

In November's *CRN* we announced that the National Science Foundation had chosen CRA to establish the Computing Community Consortium (CCC), whose goal is to create venues for community participation in developing research visions and stimulating new research activities for our field. The interim Computing Community Consortium Council has been working to roll out the new CCC activity. Here we'd like to give you a snapshot of our thinking. As always, we're vitally interested in your thoughts and suggestions and absolutely welcome your participation in this effort – send email to ccc@cra.org – your email will be read and discussed, and you will receive a reply detailing this.

CCC is all about helping the community create compelling research visions and the mechanisms to realize these visions. Such a process typically moves through a number of stages.

Nucleation

The germ of a vision, in the minds of a small number of people. Traditionally, this pretty much just happens when one or two people start talking about issues within their subdiscipline. Perhaps attendance at a workshop sparks an idea. Perhaps someone is unhappy with the direction of research in her field. But somehow, somewhere a spark forms. To gain traction, this spark must be turned into a concept, preferably in a conceptual document that describes the exciting idea, demonstrates the existence of a core team committed to evolving the idea, and proposes how to enlarge participation. CCC can encourage this step through exemplars.

Broadening and Crystallization

Broadening of involvement, and crystallization of the vision. Broadening means more people, and crystallization can mean expansion ("great research topics, but fit them into a broader context that'll sell") or greater specificity ("terrific elevator speech, but beef up the actionable research thrusts"). CCC can support this step through supporting study groups that are sustained over a period of time, leading to workshops that extend beyond the core study group and bring funding agencies and professional guilds (e.g., SIGs) into the process. There needs to be broad-based community participation to ensure community ownership of the vision and subsequent efforts. The result of this stage is a document that describes a clear and compelling vision and a set of research initiatives that would realize that vision, with an indication of the scope of the effort. This document could be translated into one or more programs by research agency staff interacting with the study group.

Program Formulation

Work with agency staff to formulate a specific program. Turning the results of broadening and crystallization into a program requires the combination of research vision and ability to 'sell' that vision with the inside knowledge of how programs are created and nurtured through the federal budget process. This is a hand-off stage between the community and the funding agencies. CCC can help—both with knowledge of the process and by creating relationships with federal agency staff.

Realization

Agency places the program into its budget request. The initiators work with CCC to ensure that the effort is included in the final budget approved by Congress and signed by the President.

Execution

Do it. Below we highlight several programs that have progressed to various stages along this pipeline. While it certainly is encouraging that great ideas are progressing from gleam to realization, what we do not know is how many did not make it. How many great ideas floundered because the conceptualizer did not have the resources to bring together the right folks at the right time? How many compelling visions were not realized because the process from vision to funded program was too mysterious? The role of CCC is to ensure that such roadblocks no longer interfere with the great ideas of the research community.

1. **Algorithms as a lens on the sciences**: Beginning in the mid-1990s, several individual theorists became concerned about the field, where it was going, and how it was funded. There was considerable dissension, with the claims that the field was too inward-looking and too hung up on mathematical elegance as opposed to relevance. Events overtook discussion as theory became highly relevant to web-based applications, protocols, and other areas. Simultaneously, theory funding was dwindling so SIGACT set up a committee to look at these issues. It concluded that new directions that connected theory to other intellectually challenging areas would take funding pressure off the core (since folks have more sources to go to, leaving the core for folks who were uninterested in application areas). A workshop series on network computation led to NSF's SING program, but SING had no money of its own and actually resulted in a decrease in theory funding. The SIGACT committee went back to work and developed the idea of algorithms as a lens

Continued on Page 6

Congress on Track to Continue Increases for Science

House, Senate Budget Resolutions Provide Funding 'Room' for R&D Agencies

By Peter Harsha

Before leaving on their traditional two-week spring recess, members of the House and Senate approved their respective versions of the Fiscal Year 2008 Congressional Budget Resolution, with each providing space beneath the budget caps for increased funding for key federal science agencies. While the differences between both versions will have to be resolved in a compromise resolution when both chambers resume work in late April, the similar treatment of science accounts in both versions of the resolution bodes well for the agencies in the upcoming FY 08 appropriations process.

The Congressional Budget Resolution is the first legislative step in the annual process that ultimately results in appropriations for federal agencies in the upcoming fiscal year. It is Congress's first official response to the President's FY 08 budget request, introduced in February 2007, which included healthy increases for the National Science Foundation (NSF), National Institute of Standards and Technology (NIST) and the Department of Energy's Office of Science (DOE SC)—three research agencies at the core of the President's *American Competitiveness Initiative (ACI)*. (For more details on the President's budget request, see *Computing Research News*, Vol. 19/ No. 2, March 2007.)

The two Congressional Budget Resolutions appear to endorse the priority the President placed on the three ACI agencies. They included room, beneath the funding caps established by the resolution, explicitly intended for increases at the agencies, as well as increases in education spending and funding at the National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), and National Institutes of Health (NIH).

In providing the budget allocations, members of the House Budget Committee included "Sense of the House" language within the resolution to spell out the goals of the increased funding:

> "America's greatest resource for innovation resides within classrooms across the country. The increased funding provided in this resolution will support important initiatives to educate 100,000 new scientists, engineers, and mathematicians, and place highly qualified teachers in math and science K–12 classrooms."
>
> ". . . Independent scientific research provides the foundation for innovation and future technologies. This resolution will put us on the path toward doubling funding for the National Science Foundation, basic research in the physical sciences across all agencies, and collaborative research partnerships; and toward achieving energy independence through the development of clean and sustainable alternative energy technologies."

The resolution initially reported out of the Senate Budget Committee failed to contain adequate allocations for federal science agencies. But in an amendment to the resolution on the Senate floor, Senators Jeff Bingaman (D-NM) and Lamar Alexander (R-TN) managed to restore an additional $1 billion in allocations specifically for science funding. The amendment, adopted overwhelmingly by the Senate, specifies that NSF would receive $400 million more in FY 08 than in FY 07, the Department of Energy's Office of Science would receive $600 million more than FY 07, and that additional provisions of the Senate's "America COMPETES Act" (S. 761) would have sufficient allocations in the resolution. In addition to continuing the doubling of NSF, NIST and DOE Office of Science, the COMPETES Act would create scholarship programs, summer academies, and AP training for current and future math and science teachers, set up new high-tech internships, and implement other recommendations of the National Academies *Rising Above the Gathering Storm* report.

If the two chambers can agree on a compromise resolution, that resolution will set the caps for the amount of money Congressional appropriators will have to spend as they begin the process of drafting and passing the 13 annual appropriations bills necessary to fund the operations of the federal government each year. If they fail to agree on a compromise, a different set of procedures in each chamber will dictate those caps. In either case, the fact that both chambers approved resolutions in which science funding was considered a priority should bode well for the science agencies at appropriations time. The approval in both chambers (and the near-unanimous approval in the Senate on a specific vote for the Bingaman/Alexander science funding amendment) argues strongly that there is clearly a "will of Congress" behind increasing science funding in support of innovation and competitiveness.

It will then be up to Congressional appropriators to actually use the allocations under the cap to fund

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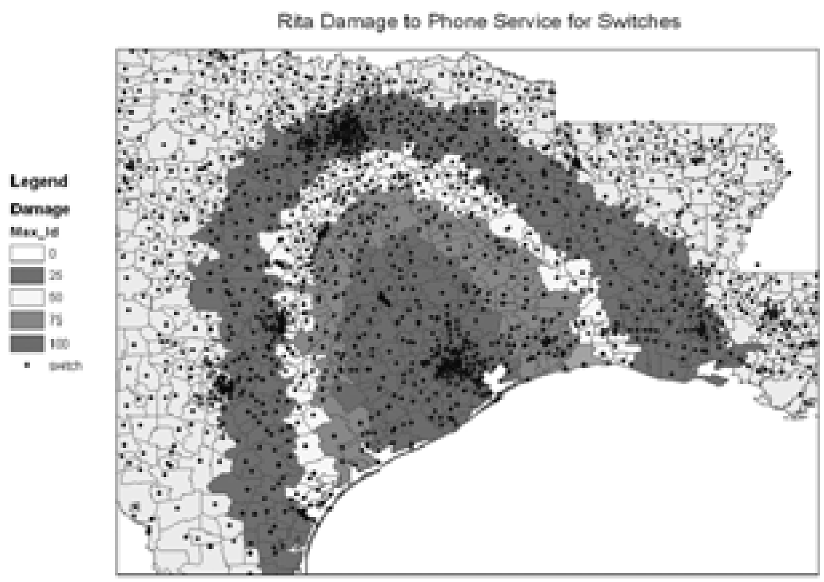
Scientific Computing at the Forefront – Los Alamos National Laboratory from Page 1



asked to make predictions of the effects on infrastructure sectors, including telecommunications, electric power, natural gas, and water infrastructure. This helped decision-makers rank order the importance of infrastructure assets such as telecom switches. Daily updates to DHS and the White House stressed our supercomputing resources for response time.

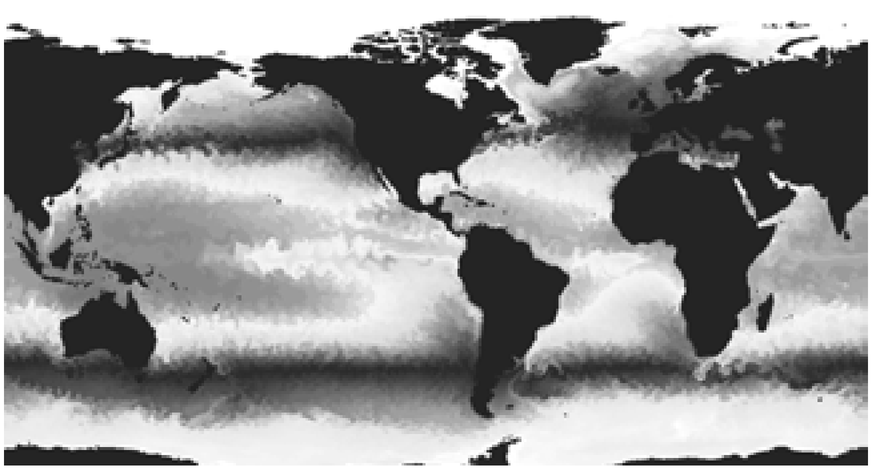
NISAC's epidemics modeling sector has also been used to "unleash virtual plagues" in real cities to see how social networks spread disease. This can help in the fight against epidemics.[2]

Questions of Climate Change Must Be Simulated – We Can't Experiment

specify actual emissions that will lead to prediction of the ability of land/ocean ecosystems to sequester carbon.[4]

Computing Scopes Out Possible Vaccines for HIV

Los Alamos maintains the HIV sequence database for the country. HIV continually evolves away from possible vaccines. It is a moving target and easily keeps ahead of experimental attempts to develop vaccines. Bette Korber, Tammoy Bhattacharya and their colleagues exploit computational techniques to watch for common features in the HIV genome that are conserved from mutation to mutation and give experimentalists a head start in constructing a vaccine. The



Modeling of the Global Climate is more important than ever. With the attention paid to greenhouse gases and their interaction with the biosphere, modeling holds the promise of understanding and perhaps knowing what to do.

Los Alamos collaborates with sister labs in building the national climate model and contributes the ocean and sea ice components. The "eddy-resolving" ocean models provide, at 10km resolution, the most detailed simulations of the global ocean circulation yet.[3]

Los Alamos develops the ocean ecosystem and trace gas components, while collaborators at Oak Ridge, Livermore, Pacific Northwest and the National Center for Atmospheric Research supply the atmospheric chemistry and land biogeochemistry. These next generation models incorporate the carbon cycle and

combinatorial possibilities are overwhelming, demanding the use of our supercomputers.[5]

Defense Against Radiological Attacks – Smuggled Nuclear Weapons? Dirty Bombs?

Detecting the radiation signature of nuclear materials is a tough job. Trying to quickly distinguish a real danger from medical isotopes, or the other myriad uses of radioactive material, demands knowledge of radiation transport. LANL has some of the world's experts in radiation transport who apply their knowledge to model what detectors should see. Real time response requires on-demand supercomputing.[6]

Astrophysics and Cosmology – Where is that Dark Energy?

Supercomputing at immense scale has become one of the central tools of cosmology. The mass function of dark matter halos is an indicator for dark energy, the enigmatic concept posed to help explain the observed acceleration of the expansion of the universe. The mass function describes the probability of finding an object of a given mass per unit volume of the Universe and can only be determined accurately via numerical simulation. Mike Warren and his colleagues performed a series of 16 different billion-particle simulations, and produced the most accurate determination of the mass function to date. Overall, these simulations required over 4×10^{18} floating point operations (4 exaflop!).[7]

Lattice QCD – Physics Beyond the Standard Model?

Quantum ChromoDynamics (QCD) is the reigning theory of quarks and gluons, the elementary particles that constitute nuclear matter. Standard methods for calculating masses and their decay fail, but some numerical simulations have already reached 5 to 10 percent accuracy. With the advent of petascale computing, we anticipate first principle results with 1 percent accuracy, providing hints of new physics beyond the standard model.[8]

These Applications Drive Our Computer Science

There are many more exciting science missions at LANL. Modeling and simulation has driven much of our computer science investment. Although we have played a major role with the computer companies in defining hardware architectures, we have invested heavily in software research.

Science Appliance – Making the Sysadmin's Life Easier

One of the challenges in managing modern parallel supercomputers has been their efficient system administration. Processor and parts count has increased greatly. Mean time between failures has decreased and the sysadmin's task of administering thousands of process spaces has become daunting. Starting as a research project in 1999, Ron Minnich and his colleagues developed the "Science Appliance" suite that attacks these problems in several ways.

Combined with the open source LinuxBIOS it allows the booting of thousands of nodes in seconds rather than minutes or hours. Science Appliance has now become production software on some of our HPC clusters. LinuxBIOS has been chosen for the "One Laptop per Child" project and has now appeared on over a million machines throughout the world. [9]

OpenMPI, MPI-IO and Data Storage – Handling Those Vast Amounts of Data

Although there has been much work on parallel languages, MPI (the Message Passing Interface) is still the workhorse of most scientific parallel computing. Los Alamos developed an implementation of MPI (LAMPI) for two special needs in very large clusters—scalable performance and reliability through hardware failure. LAMPI merged with three other implementations of MPI into the open source OpenMPI [10] which is now widely distributed and has proven its performance. It recently powered Sandia National Laboratory's Thunderbird cluster to number 6 in the top 500.[11]

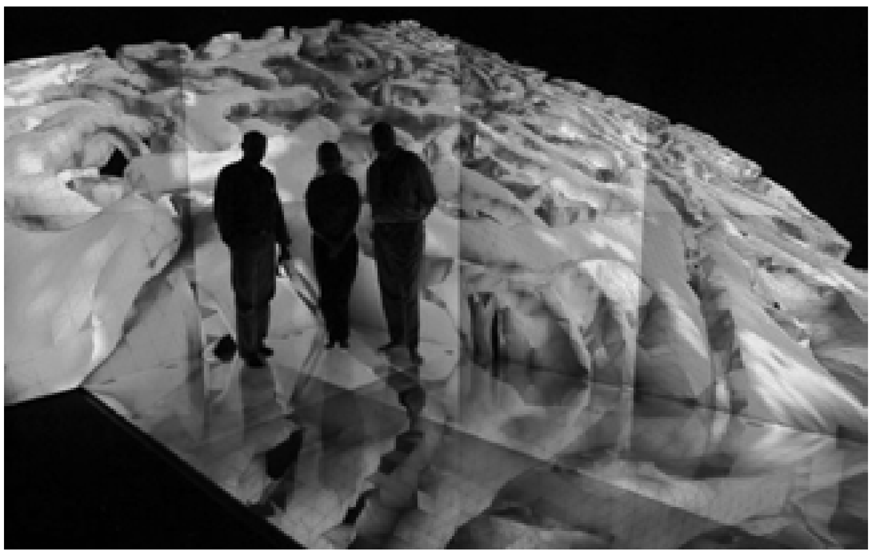
Big simulations mean big data, but that data is only useful if you can get it out of the supercomputer, store it and analyze it. With Sandia, LANL has been very active in funding enhancements to the parallel I/O standard, MPI-IO for the ASC program and leads the High End Computing Interagency Working Group (HECIWG) on File Systems, I/O, and Storage. This is the technical advisory group that coordinates the research and development investments of all participating high end computing agencies, including DOD, NSF, DOE, NASA, and others.

Performance Modeling – How Fast Do These Computers Really Go?

The Performance and Architecture Laboratory (PAL) develops end-to-end models of the entire computing system, from applications through system software to the hardware itself. Performance models developed by PAL for a wide workload and supercomputer spectrum are the tools of choice for performance analysis, system design, system and application optimization, and accurate performance prediction for current and future applications and systems. The practical impact of this work is significant, given the cost of developing application software and architectures at this scale. PAL continues to apply these techniques for LANL and plays a central role in performance modeling for much of the HPC community.[12]

Continued on Page 6

Scientific Computing at the Forefront – Los Alamos National Laboratory
from Page 6



Scientific Visualization – Picture That Instead of Numbers

Visualization ranging in scale from the desktop to large three-dimensional caves has been absolutely necessary with the vast amounts of data generated by supercomputers. Over many years LANL has contributed much to the research topics in visualization, but has also built some of the most impressive facilities on Earth. The Data Visualization Corridor built for the ASC program is a complement to the supercomputing facilities, and has provided visual insights into complex calculations not available any other way.[13]

Petaflops? – How Do We Get There?

Petaflops is an artificial computing-speed milestone along the road, but is an indication of how far we have come. The entire world of HPC is rushing towards real sustained petaflops speed, but there are immense hardware and software challenges. Commercially available processors are going through a sea change to become either "many-core" processors or hybrid processors. LANL is exploring hybrid computing and is working with IBM to build "Road Runner," a petaflops-level supercomputer based on the Cell processor! This is a game chip, right? But look more closely and you'll find that Cells have vector-like processor units and promise immense gains in computing speed.[14]

Where Are We Going?

I've described only a small fraction of scientific computing at Los Alamos. Our heritage is based on simulation and HPC, but perhaps even more important has become the analysis of Big Data acquired from all sources, not just simulation. The explosion of sequenced genetic data, new high-energy experimental facilities, comprehensive astronomical surveys, and the vast unwashed mass of data on the web have led us to place new emphasis outside of traditional HPC. Much of this data is no longer homogeneous, is not represented by floating point numbers, and is distributed all over the world. You can imagine the challenges that we need to meet to adapt to these changes in computing, but our 63-year history in scientific computing gives me confidence that we are up to the task.

Bill Feiereisen *is Chief Technologist at Los Alamos National Laboratory.*

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3. J. L. McClean, et. al., 2006: "Quantitative measures of the fidelity of eddy-resolving ocean models," *Oceanography*, 19, 104-117.
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7. Warren et. al, *Astrophysical Journal*, 646 (2006) 881-885.
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10. http://www.open-mpi.org/.
11. http://www.sandia.gov/news/resources/releases/2006/thunderbird.html.
12. http://www.hpcwire.com/hpc/593744.html and A. Hoisie, et. al. "A Performance Comparison through Benchmarking and Modeling of Three Leading Supercomputers: Blue Gene/L, Red Storm, and Purple." *Proceedings of SC06*, Tampa, FL, November 2006.
13. "Extreme Resolution Visualization Enables New Discoveries. Advancing the nature of predictive simulation science." L. Monroe, et. al., *Scientific Computing*, February 2006.
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The Computing Community Consortium—The Way Forward
from Page 4

on science. This idea went forward as a White Paper to appropriate folks within NSF. Eventually, after working its way through the internal NSF budget process, it resulted in a large new FY08 request—Cyber-Enabled Discovery and Innovation (a foundation-wide program beginning at $52 million in FY08 and intended to grow to $250 million in FY12).

This is an example of an idea begun by a few individuals, nurtured within a professional guild, supported by a federal agency, and turned into a major funded program—but not without a few bumps.

2. **GENI**: Global Environment for Network Innovations (see www.geni.org for more details). This is an example of a program that was nucleated by a program officer within NSF who took the idea to several key networking researchers who ran with it. At this point a fairly large community extending beyond networking is involved, and the program is moving through the NSF Major Equipment and Research Facilities Construction process.
3. **Internet-scale computing research or data-intensive supercomputing**: Thinking about research problems on a scale like Google—massive amounts of data, massive amounts of computation. The concept is to provide academic researchers with the infrastructure to explore algorithms, protocols, and ideas that require access to massive server farms and streaming data. Still in the nucleation stage.
4. **How to cope with multicore**: computer architecture and programming research for the future. In December 2005 CRA held a Grand Research Challenges in Computer Architecture workshop to discuss these, and other, issues. This was not a unique event—all computing researchers can see the collision of multicores and our current ability to compute concurrently. This is an example of an area that is gaining traction in both industry and federal agencies.

These are samples of ongoing efforts. CCC's goal is to encourage more such efforts, and to help those that gain traction to succeed.

We have chosen to highlight CCC at the upcoming FCRC (http://www.acm.org/fcrc), and have five presentations scheduled:

1. Ed Lazowska, Chair of the CCC Council, will be giving a keynote on Friday, June 15.
2. Christos Papadimitriou, UC Berkeley, will be talking about the theory initiative.
3. Randy Bryant, CMU, will be talking about Internet-scale computing research.
4. Larry Peterson, Princeton, and Scott Shenker, UC Berkeley, will be talking about GENI.
5. Bob Colwell (ex-Intel) will be talking about future research in computer architecture, compilers and languages.

Each of these talks will be in the context of how to move from gleam to funded program, and how CCC can help.

"The best way to predict the future is to invent it." Hope to see you there!

Andy Bernat *(abernat@cra.org) is CRA's Executive Director.* ***Ed Lazowska*** *(lazowska@cs.washington.edu), Bill & Melinda Gates Chair in Computer Science & Engineering at the University of Washington, was recently appointed the inaugural Chair of the Computing Community Consortium (CCC) Council.* ∎

CRA Announces 2007 Service Award Winners from Page 1

a Program Director in CISE at the National Science Foundation.

Jan Cuny has been a prime mover within CRA-W on a number of projects over a long period of time, including: co-founder (with Mary Lou Soffa) of both the Grad Cohort and the Associate Professor Cohort programs; Distributed Mentor Program; Computing Research Experiences for Women; and Computing Research Experiences for Undergraduates. In addition, she was co-author (with Bill Aspray) of the highly regarded and widely read report, "Best Practices in the Recruitment and Retention of Women Graduate Students in Computer Science and Engineering"; co-organizer of one of the earliest CRA panels on diversity in computing (1996); and a member of the Executive Committee of the Coalition to Diversify Computing.

Currently Cuny directs the Broadening Participation in Computing (BPC) program at NSF. From the beginning of this program, her vision directed a process that has been a model of inclusiveness for diversity-oriented programs at NSF and elsewhere. ∎

Staff Accountant Joins CRA

CRA is pleased to welcome Fidelio "Feddy" Tolentino as Staff Accountant, effective March 19, 2007.

Feddy has a bachelor's degree in business administration with a major in accounting. He passed the CPA board in the Philippines, and was a United Nations Development Program Scholar.

Before joining CRA, Feddy was Accounting Manager at the National Petrochemical & Refiners Association, and has more than 20 years of experience in the accounting field in a variety of settings. He has the skills necessary to provide the kind of assistance CRA needs as we continue to upgrade and improve our financial systems to meet increasing demands. ∎

2005-2006 Taulbee Survey

Record Ph.D. Production Continues; Undergraduate Enrollments Turning the Corner

By Stuart Zweben

This article and the accompanying figures and tables present the results of the 36th 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 22, 2007 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 (2005-2006). Data for new students in all categories refer to the current academic year (2006-2007). Projected student production and information on faculty salaries and demographics also refer to the current academic year. Faculty salaries are those effective January 1, 2007.

The data were collected from Ph.D.-granting departments only. A total of 235 departments were surveyed, three more than last year. As shown in Figure 1, 188 departments returned their survey forms, for a response rate of 80%. This is down slightly from last year's 81%, but is still quite comprehensive. The return rate of 12 out of 33 (36%) for CE programs is, as usual, very low. 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 175, or 89%) again was very good, and there was only a fair response rate (20 of 28, or 71%) 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. Nevertheless, 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. This year, the survey included questions about department space, sources of external funding, support staff, grad student recruiting methods, and teaching loads. These questions are added to the survey only every third year because the data in these areas change slowly.

There are some new reports generated this year in the area of faculty demographics. See that section for details.

Departments that responded to the survey were sent preliminary results about faculty salaries in December 2006; 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)*

Last year, we reported record Ph.D. production of 1,189. This year, another record crop of Ph.D.s was produced. The total Ph.D. production between July 2005 and June 2006 of 1,499 (Table 1) represents a phenomenal 26% increase. While last year's report anticipated a new record, the magnitude of the increase was not anticipated. Even with the 26% growth, departments last year overestimated the number of Ph.D.s that would be produced. But the "optimism ratio," defined as the actual number divided by the predicted number, was 0.94, well in excess of the 0.80 and 0.76 ratios from the past two years. If this year's optimism ratio holds again next year, there will be more than 1,700 new Ph.D.s produced in 2006-2007.

The number of new students passing thesis candidacy exams (most, but not all, departments have such exams) rose 19%. This is an indication that more record production is in store in the near term.

Longer term, Ph.D. production should ease. The number of students who passed the qualifier declined 5%, and the total number of new Ph.D. students (Table 5) declined more than 6% (the fourth straight year of a decline in number of new students). Figure 3 (see p. 11) shows a graphical view of the pipeline for the computer science programs. The data in this graph are normalized by the number of departments reporting to the survey. 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. As mentioned in previous reports, these data can be useful in estimating the timing of changes in production rates.

This is the second year we obtained information about the number of new students who come from outside North America. Table 5a (see p. 9) reports the data for the fall 2006 class. Top-ranked U.S. departments continue to 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. In fact, each of these differences grew during the past year.

Table 4 shows employment for new Ph.D. recipients. Of those who reported employment, only one-third took academic employment in North America (compared to 43% last year and 60% the year before). Again, most of these academic positions were in Ph.D.-granting departments, and once more there was a decline in the percentage who went into tenure-track positions (12.8% vs. 17.5% last year and 27.5% the year before). There was a slight decline this year in

Table 2. Gender of PhD Recipients by Type of Degree

	CS		CE		CS&CE	
Male	1,068	81.5%	126	85.7%	1,194	81.9%
Female	243	18.5%	21	14.3%	264	18.1%
Total have Gender Data for	**1,311**		**147**		**1,458**	
Unknown	1		40		41	
Total	**1,312**		**187**		**1,499**	

Table 3. Ethnicity of PhD Recipients by Type of Degree

	CS		CE		CS&CE	
Nonresident Alien	720	56.0%	94	63.9%	814	56.8%
African-American, Non-Hispanic	18	1.4%	0	0.0%	18	1.3%
Native American/ Alaskan Native	8	0.6%	0	0.0%	8	0.6%
Asian/Pacific Islander	165	12.8%	26	17.7%	191	13.3%
Hispanic	10	0.8%	2	1.4%	12	0.8%
White, Non-Hispanic	351	27.3%	25	17.0%	376	26.2%
Other/Not Listed	14	1.1%	0	0.0%	14	1.0%
Total have Ethnicity Data for	**1,286**		**147**		**1,433**	
Ethnicity/ Residency Unknown	26		40		66	
Total	**1,312**		**187**		**1,499**	

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	272	27.2	293	24.4	287	23.9	170 (7)	24.3
US CS 13-24	220	18.3	247	22.0	242	20.2	203 (11)	18.4
US CS 25-36	151	12.6	187	15.6	204	17.0	120 (10)	12.0
US CS Other	667	6.4	875	7.5	949	8.1	769 (96)	8.0
Canadian	98	5.2	156	7.8	212	10.6	161 (16)	10.1
US CE	91	10.1	105	8.8	60	5.0	54 (8)	6.8
Total	**1,499**	**8.9**	**1,863**	**10.1**	**1,954**	**10.6**	**1,477 (148)**	**10.0**

2005-2006 Taulbee Survey

the number (66 vs. 72 last year) and percentage (5.2% vs. 7.0% last year) of those who went to other CS/CE departments. Nevertheless, the 66 figure still is more than twice that of just two years ago. The data on employment in postdoctoral positions were similar to last year.

There was a large increase (49.4% vs. 39.6% last year) in the fraction of new Ph.D.s going to industry. Figure 4 (see p. 11) shows the employment trend of new Ph.D.s in academia and industry, and the proportion of those going to academia who took positions in other than Ph.D.-granting CS/CE departments. As was the case during the dot-com boom years, industry is taking a much larger share of new Ph.D.s than is academia.

The continued record Ph.D. production has not resulted in higher unemployment among new Ph.D.s. In fact, the reported unemployment is even lower than

Taulbee Continued on Page 9

Figure 1. Number of Respondents to the Taulbee Survey

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%)
2006	156/175 (89%)	12/33 (36%)	20/28 (71%)	188/235 (80%)

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	15	21	2	11	41	11	12	19	22	9	163	12.8%
Researcher	7	1	3	2	4	2	3	2	5	4	33	2.6%
Postdoc	32	2	5	7	10	4	19	9	6	20	114	8.9%
Teaching Faculty	2	2	0	1	4	2	2	2	2	5	22	1.7%
											332	26.0%
North American, Other Categories												
Other CS/CE Dept.	9	3	4	5	14	4	10	2	6	9	66	5.2%
Non-CS/CE Dept.	3	0	0	1	3	3	1	1	2	3	17	1.3%
Industry	84	67	25	44	157	47	34	45	70	57	630	49.4%
Government	10	2	4	0	3	1	0	3	1	8	32	2.5%
Self-Employed	2	0	0	1	1	0	1	1	1	0	7	0.5%
Unemployed	2	0	0	0	0	0	3	0	2	2	9	0.7%
Other	1	1	0	0	4	2	2	1	4	1	16	1.3%
											777	60.9%
Outside North America												
Tenure-Track in PhD Granting	3	0	2	2	10	7	3	5	4	3	39	3.1%
Researcher in PhD	2	0	0	0	2	0	0	2	1	1	8	0.6%
Postdoc in PhD	8	1	2	1	4	1	6	2	1	4	30	2.4%
Teaching in PhD	2	0	0	1	0	0	1	2	1	4	11	0.9%
Other Academic	0	1	0	0	1	2	3	0	1	1	9	0.7%
Industry	4	5	1	2	14	1	2	4	1	3	37	2.9%
Government	2	0	0	0	1	0	0	0	2	1	6	0.5%
Other	1	3	0	0	3	2	1	1	2	14	27	2.1%
											167	13.1%
Total in North America	**167**	**99**	**43**	**72**	**241**	**76**	**87**	**85**	**121**	**118**	**1,109**	86.9%
Total Outside North America	**22**	**10**	**5**	**6**	**35**	**13**	**16**	**16**	**13**	**31**	**167**	13.1%
Total have Employment Data for	189	109	48	78	276	89	103	101	134	149	1,276	100.0%
Unknown	13	11	5	2	29	9	7	13	7	127	223	
Total	**202**	**120**	**53**	**80**	**305**	**98**	**110**	**114**	**141**	**276**	**1,499**	

Table 5. New PhD Students in Fall 2006 by Department Type and Rank

	CS				CE				CS&CE	
Department, Rank	**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	334	28	362	30.2	0	0	0	0.0	362	30.2
US CS 13-24	278	19	297	24.8	3	0	3	0.3	300	25.0
US CS 25-36	268	26	294	24.5	20	2	22	1.8	316	26.3
US CS Other	976	159	1,135	9.7	145	28	173	1.5	1,308	11.2
Canadian	180	17	197	9.9	0	0	0	0.0	197	9.9
US CE	0	0	0	0.0	82	8	90	7.5	90	7.5
Total	**2,036**	**249**	**2,285**	12.4	**250**	**38**	**288**	1.6	**2,573**	**13.9**

2005-2006 Taulbee Survey

Table 5a. New PhD Students from Outside North America

Department, Rank	CS	CE	CS&CE	Total New	% Outside North America
US CS 1-12	143	0	143	362	39.5%
US CS 13-24	147	2	149	300	49.7%
US CS 25-36	172	5	177	316	56.0%
US CS Other	650	122	772	1,308	59.0%
Canadian	70	0	70	197	35.5%
US CE 0	0	55	55	90	61.1%
Total	**1,182**	**184**	**1,366**	**2,573**	**53.1%**
Total New	2,285	288	2,573		
% Outside	**51.7%**	**63.9%**	**53.1%**		

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

Department, Rank	CS		CE		CS&CE	
US CS 1-12	2,283	18.3%	0	0.0%	2,283	16.6%
US CS 13-24	1,662	13.3%	21	1.7%	1,683	12.2%
US CS 25-36	1,323	10.6%	22	1.8%	1,345	9.8%
US CS Other	5,956	47.7%	735	58.6%	6,691	48.7%
Canadian	1,272	10.2%	0	0.0%	1,272	9.3%
US CE	0	0.0%	477	38.0%	477	3.5%
Total	**12,496**		**1,255**		**13,751**	

Table 7. PhD Program Total Enrollment by Gender

	CS		CE		CS&CE	
Male	9,942	79.8%	1,025	81.9%	10,967	80.0%
Female	2,522	20.2%	227	18.1%	2,749	20.0%
Total have Gender Data for	**12,464**		**1,252**		**13,716**	
Unknown	32		3		35	
Total	**12,496**		**1,255**		**13,751**	

Table 8. PhD Program Total Enrollment by Ethnicity

	CS		CE		CS&CE	
Nonresident Alien	5,965	51.9%	828	68.3%	6,793	53.5%
African-American, Non-Hispanic	203	1.8%	21	1.7%	224	1.8%
Native American/ Alaskan Native	26	0.2%	4	0.3%	30	0.2%
Asian/Pacific Islander	1,160	10.1%	90	7.4%	1,250	9.8%
Hispanic	158	1.4%	15	1.2%	173	1.4%
White, Non-Hispanic	3,784	32.9%	243	20.0%	4,027	31.7%
Other/Not Listed	201	1.7%	11	0.9%	212	1.7%
Total have Ethnicity Data for	**11,497**		**1,212**		**12,709**	
Ethnicity/Residency Unknown	999		43		1,042	
Total	**12,496**		**1,255**		**13,751**	

Taulbee from Page 8

last year (0.7% vs. 1.5% last year). Among those whose employment is known, the proportion (13.1%) of Ph.D. graduates who were reported taking positions outside North America is higher than last year for the second year in a row.

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 and multi-year trends are difficult to discern. This year, there was a huge increase in the OS/networks area and a decline in the software engineering area. There also was an increase in the "unknown/other" category. It may be necessary to examine the categories being used to see if they are missing significant emerging areas.

The proportion of women among new Ph.D.s rose to 18.1% in 2006 after falling to 14.7% in 2005 (Table 2). This year's proportion is about the same as it was two years ago. The proportion of nonresident alien Ph.D.s rose from 53.4% in 2005 to 56.8% in 2006 (Table 3). Just two years ago this fraction was only 48.2%. This increase comes mainly at the expense of White, non-Hispanics. African-American, Native-American/Alaskan Native, and Hispanics collectively accounted for only 2.7% of the total, about the same as two years ago and down slightly from last year.

Current Ph.D. enrollment proportions are similar this year to those of last year. This is true for both gender and ethnicity proportions (Tables 7 and 8).

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

	Bachelor's						Master's					
	CS		CE		CS&CE		CS		CE		CS&CE	
Male	10,429	85.8%	1,824	85.8%	12,253	85.8%	5,353	77.1%	696	78.4%	6,049	77.3%
Female	1,725	14.2%	302	14.2%	2,027	14.2%	1,587	22.9%	192	21.6%	1,779	22.7%
Total have Gender Data for	**12,154**		**2,126**		**14,280**		**6,940**		**888**		**7,828**	
Unknown	775		368		1,143		177		69		246	
Total	**12,929**		**2,494**		**15,423**		**7,117**		**957**		**8,074**	

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

	Bachelor's						Master's					
	CS		CE		CS&CE		CS		CE		CS&CE	
Nonresident Aliens	794	8.7%	217	11.3%	1,011	9.2%	2,979	47.3%	397	46.7%	3,376	47.3%
African-American, Non-Hispanic	358	3.9%	102	5.3%	460	4.2%	124	2.0%	13	1.5%	137	1.9%
Native American/ Alaskan Native	25	0.3%	5	0.3%	30	0.3%	16	0.3%	2	0.2%	18	0.3%
Asian/Pacific Islander	1,587	17.4%	361	18.9%	1,948	17.7%	942	15.0%	141	16.6%	1,083	15.2%
Hispanic	421	4.6%	108	5.6%	529	4.8%	106	1.7%	21	2.5%	127	1.8%
White, Non-Hispanic	5,805	63.7%	1,089	56.9%	6,894	62.6%	2,052	32.6%	269	31.6%	2,321	32.5%
Other/Not Listed	118	1.3%	31	1.6%	149	1.4%	74	1.2%	7	0.8%	81	1.1%
Total have Ethnicity Data for	**9,108**		**1,913**		**11,021**		**6,293**		**850**		**7,143**	
Ethnicity/Residency Unknown	3,821		581		4,402		824		107		931	
Total	**12,929**		**2,494**		**15,423**		**7,117**		**957**		**8,074**	

2005-2006 Taulbee Survey

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

While Ph.D. production was at a record high, Master's and Bachelor's degree production dropped significantly. Master's degree production was down 13%, from 9,286 in the year ending June 2005 to 8,074 in the year ending June 2006 (Tables 9, 10). This is reasonably consistent with the 17% drop in new Master's students reported two years ago.

There was very little difference in gender characteristics of Master's recipients compared to last year's survey. A slightly higher percentage of Master's recipients reported this year were White, non-Hispanic, while there was a corresponding decrease in the percentage of Nonresident Alien recipients. Actual Master's degrees awarded were within 2% of last year's projections. This year's projections by the departments would suggest another decline of nearly 10% in Master's production for the current academic year.

Enrollment in Master's programs by new students (Table 13) is about the same as last year, while total enrollment (Table 15) is down by more than 10% (all attributable to declines in computer science Master's programs). The proportion of new Master's students coming from outside North America rose from 46.5% last year to 56.7% this year. As was the case for new Ph.D. students, top departments have a greater proportion of new domestic Master's students than lower-ranked departments.

Bachelor's degree production was down more than 15%, following the 13% decrease reported last year. These decreases are predictable from the significantly decreased enrollments in undergraduate programs that have been observed in recent surveys and reported widely in the media. The proportion of Bachelor's degrees awarded to women was about the same as last year. There also was another increase in the proportion of White, non-Hispanics receiving Bachelor's degrees, from 59.6% to 62.6%, and another corresponding decrease in the proportion of Asian/Pacific Islanders receiving these degrees.

Actual Bachelor's degree production in departments reporting this year was only 3.1% lower than the projection from last year's reporting departments. From this year's estimates, it would appear that another 16% decline is looming. If this holds true, it would represent a drop of more than 40% over a three-year period.

Taulbee Continued on Page 11

Figure 2. PhD Production

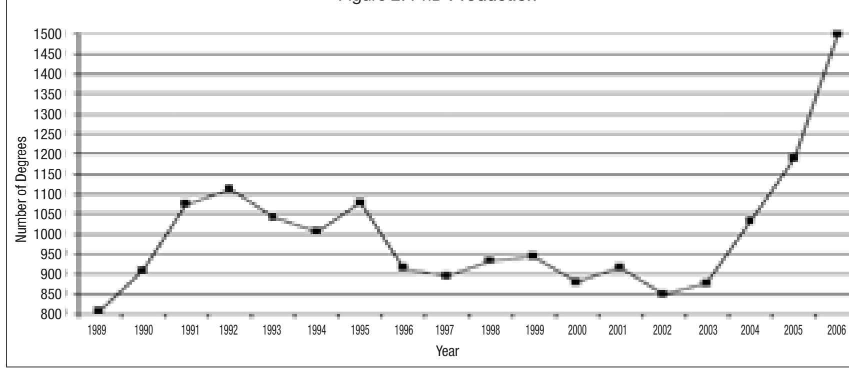


Table 11. Bachelor's Degree Candidates for 2006-2007 by Department Type and Rank

Department, Rank	CS		CE		CS&CE	
US CS 1-12	1,172	11.0%	180	8.1%	1,352	10.5%
US CS 13-24	861	8.1%	140	6.3%	1,001	7.7%
US CS 25-36	936	8.8%	167	7.5%	1,103	8.5%
US CS Other	5,521	51.6%	1,147	51.4%	6,668	51.6%
Canadian	2,203	20.6%	20	0.9%	2,223	17.2%
US CE	0	0.0%	579	25.9%	579	4.5%
Total	**10,693**		**2,233**		**12,926**	

Table 12. Master's Degree Candidates for 2006-2007 by Department Type and Rank

Department, Rank	CS		CE		CS&CE	
US CS 1-12	733	11.4%	68	7.6%	801	11.0%
US CS 13-24	791	12.3%	2	0.2%	793	10.8%
US CS 25-36	437	6.8%	230	25.8%	667	9.1%
US CS Other	3,770	58.8%	360	40.4%	4,130	56.5%
Canadian	686	10.7%	0	0.0%	686	9.4%
US CE	0	0.0%	232	26.0%	232	3.2%
Total	**6,417**		**892**		**7,309**	

Table 13. New Master's Students in Fall 2006 by Department Type and Rank

	CS		CE		CS & CE		Outside North America	
Department, Rank	Total	Avg. per Dept.	Total	Avg. per Dept.			Total	%
US CS 1-12	503	41.9	66	5.5	569	47.4	222	39.0%
US CS 13-24	890	80.9	3	0.3	893	81.2	603	67.5%
US CS 25-36	299	24.9	25	2.1	324	27.0	217	67.0%
US CS Other	3,205	27.4	370	3.2	3,575	30.6	2,071	57.9%
Canadian	521	26.1	0	0.0	521	26.1	243	46.6%
US CE	0	0.0	119	9.2	119	9.2	49	41.2%
Total	**5,418**		**583**		**6,001**	**32.4**	3,405	56.7%

Table 14. New Undergraduate Students in Fall 2006 by Department Type and Rank

	CS			CE			CS&CE Majors	
Department, Rank	Pre-Major	Major	Avg. Major per Dept.	Pre-Major	Major	Avg. Major per Dept.	Major	Avg. Major per Dept.
US CS 1-12	193	762	63.5	0	154	25.7	916	76.3
US CS 13-24	126	527	43.9	0	237	33.9	764	63.7
US CS 25-36	220	932	77.7	0	227	28.4	1,159	96.6
US CS Other	2,742	5,619	54.6	896	1,426	26.4	7,045	68.4
Canadian	206	2,335	129.7	0	17	2.4	2,352	130.7
US CE	0	0	0.0	71	547	60.8	547	60.8
Total	**3,487**	**10,175**		**967**	**2,608**		**12,783**	**77.0**

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

Department, Rank	CS		CE		CS&CE	
US CS 1-12	1,078	6.7%	99	6.1%	1,177	6.6%
US CS 13-24	1,701	10.5%	10	0.6%	1,711	9.6%
US CS 25-36	792	4.9%	51	3.1%	843	4.7%
US CS Other	10,530	65.1%	990	61.0%	11,520	64.7%
Canadian	2,084	12.9%	0	0.0%	2,084	11.7%
US CE	0	0.0%	474	29.2%	474	2.7%
Total	**16,185**		**1,624**		**17,809**	

CRA Academic Careers Workshop

Feb. 25-26 - **2008**

Check: http://www.cra.org in the fall for details

2005-2006 Taulbee Survey

Taulbee from Page 10

The news is much better when looking at new Bachelor's degree students. For the first time in four years, the number of new undergraduate majors is slightly higher than the corresponding number last year (see Table 14 and Figure 7). This holds true when looking at only the more robust computer science numbers. The number of new computer science pre-majors is up nearly 10%. Perhaps these are signs of renewed interest in the undergraduate computer science major. One should not jump to conclusions based on one year's data, but the cessation of declining numbers of new students is welcomed by our computer science programs.

Total enrollment in Bachelor's programs (Table 16) is down 14% from last year, echoing the drop reported in last year's survey. Enrollment today is more than 40% lower than it was four years ago.

Faculty Demographics *(Tables 17-23)*

Total faculty sizes fell by 4% during the past year. All categories except postdocs experienced a decline. Tenure-track faculty, the dominant category, fell 3% to nearly the level of two years ago. In view of the record Ph.D. production, it appears the effects of reduced enrollments in our undergraduate programs have had an impact on faculty hiring. It should be noted, however, that departments ranked 13-36 did grow by more than 8% in aggregate.

Last year, the reporting departments predicted a 6% increase in faculty size, so the decline may have surprised many. Last year's predictions were unmet in all categories of faculty, although ranks 13-36 came very close. Departments reporting this year forecast a slightly more modest 4% growth for next year. If achieved, this will return sizes to last year's level. We'll see.

Table 18a is new this year. It shows the faculty demographics for each of the U.S. CS ranking strata. The table illustrates that higher ranked

Figure 3. CS Pipeline Corrected for Year of Entry

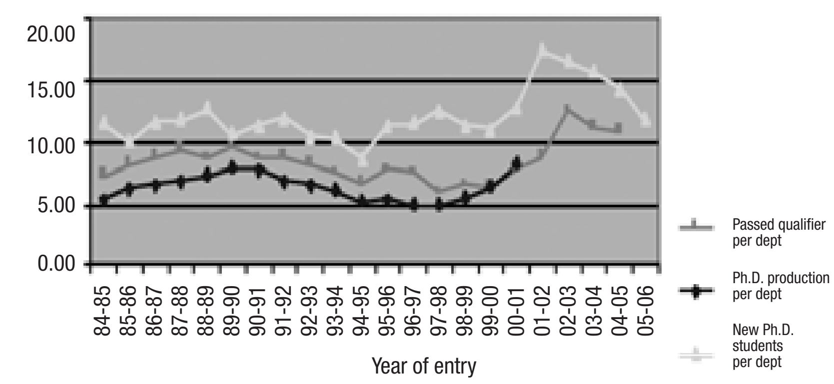


Figure 5. Nonresident Aliens as Fraction of Ph.D. Enrollments

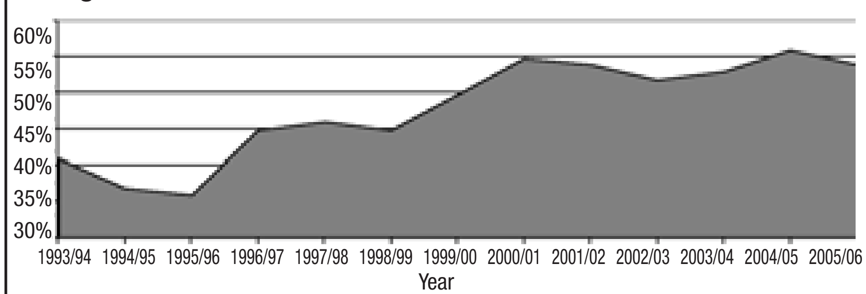


Figure 4. Employment of New Ph.D.s in U.S. and Canada

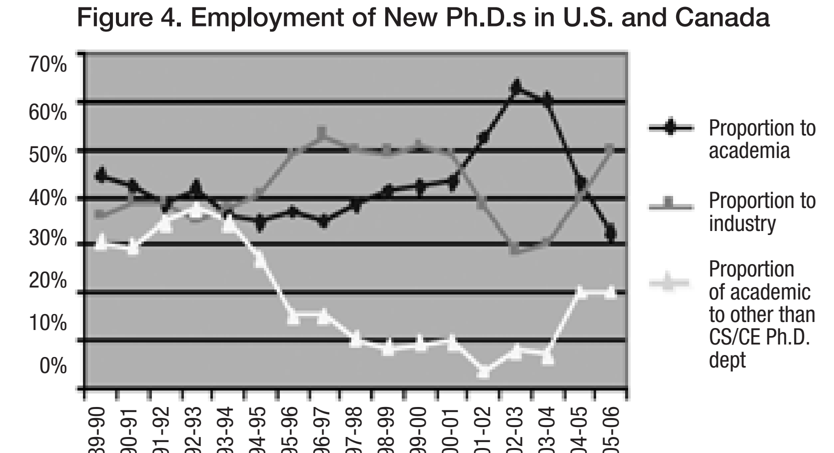


Figure 6. BS Production

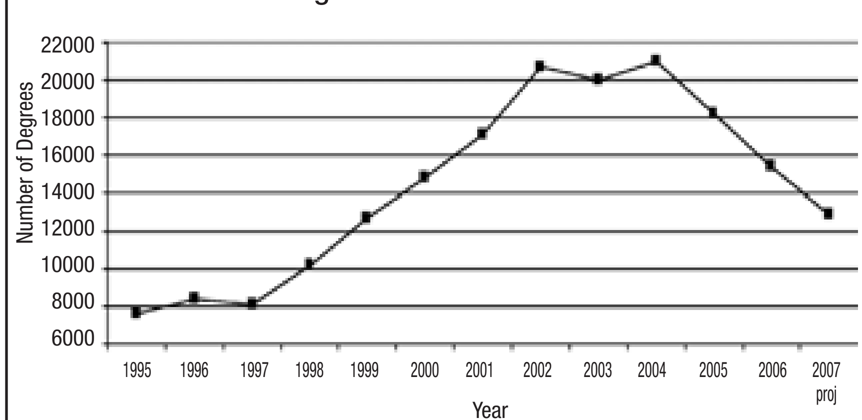


Table 16. Bachelor's Degree Program Total Enrollment by Department Type and Rank

	CS			CE			CS&CE Majors	
Department, Rank	Pre-Major	Major	Avg. Major per Dept.	Pre-Major	Major	Avg. Major per Dept.	Total	Avg. Major per Dept.
US CS 1-12	266	3,677	306.4	0	531	88.5	4,208	350.7
US CS 13-24	182	2,887	240.6	0	853	121.9	3,740	311.7
US CS 25-36	430	3,770	314.2	44	581	72.6	4,351	362.6
US CS Other	5,669	24,650	228.2	1,368	5,398	100.0	30,048	278.2
Canadian	153	12,977	648.9	0	97	13.9	13,074	653.7
US CE	0	0	0.0	138	1,958	195.8	1,958	195.8
Total	**6,700**	**47,961**	**275.6**	**1,550**	**9,418**	**54.1**	**57,379**	**329.8**

Table 17. Actual and Anticipated Faculty Size by Position

	Actual	Projected		Expected Two-Year Growth	
	2006-2007	2007-2008	2008-2009		
Tenure-Track	4,403	4,534	4,718	315	7.2%
Researcher	411	451	485	74	18.0%
Postdoc	316	381	420	104	32.9%
Teaching Faculty	635	641	656	21	3.3%
Other/Not Listed	94	96	102	8	8.5%
Total	**5,859**	**6,103**	**6,381**	**522**	**8.9%**

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	720	743	767	47	6.5%
US CS 13-24	603	652	688	85	14.1%
US CS 25-36	560	603	634	74	13.2%
US CS Other	2,956	3,045	3,194	238	8.1%
Canadian	829	862	877	48	5.8%
US CE	191	200	221	30	15.7%
Total	**5,859**	**6,105**	**6,381**	**522**	**8.9%**

Note: Totals differ in Tables 17 & 18 due to roundoff of FTEs.

2005-2006 Taulbee Survey

departments tend to have more tenure-track faculty members and more postdocs than do lower ranked departments. If the growth forecasts hold true, departments ranked 13-36 will be hiring more postdocs in the next two years than will the top 12 departments.

Table 18b also is new this year, and shows the recruiting results from last year's hiring cycle. The data indicate that roughly one of every three open tenure-track positions went unfilled last year. In future years, trends in these data will be of interest to our community.

Table 23 on faculty "losses" shows no change (100 vs. 103 last year) in the number who left academia this past year through death, retirement, or taking nonacademic positions. In particular, the retirement number stayed about the same. The amount of "churn," the number of professors moving from one academic position to another, rose somewhat from 61 to 74, but this is less than 2% of the total size of the tenure-track faculty.

The percentage of newly hired women faculty (Table 19) dropped slightly from 22% to 19.6%; the proportion of women hired into tenure-track positions mirrors that for all faculty positions. These proportions of new women faculty are similar to the 18.1% proportion of new female Ph.D.s shown in Table 2.

The proportion of White, non-Hispanic tenure-track hires stayed the same this year, while the proportion of nonresident aliens and African-Americans increased and the proportion of Asian/Pacific Islanders hired decreased. The trend of disproportionately fewer nonresident aliens being hired into tenure-track faculty positions (28.5%) compared to nonresident aliens' proportion of the new Ph.D.s produced (56.8%) continues. The increased proportion of newly hired African-Americans (3.3% of faculty hires with known ethnicity, compared to 1.3% last year) is welcome in addressing diversity concerns. Nevertheless, with African-Americans comprising only 1.8% of our current Ph.D. enrollments (Table 8), it is not likely that this is a sustainable increase.

Tables 21 and 22 show gender and ethnicity data for all categories of current faculty, including postdocs. The proportion of female tenured faculty rose slightly this year (10.4% full professors vs. 9.8% last year; 13.1% associate professors vs. 12.5% last year), and the proportion of female postdocs also rose (19.6% vs. 16.7% last year). There is a smaller proportion of non-resident aliens as assistant professors and as postdocs compared to last year, while the proportion of postdocs who are Asian/Pacific Islanders and White, Non-Hispanic rose.

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

Taulbee Continued on Page 13

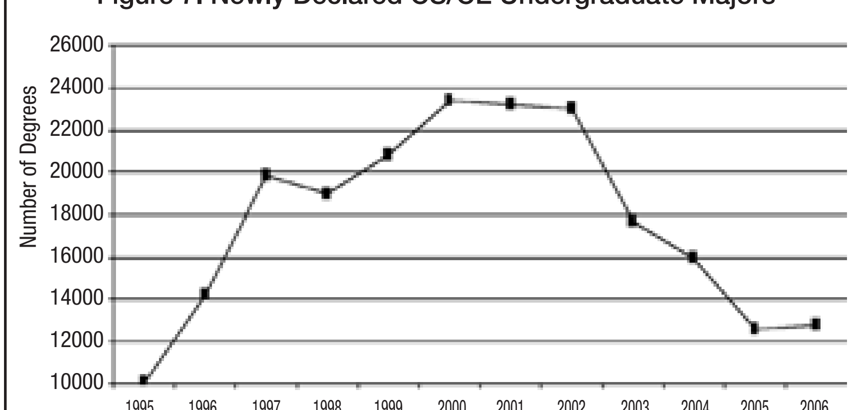
Table 18a. Actual and Anticipated CS Faculty Size by Position and Department Rank

	Actual		Projected					
	2006-2007		2007-2008		2008-2009		Expect 2-Yr Growth	
US CS 1-12	Total	Average	Total	Average	Total	Average	#	%
TenureTrack	484	40.3	497	41.4	514	42.8	30	6.2%
Research	55	4.6	59	4.9	62	5.2	7	12.7%
Postdoc	77	6.4	81	6.8	83	6.9	6	7.8%
Teaching	62	5.2	63	5.3	64	5.3	2	3.2%
Other	42	3.5	43	3.6	44	3.7	2	4.8%
US CS 13-24	Total	Average	Total	Average	Total	Average	#	%
TenureTrack	387	32.3	402	33.5	418	34.8	31	8.0%
Research	110	9.2	120	10.0	129	10.8	19	17.3%
Postdoc	57	4.8	74	6.2	85	7.1	28	49.1%
Teaching	47	3.9	51	4.3	53	4.4	6	12.8%
Other	3	0.3	3	0.3	3	0.3	0	0.0%
US CS 25-36	Total	Average	Total	Average	Total	Average	#	%
TenureTrack	378	31.5	405	33.8	422	35.2	44	11.6%
Research	59	4.9	65	5.4	70	5.8	11	18.6%
Postdoc	39	3.3	48	4.0	56	4.7	17	43.6%
Teaching	59	4.9	60	5.0	60	5.0	1	1.7%
Other	25	2.1	25	2.1	25	2.1	0	0.0%
US CS Other	Total	Average	Total	Average	Total	Average	#	%
TenureTrack	2,304	19.5	2,354	19.9	2,462	20.9	158	6.9%
Research	148	1.3	162	1.4	174	1.5	26	17.6%
Postdoc	93	0.8	115	1.0	128	1.1	35	37.6%
Teaching	388	3.3	389	3.3	401	3.4	13	3.4%
Other	22	0.2	24	0.2	28	0.2	6	27.3%

Table 18b. Vacant Positions 2005-2006 by Position and Department Rank and Type

	Vacant Positions 2005-2006			
	Tried to fill	Filled	Unfilled	% Unfilled
US CS 1-12				
TenureTrack	30	20	10	33.3%
Research	9	9	0	0.0%
Postdoc	6	6	0	0.0%
Teaching	40	29	11	27.5%
Other	10	7	3	30.0%
US CS 13-24				
TenureTrack	25	14	11	44.0%
Research	2	2	0	0.0%
Postdoc	6	6	0	0.0%
Teaching	12	12	0	0.0%
Other	3	3	0	0.0%
US CS 25-36				
TenureTrack	36	22	14	38.9%
Research	10	8	2	20.0%
Postdoc	10	8	2	20.0%
Teaching	14	9	5	35.7%
Other	3	2	1	33.3%
US CS Other				
TenureTrack	187	134	53	28.3%
Research	44	42	2	4.5%
Postdoc	43	42	1	2.3%
Teaching	40	36	4	10.0%
Other	4	3	1	25.0%
Canadian				
TenureTrack	39	27	12	30.8%
Research	6	5	1	16.7%
Postdoc	22	21	1	4.5%
Teaching	19	16	3	15.8%
Other	0	0	0	
US CE				
TenureTrack	13	9	4	30.8%
Research	7	7	0	0.0%
Postdoc	19	19	0	0.0%
Teaching	8	8	0	0.0%
Other	1	1	0	0.0%

Figure 7. Newly Declared CS/CE Undergraduate Majors



2005-2006 Taulbee Survey

Taulbee from Page 12

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 historically in the survey. The second is relative to researchers and postdocs, as well as tenured and tenure-track faculty. In general, the higher the ranking of the department, the higher the amount of external funding it receives (both in total and per capita). However, departments ranked 13-24 are close to the top 12 in median total funding and, in fact, are higher in median funding when the first capitation method is used. Canadian levels are shown in Canadian dollars.

Mean and median expenditures—both in total and on a per capita basis (no matter which capitation method is used)—declined for the top 12 U.S. departments for the second year in a row. Median expenditures for all U.S. CS department strata declined using the first capitation method, while other U.S. CS strata stayed about the same as last year using the second capitation method. Means and median expenditures for Canadian departments and computer engineering departments rose using either capitation method. While the details are somewhat different, the overall message stated in last year's report still holds: "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 2006, further categorized as teaching assistants, research assistants, fellows, or computer systems supporters, and split between those on institutional vs. external funds. The number of teaching assistants held steady this year, except in departments ranked 25-36 and computer engineering departments where it increased, and in Canadian departments where it declined. Total number of research assistants fell, although the number supported on external funds rose. This shift from institutional to external support is predominant in departments ranked 1-24.

After a decline of more than 10% last year, the number of full-support fellows is up substantially this year. Canadian departments explain the entire change at the institutional support level, but less than 25% of the change in fellows were supported on external funds.

Respondents were asked to "provide the net amount (as of fall 2006) 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. Because some departments report this information in some years and not others, the data within the various ranking strata may

Taulbee Continued on Page 14

Table 19. Gender of Newly Hired Faculty

	Tenure-track		Researcher		Postdoc		Teaching Faculty		Total	
Male	161	80.5%	39	83.0%	71	78.9%	37	74.0%	308	79.6%
Female	39	19.5%	8	17.0%	16	17.8%	13	26.0%	76	19.6%
	0		0		3		0		3	
Total	**200**		**47**		**90**		**50**		**387**	

Table 20. Ethnicity of Newly Hired Faculty

	Tenure-Track		Researcher		Postdoc		Teaching Faculty		Total
Nonresident Alien	53	28.5%	14	31.8%	31	37.8%	4	8.3%	**102**
African-American, Non-Hispanic	8	4.3%	1	2.3%	2	2.4%	1	2.1%	**12**
Native American/Alaskan Native	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0**
Asian/Pacific Islander	36	19.4%	11	25.0%	21	25.6%	8	16.7%	**76**
Hispanic	3	1.6%	1	2.3%	0	0.0%	1	2.1%	**5**
White, Non-Hispanic	80	43.0%	17	38.6%	27	32.9%	34	70.8%	**158**
Other/Not Listed	6	3.2%	0	0.0%	1	1.2%	0	0.0%	**7**
Total have Ethnicity Data for	**186**		**44**		**82**		**48**		**360**
Ethnicity/Residency Unknown	14		3		8		2		**27**
Total	**200**		**47**		**90**		**50**		**387**

Table 21. Gender of Current Faculty

	Full		Associate		Assistant		Teaching Faculty		Research Faculty		Postdocs		Total	
Male	1,692	89.6%	1,140	86.9%	1,010	81.5%	531	74.4%	345	84.4%	221	80.4%	**4,939**	**84.6%**
Female	196	10.4%	172	13.1%	229	18.5%	183	25.6%	64	15.6%	54	19.6%	**898**	**15.4%**
Total gender known	**1,888**		**1,312**		**1,239**		**714**		**409**		**275**		**5,837**	
Gender unknown	0		0		0		0		1		13		**14**	
Total	**1,888**		**1,312**		**1,239**		**714**		**410**		**288**		**5,851**	

Table 22. Ethnicity of Current Faculty

	Full		Associate		Assistant		Teaching Faculty		Research Faculty		Postdocs		Total	
Nonresident Alien	3	0.2%	19	1.6%	178	15.7%	10	1.5%	44	11.4%	83	31.8%	**337**	6.3%
African-American, Non-Hispanic	8	0.5%	11	0.9%	26	2.3%	15	2.2%	4	1.0%	4	1.5%	**68**	1.3%
Native American/ Alaskan Native	3	0.2%	4	0.3%	2	0.2%	1	0.1%	0	0.0%	0	0.0%	**10**	0.2%
Asian/Pacific Islander	369	21.8%	262	22.4%	323	28.5%	60	9.0%	64	16.5%	62	23.8%	**1,140**	21.4%
Hispanic	28	1.7%	29	2.5%	18	1.6%	12	1.8%	3	0.8%	3	1.1%	**93**	1.7%
White, Non-Hispanic	1,262	74.5%	831	71.0%	566	50.0%	564	84.2%	268	69.3%	98	37.5%	**3,589**	67.5%
Other/Not Listed	21	1.2%	14	1.2%	20	1.8%	8	1.2%	4	1.0%	11	4.21%	**78**	1.5%
Total Have Ethnicity Data For	**1,694**		**1,170**		**1,133**		**670**		**387**		**261**		**5,315**	
Ethnicity/Residency Unknown	194		142		106		44		23		27		**536**	
Total	**1,888**		**1,312**		**1,239**		**714**		**410**		**288**		**5,851**	

2005-2006 Taulbee Survey

Table 22a. Part-Time Faculty

	Total
Full Professor	71
Associate Professor	33
Assistant Professor	24
Teaching Faculty	301
Research Faculty	41
Postdoctorate	8
Total	**478**

Table 23. Faculty Losses

	Total
Died	7
Retired	55
Took Academic Position Elsewhere	74
Took Nonacademic Position	38
Remained, but Changed to Part-Time	11
Other	18
Unknown	4
Total	**207**

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

	Total Expenditure			
Department, Rank	Minimum	Mean	Median	Maximum
US CS 1-12	$3,200,000	$19,961,143	$11,042,484	$84,967,163
US CS 13-24	$4,486,612	$10,772,192	$10,082,630	$26,154,500
US CS 25-36	$1,288,031	$6,155,334	$5,794,512	$15,406,490
US CS Other	$20,572	$2,617,977	$1,705,995	$31,500,000
Canadian	$93,402	$3,099,463	$2,317,456	$10,887,598
US CE	$91,789	$2,352,773	$2,689,560	$5,199,187

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

	Per Capita Expenditure (Tenure-Track Faculty Only)				Per Capita Expenditure (Tenure-Track, Research, and Postdoctorate Faculty)			
Department, Rank	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum
US CS 1-12	$125,164	$379,055	$265,001	$1,075,534	$104,918	$300,360	$241,688	$660,324
US CS 13-24	$165,273	$304,307	$297,244	$533,765	$142,009	$212,344	$214,745	$285,218
US CS 25-36	$84,461	$198,093	$182,786	$376,961	$83,343	$156,286	$139,339	$308,422
US CS Other	$1,591	$132,766	$91,781	$112,500	$1,591	$116,454	$89,413	$1,125,000
Canadian	$3,013	$80,863	$73,428	$226,825	$3,013	$71,498	$69,638	$194,421
US CE	$9,179	$199,603	$146,775	$611,669	$9,179	$168,160	$127,919	$452,103

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

	Number on Institutional Funds										Number on External Funds									
Department, Rank	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	369	17.8%	141	6.8%	86	4.2%	1	0.0%	27	1.3%	0	0.0%	1,159	56.0%	253	12.2%	0	0.0%	34	1.6%
US CS 13-24	268	18.4%	86	5.9%	84	5.8%	0	0.0%	7	0.5%	6	0.4%	910	62.6%	90	6.2%	0	0.0%	2	0.1%
US CS 25-36	364	31.3%	97	8.3%	62	5.3%	6	0.5%	3	0.3%	21	1.8%	524	45.1%	76	6.5%	0	0.0%	10	0.9%
US CS Other	1,764	36.2%	532	10.9%	187	3.8%	86	1.8%	90	1.8%	51	1.0%	2,027	41.6%	98	2.0%	36	0.7%	6	0.1%
Canadian	372	29.5%	232	18.4%	228	18.1%	12	1.0%	71	5.6%	0	0.0%	155	12.3%	137	10.9%	0	0.0%	53	4.2%
US CE	99	22.7%	9	2.1%	25	5.7%	0	0.0%	0	0.0%	0	0.0%	293	67.0%	11	2.5%	0	0.0%	0	0.0%
Total	**3,236**	28.7%	**1,097**	9.7%	**672**	6.0%	**105**	0.9%	**198**	1.8%	**78**	0.7%	**5,068**	45.0%	**665**	5.9%	**36**	0.3%	**105**	0.9%

Table 26-1. Fall 2006 Academic-Year Graduate Stipends by Department Type and Rank

	Teaching Assistantships				Research Assistantships			
Department, Rank	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum
US CS 1-12	$9,800	$16,296	$16,488	$20,203	$14,769	$18,290	$17,541	$26,640
US CS 13-24	$4,400	$15,792	$16,170	$24,500	$12,000	$18,766	$18,479	$24,500
US CS 25-36	$12,276	$15,428	$15,000	$19,547	$13,302	$15,624	$15,390	$19,547
US CS Other	$1,450	$13,827	$14,088	$26,550	$1,500	$15,436	$15,447	$60,000
Canadian	$2,500	$8,641	$9,600	$16,020	$5,100	$12,049	$11,750	$19,700
US CE	$6,300	$13,713	$14,500	$17,850	$10,000	$14,639	$14,922	$18,000

Table 26-2. Fall 2006 Academic-Year Graduate Stipends by Department Type and Rank

	Full-Support Fellows				Assistantships for Computer Systems Support			
Department, Rank	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum
US CS 1-12	$16,900	$19,733	$19,300	$26,640	*	*	*	*
US CS 13-24	$12,000	$20,101	$20,000	$30,000	*	*	*	*
US CS 25-36	$12,000	$17,701	$16,366	$25,000	$10,000	$14,378	$14,909	$17,694
US CS Other	$1,800	$17,677	$18,000	$30,000	$1,000	$13,073	$13,124	$23,000
Canadian	$14,450	$19,273	$17,058	$28,855	*	*	*	*
US CE	$13,950	$21,429	$20,900	$30,000	*	*	*	*

*Numbers not reported due to low number of respondents

2005-2006 Taulbee Survey

Taulbee from Page 14

only be a weak indicator of the actual stipend changes from one year to the next. The data show approximately a 5% to 6% increase in median teaching assistant (TA) salaries in all U.S. ranking strata except departments ranked 13-24, which showed a 9% decrease. Canadian departments showed a small decline in median TA stipends.

The effect on Research assistant (RA) stipends is similar to the teaching assistant stipends, according to reporting departments. Median salaries for RAs were flat for U.S. departments ranked 13-24, and rose about 2% to 8% in other U.S. ranking strata. Canadian median stipends dropped significantly, undoubtedly more seriously affected by the differences in departments that reported this information.

Table 26-3. Fall 2006 Academic-Year Graduate Stipends by Department Type and Rank

	Other Assistantships			
Department, Rank	Minimum	Mean	Median	Maximum
US CS 1-12	$17,100	$20,483	$19,350	$25,000
US CS 13-24	$15,077	$18,952	$17,332	$27,672
US CS 25-36	*	*	*	*
US CS Other	$1,000	$8,801	$8,220	$18,667
Canadian	$5,000	$17,000	$19,000	$27,000
US CE	*	*	*	*

*Numbers not reported due to low number of respondents

Table 27. Nine-month Salaries, 155 Responses of 175 US Computer Science Departments

		Reported Salary Minimum					Reported Salary Maximum		
Faculty Rank Tenured and Tenure-Track	Number of Faculty	Minimum	Mean	Maximum	Overall Mean	Overall Median	Minimum	Mean	Maximum
Full Professor	1,518	$71,250	$100,272	$176,872	$123,942	$120,521	$92,977	$163,294	$304,080
Associate Professor	1,036	$58,852	$85,105	$132,550	$94,712	$94,178	$71,017	$105,746	$178,990
Assistant Professor	1,016	$60,423	$79,947	$99,000	$84,642	$84,552	$72,000	$89,052	$150,000
Non-Tenure-Track									
Teaching Faculty	555	$25,000	$55,317	$128,500	$63,465	$62,523	$25,000	$74,178	$149,715
Research Faculty	380	$21,000	$68,954	$150,000	$82,685	$80,902	$50,000	$101,155	$283,593
Postdoctorates	185	$20,000	$41,516	$70,000	$46,920	$46,930	$24,000	$52,109	$103,301

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

		Reported Salary Minimum					Reported Salary Maximum		
Faculty Rank	Number of Faculty	Minimum	Mean	Maximum	Overall Mean	Overall Median	Minimum	Mean	Maximum
Full Professor	248	$88,900	$107,929	$144,400	$140,161	$134,815	$172,758	$209,953	$234,100
Associate Professor	84	$75,615	$92,428	$117,500	$102,578	$102,793	$94,169	$110,439	$124,250
Assistant Professor	104	$60,423	$82,363	$89,200	$89,434	$89,310	$88,400	$95,662	$104,600
Non-Tenure-Track									
Teaching Faculty	60	$35,189	$67,725	$128,500	$83,126	$84,054	$71,587	$99,345	$128,500
Research Faculty	100	$53,200	$81,104	$117,341	$109,483	$107,621	$108,000	$156,840	$283,593
Postdoctorates	138	$20,004	$39,319	$51,750	$50,728	$50,240	$54,600	$63,748	$75,700

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

		Reported Salary Minimum					Reported Salary Maximum		
Faculty Rank	Number of Faculty	Minimum	Mean	Maximum	Overall Mean	Overall Median	Minimum	Mean	Maximum
Full Professor	214	$84,600	$105,126	$135,200	$148,700	$140,934	$177,368	$216,022	$304,080
Associate Professor	85	$71,091	$94,303	$122,500	$108,502	$107,565	$104,446	$123,837	$155,200
Assistant Professor	89	$78,200	$86,433	$99,000	$92,665	$92,606	$86,975	$100,271	$150,000
Non-Tenure-Track									
Teaching Faculty	43	$53,000	$71,323	$95,000	$79,132	$77,451	$67,390	$91,030	$149,715
Research Faculty	90	$27,936	$71,534	$101,100	$92,398	$91,095	$78,400	$123,194	$203,250
Postdoctorates	53	$20,000	$40,170	$63,000	$50,061	$50,066	$50,923	$58,166	$65,780

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

		Reported Salary Minimum					Reported Salary Maximum		
Faculty Rank	Number of Faculty	Minimum	Mean	Maximum	Overall Mean	Overall Median	Minimum	Mean	Maximum
Full Professor	184	$89,500	$103,924	$119,000	$133,136	$129,747	$133,295	$184,303	$228,750
Associate Professor	103	$67,784	$87,646	$132,550	$98,902	$100,428	$93,007	$110,011	$132,550
Assistant Professor	95	$63,785	$81,360	$90,982	$87,254	$87,540	$82,752	$90,722	$98,752
Non-Tenure-Track									
Teaching Faculty	46	$43,622	$55,418	$76,200	$70,578	$65,601	$70,290	$91,091	$144,700
Research Faculty	54	$25,000	$62,407	$109,409	$82,905	$82,334	$58,800	$106,582	$171,900
Postdoctorates	34	$25,000	$42,594	$62,400	$46,812	$46,344	$35,568	$52,592	$77,600

Table 31. Nine-month Salaries, 121 Responses of 139 US Computer Science Departments Ranked Higher than 36 or Unranked

		Reported Salary Minimum					Reported Salary Maximum		
Faculty Rank	Number of Faculty	Minimum	Mean	Maximum	Overall Mean	Overall Median	Minimum	Mean	Maximum
Full Professor	872	$71,250	$98,771	$176,872	$119,156	$116,366	$92,977	$152,032	$287,877
Associate Professor	764	$58,852	$83,353	$117,567	$92,263	$91,479	$71,017	$103,114	$178,990
Assistant Professor	728	$63,300	$79,002	$96,361	$83,223	$83,107	$72,000	$87,290	$110,254
Non-Tenure-Track									
Teaching Faculty	406	$25,000	$52,452	$113,743	$59,413	$58,807	$25,000	$68,729	$125,000
Research Faculty	136	$24,000	$59,606	$112,356	$68,857	$66,253	$30,000	$83,481	$194,670
Postdoctorates	91	$20,000	$42,004	$70,000	$45,594	$45,748	$24,000	$48,654	$103,301

2005-2006 Taulbee Survey

Faculty Salaries
(Tables 27-34)

Each department was asked to report individual (but anonymous) faculty salaries if possible; otherwise, 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, 2007. 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 2006. A total of 152 departments (82% 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 2.7% and 4.7%, depending on tenure-track rank, and 4.2% for non-tenure-track teaching faculty. These increases are somewhat similar to the 3.7% to

Taulbee Continued on Page 17

Table 32. Nine-month Salaries, 12 Responses of 32 US Computer Engineering Departments

Faculty Rank	Number of Faculty	Reported Salary Minimum: Minimum	Mean	Maximum	Overall Mean	Overall Median	Reported Salary Maximum: Minimum	Mean	Maximum
Full Professor	64	$90,800	$104,220	$120,908	$122,009	$120,377	$102,179	$145,750	$185,956
Associate Professor	42	$72,976	$87,185	$104,210	$90,428	$90,179	$72,796	$95,101	$112,316
Assistant Professor	52	$69,300	$80,762	$98,600	$84,099	$84,160	$77,721	$87,937	$99,100
Non-Tenure-Track									
Teaching Faculty	15	$47,853	$63,926	$85,000	$68,485	$67,236	$47,853	$75,398	$124,026
Research Faculty	8	*	*	*	*	*	*	*	*
Postdoctorates	7	*	*	*	*	*	*	*	*

*Numbers not reported due to low number of respondents

Table 33. Twelve-month Salaries, 19 Responses of 28 Canadian Computer Science Departments (Canadian Dollars)

Faculty Rank	Number of Faculty	Reported Salary Minimum: Minimum	Mean	Maximum	Overall Mean	Overall Median	Reported Salary Maximum: Minimum	Mean	Maximum
Full Professor	265	$56,727	$107,270	$139,154	$129,342	$126,698	$86,443	$156,692	$224,259
Associate Professor	221	$49,368	$86,498	$119,517	$102,615	$102,732	$94,308	$115,695	$149,281
Assistant Professor	173	$59,559	$80,881	$110,200	$90,873	$91,081	$67,474	$101,321	$134,988
Non-Tenure-Track									
Teaching Faculty	73	$24,600	$61,161	$80,383	$73,535	$73,740	$47,355	$85,613	$125,630
Research Faculty	9	*	*	*	*	*	*	*	*
Postdoctorates	19	$22,800	$33,260	$48,000	$38,694	$40,000	$35,000	$46,600	$65,000

*Numbers not reported due to low number of respondents

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

Employment Position	Number of Faculty	Reported Salary Minimum: Minimum	Mean	Maximum	Overall Mean	Overall Median	Reported Salary Maximum: Minimum	Mean	Maximum
Tenure-Track Faculty	94	$70,000	$82,433	$99,000	$82,626	$82,781	$70,000	$82,869	$99,000
Non-Tenure-Track									
Researcher	8	*	*	*	*	*	*	*	*
Postdoc	11	$60,000	$77,798	$95,000	$77,798	$80,255	$60,000	$77,798	$95,000
Non-Tenure Teaching Faculty	45	$20,000	$45,099	$70,000	$46,506	$46,462	$24,000	$47,767	$70,000

*Numbers not reported due to low number of respondents

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

Employment Position	Number of Faculty	Reported Salary Minimum: Minimum	Mean	Maximum	Overall Mean	Overall Median	Reported Salary Maximum: Minimum	Mean	Maximum
Tenure-Track Faculty	5	$61,142	$81,587	$93,000	$81,814	$81,814	$64,308	$82,040	$93,000

Table 35. Official Teaching Load of Tenured and Tenure-Track Faculty

Department, Rank	Official Teaching Load*: Minimum	Mean	Median	Maximum	Academic Calendar: Semester	Quarter	Other
US CS 1-12	1.3	2.1	2.0	3.0	9	3	0
US CS 13-24	2.0	2.5	2.6	3.0	10	2	0
US CS 25-36	2.0	2.3	2.0	3.0	10	2	0
US CS Other	0.7	3.3	3.0	6.0	95	13	1
Canadian	1.0	3.1	3.0	4.0	19	0	1
US CE	2.0	3.4	3.0	4.0	10	2	0
Total	**0.7**	**3.1**	**3.0**	**6.0**	**153**	**22**	**2**

* Teaching load is given for a semester calendar. Loads for a quarter system were multiplied by 2/3.
To convert back to quarter-system equivalent, multiply these values by 1.5.

2005-2006 Taulbee Survey

Taulbee from Page 16

4.1% levels experienced last year for tenure-track faculty and the 4.8% level for non-tenure-track teaching faculty. Tenure-track faculty of higher rank tended to get larger increases this year than did those of lower rank. Canadian salaries (shown as 12-month salaries in Canadian dollars) rose 2.3% to 4.4%, with the larger increase at the full professor rank and the smaller at the associate professor rank.

Average salaries for new Ph.D.s (those who received their Ph.D. last year and then joined departments as tenure-track faculty) increased 3% from those reported in last year's survey (Table 34). This level of increase is somewhat smaller than the average increases for continuing faculty, for the third year out of the past four.

Additional Departmental Profiles Analysis

Every three years, CRA collects additional information about various aspects of departmental activities that are not expected to change much over a one-year period. The additional data include teaching loads, sources of external funding, methods of recruiting graduate students, departmental support staff, and space. The most recent data about these activities were collected in the 2003 Taulbee Survey, and reported in the May 2004 edition of *Computing Research News*.

Teaching Loads *(Tables 35-38)*

Average official teaching loads range from two to a little more than three semester courses per faculty member per year. The overall mean load of 3.1 courses is lower than the 3.5 value three years ago. Almost all departments report that there are factors that cause the load for an individual faculty member to vary. Compared with three years ago, a smaller percentage of departments report allowing reduction for administrative duties (75.9% vs. 84.1%) or the type or size of class being taught (18.2% vs 29.0%), while other factors show percentages this year similar to those reported three years ago. This year, 75.6% of departments reported that increases from the standard load take place for faculty members who shift their primary responsibility to teaching; this fraction was 70.3% three years ago.

Table 36. Faculty Load Reductions and Increases

	Faculty Load Reduction Possible		Faculty Load Increase Possible	
Department, Rank	**Yes**	**No**	**Yes**	**No**
US CS 1-12	100.0%	0.0%	75.0%	25.0%
US CS 13-24	91.7%	8.3%	75.0%	25.0%
US CS 25-36	91.7%	8.3%	75.0%	25.0%
US CS Other	97.2%	2.8%	75.2%	24.8%
Canadian	100.0%	0.0%	68.4%	31.6%
US CE	100.0%	0.0%	50.0%	50.0%
Total	**97.1%**	**2.9%**	**73.0%**	**27.0%**

Table 37. Type of Load Reductions Possible in Departments Offering Reductions

Department, Rank	Special Package for New Faculty	Administrative Duties	Type or Size of Class Taught	Buy-out Policy	Strong Research Involvement	Other
US CS 1-12	91.7%	75.0%	0.0%	41.7%	8.3%	16.7%
US CS 13-24	81.8%	90.9%	18.2%	81.8%	54.5%	18.2%
US CS 25-36	90.9%	90.9%	18.2%	63.6%	18.2%	9.1%
US CS Other	84.0%	77.4%	19.8%	83.0%	54.7%	11.3%
Canadian	85.0%	90.0%	5.0%	30.0%	75.0%	35.0%
US CE	90.0%	100.0%	50.0%	90.0%	60.0%	10.0%
Total	**85.3%**	**75.9%**	**18.2%**	**72.9%**	**51.8%**	**14.7%**

Table 38. Reasons for Increase in Teaching Load in Departments where Increase is Possible

Department, Rank	Shifting Primary Responsibilities to Teaching	Other
US CS 1-12	66.7%	33.3%
US CS 13-24	66.7%	33.3%
US CS 25-36	66.7%	33.3%
US CS Other	80.5%	19.5%
Canadian	53.8%	46.1%
US CE	100.0%	0.0%
Total	**75.6%**	**24.4%**

Table 39. Sources of External Funding, 9 of 12 US Computer Science Departments Ranked 1-12

	Mean	Median	% Non-Zero	Mean Non-Zero	Total	% of Total External Funding
NSF	$6,908,695	$5,700,000	100.0%	$6,908,695	$62,178,254	33.7%
DARPA	$4,431,371	$911,510	100.0%	$4,431,371	$39,882,340	21.6%
NIH	$548,682	$140,136	66.7%	$602,836	$4,938,136	2.7%
DOE	$527,203	$280,000	77.8%	$677,832	$4,744,824	2.6%
State agencies	$187,848	$0	33.3%	$563,545	$1,690,636	0.9%
Industrial sources	$2,512,392	$802,783	88.9%	$2,826,441	$22,611,526	12.2%
Other defense	$4,409,981	$698,975	77.8%	$5,669,975	$39,689,826	21.5%
Other federal	$698,975	$0	33.3%	$529,873	$6,290,772	3.4%
Private foundation	$239,715	$85,938	66.7%	$359,572	$2,157,435	1.2%
Other	$415,433	$233,399	66.7%	$623,150	$461,559	0.2%
Total					**$184,645,308**	

Table 40. Sources of External Funding, 11 of 12 US Computer Science Departments Ranked 13-24

	Mean	Median	% Non-Zero	Mean Non-Zero	Total	% of Total External Funding
NSF	$4,928,232	$4,939,000	100.0%	$4,928,232	$54,210,550	45.7%
DARPA	$792,083	$485,568	81.8%	$968,101	$8,712,909	7.4%
NIH	$382,878	$420,000	81.8%	$467,962	$4,211,660	3.6%
DOE	$519,113	$28,959	63.6%	$815,749	$5,710,246	4.8%
State agencies	$361,025	$213,458	63.6%	$567,326	$3,971,279	3.4%
Industrial sources	$797,210	$660,038	81.8%	$974,368	$8,769,308	7.4%
Other defense	$1,886,694	$554,704	90.9%	$2,075,364	$20,753,638	17.5%
Other federal	$546,978	$139,902	54.5%	$1,002,792	$6,016,755	5.1%
Private foundation	$276,600	$33,218	81.8%	$338,067	$3,042,599	2.6%
Other	$281,379	$20,000	72.7%	$386,896	$3,095,167	2.6%
Total					**$118,494,111**	

2005-2006 Taulbee Survey

Sources of External Funding *(Tables 39-44)*

NSF continues to be the dominant source of external funding for U.S. computer science programs. NSF's share of this funding, compared with three years ago, increased by about 3% in all ranking strata except 13-24, where it increased 7%. DARPA had a larger share of the funding for top 12 departments (21.6% vs 14.3% three years ago), while other U.S. ranking strata showed a decline in the fraction of support obtained from DARPA. NIH's share was higher in the top 36 departments, and slightly lower for other U.S. departments. DOE's share went up somewhat in all strata except 25-36. The funding share from other defense agencies was generally lower except for top 12 departments, while the funding share from industry was somewhat higher except for top 12 departments. Table_ 44a shows the aggregate comparisons among all U.S. CS departments for each source of funding.

Canadian departments continue to get just over 40% of their funding from NSERC. Provincial agencies' share of the external funding declined from about one-third to about one-quarter, while share of support from industry and other federal agencies rose.

This year, the tables report mean dollar amounts of funding from each source for all departments

Taulbee Continued on Page 19

Table 41. Sources of External Funding, 12 of 12 US Computer Science Departments Ranked 25-36

	Mean	Median	% Non-Zero	Mean Non-Zero	Total	% of Total External Funding
NSF	$3,433,367	$2,843,690	100.0%	$3,433,367	$41,200,409	55.8%
DARPA	$419,850	$242,526	58.3%	$719,742	$5,038,196	6.8%
NIH	$683,628	$146,530	58.3%	$1,171,934	$8,203,537	11.1%
DOE	$149,302	$13,552	50.0%	$298,604	$1,791,626	2.4%
State agencies	$75,045	$14,780	50.0%	$150,090	$900,542	1.2%
Industrial sources	$356,496	$162,712	75.0%	$475,328	$4,277,950	5.8%
Other defense	$440,416	$366,110	75.0%	$587,222	$5,284,993	7.2%
Other federal	$177,670	$37,318	50.0%	$355,340	$2,132,037	2.9%
Private foundation	$330,469	$574	50.0%	$660,938	$3,965,625	5.4%
Other	$89,091	$11,272	50.0%	$178,182	$1,069,092	1.4%
Total					**$73,864,007**	

Table 42. Sources of External Funding, 94 of 139 US Computer Science Departments Ranked Higher than 36 or Unranked

	Mean	Median	% Non-Zero	Mean Non-Zero	Total	% of Total External Funding
NSF	$1,037,240	$659,238	96.8%	$1,070,435	$97,500,604	45.7%
DARPA	$112,316	$0	25.5%	$439,905	$10,557,705	5.0%
NIH	$80,072	$0	35.1%	$228,084	$7,526,780	3.5%
DOE	$129,198	$0	41.5%	$311,401	$12,144,633	5.7%
State agencies	$109,714	$0	44.7%	$245,550	$10,313,122	4.8%
Industrial sources	$156,109	$33,390	67.0%	$232,925	$14,674,255	6.9%
Other defense	$338,133	$73,752	64.9%	$521,057	$31,784,503	14.9%
Other federal	$190,948	$0	47.9%	$398,869	$17,949,100	8.4%
Private foundation	$17,670	$0	30.8%	$57,279	$1,660,997	0.8%
Other	$96,734	$0	44.7%	$1,886,501	$9,092,949	4.3%
Total					**$213,204,648**	

Table 43. Sources of External Funding, 16 of 28 Canadian, in Canadian Dollars

	Mean	Median	% Non-Zero	Mean Non-Zero	Total	% of Total External Funding
NSERC	$1,218,387	$1,149,813	100.0%	$1,218,387	$19,494,193	40.5%
State agencies	$777,893	$141,898	75.0%	$1,037,191	$12,446,288	25.8%
Industrial sources	$355,455	$122,328	75.0%	$473,940	$5,687,285	11.8%
Other defense	*	*	6.0%	*	*	
Other federal	$459,943	$0	43.8%	$1,051,298	$7,359,084	15.3%
Private foundation	$31,938	$0	18.8%	$170,334	$511,002	1.1%
Other	$165,922	$25,000	56.2%	$794,972	$2,654,746	5.5%
Total					**$48,152,598**	

Table 44. Sources of External Funding, 10 of 32 US Computer Engineering Departments

	Mean	Median	% Non-Zero	Mean Non-Zero	Total	% of Total External Funding
NSF	$1,001,659	$1,019,131	100.0%	$1,001,659	$10,016,588	42.6%
DARPA	$160,009	$0	40.0%	$400,023	$1,600,091	6.8%
NIH	$86,637	$0	40.0%	$216,593	$866,373	3.7%
DOE	$125,995	$0	40.0%	$314,986	$1,259,945	5.4%
State agencies	$207,293	$76,444	60.0%	$345,488	$2,072,927	8.8%
Industrial sources	$214,732	$187,485	80.0%	$268,415	$2,147,321	9.1%
Other defense	$219,852	$199,531	80.0%	$285,677	$2,198,517	9.3%
Other federal	$203,152	$25,670	50.0%	$406,303	$2,031,517	8.6%
Private foundation	$122,100	$2,044	50.0%	$244,200	$1,221,002	5.2%
Other	$11,345	$0	30.0%	$37,818	$113,453	0.5%
Total					**$23,527,734**	

2005-2006 Taulbee Survey

Table 44a. Comparison of US CS External Funding 2003-2006	2003 (126 departments)		2006 (123 departments)	
	Total	% of Funding	Total	% of Funding
NSF	$354,451,309	40.7%	$255,089,816	43.0%
DARPA	$85,401,891	9.8%	$64,191,150	10.8%
NIH	$15,864,767	1.8%	$24,880,112	4.2%
DOE	$20,471,676	2.4%	$24,391,329	4.1%
State agencies	$24,438,483	2.8%	$16,875,578	2.8%
Industrial sources	$70,813,388	8.1%	$50,333,039	8.5%
Other defense	$177,357,598	20.4%	$97,512,961	16.4%
Other federal	$50,555,980	5.8%	$32,388,664	5.5%
Private foundation	$32,977,093	3.8%	$10,826,656	1.8%
Other	$37,995,002	4.4%	$16,996,108	2.9%
Total	**$870,327,187**		**$593,485,413**	

Taulbee from Page 18

that reported in the stratum and among those who reported non-zero values from the funding source. Also shown is the fraction of departments within the stratum that reported any funding from that source. The data about non-zero departments was not reported three years ago.

Methods of Recruiting Graduate Students *(Tables 45-47)*

Graduate student stipends continue to be affected more by advancement to the next stage of the graduate program than by factors such as years of service, GPA, recruitment enhancements, or differences in funding source. Nevertheless, the fraction of departments that reported using recruitment enhancements and differences among funding sources as the basis for stipends was markedly lower this year than three years ago (13.9% vs 24.4% for recruiting enhancements, and 28.3% vs 44.8% for funding source differences). Stipend enhancements appear to be used as a recruiting incentive at a greater fraction of departments this year (30.6% vs 20.3% three years ago). Mean stipend enhancements are now around $5,000 compared with $3,238 three years ago.

Table 45. Factors Affecting the Amount of a Graduate Student's Stipend

Department, Rank	Advancement to Next Stage of Program	Years of Service	GPA	Recruitment Enhancements	Differences Among Various Stipend Sources	Other
US CS 1-12	58.3%	8.3%	8.3%	50.0%	66.7%	33.3%
US CS 13-24	41.7%	25.0%	0.0%	33.3%	25.0%	50.0%
US CS 25-36	50.0%	8.3%	16.7%	16.7%	16.7%	25.0%
US CS Other	65.2%	23.2%	14.3%	25.0%	46.4%	17.0%
Canadian	25.0%	20.0%	25.0%	25.0%	35.0%	20.0%
US CE	83.3%	33.3%	8.3%	50.0%	75.0%	8.3%
Total	58.9%	21.7%	13.9%	28.3%	45.0%	20.6%

Table 46. Departments Using Selected Graduate Student Recruitment Incentives

Department, Rank	Upfront One-Time Signing Bonus	Stipend Enhancements	Guaranteed Multi-Year Support	Guaranteed Summer Support	Paid Visits to Campus	Other Recruitment Incentives
US CS 1-12	33.3%	33.3%	83.3%	8.3%	75.0%	50.0%
US CS 13-24	16.7%	41.7%	66.7%	50.0%	83.3%	41.7%
US CS 25-36	16.7%	50.0%	66.7%	16.7%	50.0%	25.0%
US CS Other	4.5%	26.8%	50.0%	36.6%	33.3%	11.6%
Canadian	10.0%	30.0%	70.0%	20.0%	25.0%	15.0%
US CE	8.3%	33.3%	50.0%	33.3%	58.3%	8.3%
Total	8.9%	30.6%	56.7%	32.2%	41.1%	17.2%

Table 47. Mean Amounts and Years of Selected Graduate Student Recruitment Incentives

Department, Rank	Upfront One-Time Signing Bonus	Stipend Enhancements	Guaranteed Years of Support	Guaranteed Summer Support	Paid Visits to Campus
US CS 1-12	$6,875	*	4.1	*	$667
US CS 13-24	*	$5,750	3.9	$3,899	$454
US CS 25-36	*	$2,717	3.6	*	$620
US CS Other	$3,000	$5,153	3.5	$4,421	$547
Canadian	*	$7,170	3.4	*	$289
US CE	*	*	3.2	*	$500
Total	**$3,964**	**$5,061**	**3.6**	**$4,482**	**$562**

*Numbers not reported due to low number of respondents

Table 48. Full-time Secretarial/Administrative Employees by Type of Support

Department, Rank	Institutional Support				External Support				Total			
	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum
US CS 1-12	1.5	20.6	17.8	89.0	0.0	5.9	3.0	22.5	6.2	28.2	25.0	101.0
US CS 13-24	0.2	11.1	9.0	25.6	0.0	2.8	3.0	6.7	1.0	13.4	12.0	34.3
US CS 25-36	2.0	10.8	7.0	37.8	0.0	1.0	0.2	3.0	4.0	11.6	8.0	38.0
US CS Other	1.0	4.6	3.5	26.0	0.0	0.8	0.0	8.0	0.0	5.1	4.0	26.0
Canadian	3.0	8.5	7.8	16.0	0.0	0.5	0.0	4.0	3.0	8.8	7.5	16.0
US CE	1.0	6.7	5.4	17.0	0.0	0.5	0.5	1.2	1.0	7.2	5.4	18.0
Total	**0.0**	**7.1**	**5.0**	**89.0**	**0.0**	**1.3**	**0.0**	**22.5**	**0.0**	**8.1**	**5.0**	**101.0**

2005-2006 Taulbee Survey

Table 49. Full-time Computer Support Employees by Type of Support

Department, Rank	Institutional Support				External Support				Total			
	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum
US CS 1-12	1.0	8.5	7.0	20.0	0.0	6.2	3.0	35.0	2.0	14.5	12.0	47.0
US CS 13-24	0.0	6.1	6.0	12.0	0.0	3.0	2.5	7.0	0.0	8.8	10.0	18.5
US CS 25-36	1.0	6.5	6.0	14.0	0.0	0.8	1.0	2.0	2.0	7.2	6.0	14.0
US CS Other	0.0	2.6	2.0	12.0	0.0	0.4	0.0	5.0	0.0	2.9	2.0	0.0
Canadian	1.5	7.7	5.0	19.0	0.0	0.5	0.0	2.0	1.5	8.2	6.0	19.0
US CE	0.0	2.5	3.0	4.5	0.0	0.4	0.0	3.0	0.0	2.8	3.0	4.5
Total	**0.0**	**4.1**	**3.0**	**20.0**	**0.0**	**1.1**	**0.0**	**35.0**	**0.0**	**4.9**	**3.0**	**47.0**

Table 50. Full-time Research Employees by Type of Support

Department, Rank	Institutional Support				External Support				Total			
	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum
US CS 1-12	0.0	1.9	0.0	12.0	0.5	33.7	7.0	250.0	1.0	32.1	7.5	254.0
US CS 13-24	0.0	0.1	0.0	1.0	0.0	9.6	3.0	31.7	0.0	9.8	3.0	31.7
US CS 25-36	0.0	0.4	0.0	1.0	0.0	0.9	0.0	6.0	0.0	1.2	0.0	7.0
US CS Other	0.0	0.3	0.0	5.0	0.0	1.0	0.0	10.5	0.0	1.2	0.0	10.5
Canadian	0.0	5.6	0.0	53.0	0.0	0.8	0.0	3.0	0.0	4.7	0.0	53.0
US CE	0.0	0.4	0.0	1.0	0.0	1.4	1.0	3.0	0.0	1.7	2.0	3.5
Total	**0.0**	**0.9**	**0.0**	**53.0**	**0.0**	**4.1**	**0.0**	**250.0**	**0.0**	**4.6**	**1.0**	**254.0**

Table 51. Total Departmental Space (net sq. ft. US, net sq. meters Canadian)

Department, Rank	Minimum	Mean	Median	Maximum	Total
US CS 1-12	14,410	79,215	62,076	223,000	950,577
US CS 13-24	19,456	45,997	38,393	77,052	505,964
US CS 25-36	20,446	35,536	29,296	66,472	355,355
US CS Other	4,000	23,592	18,022	100,000	2,288,470
US CE	3,500	41,125	30,787	115,302	452,373
Total US	**3,500**	**32,289**	**23,516**	**223,000**	**4,552,739**
Canadian	1,531	3,737	3,331	7,592	59,796

Table 52. Departmental Space for Faculty, Staff, and Student Offices (net sq. ft. US, net sq. meters Canadian)

Department, Rank	Minimum	Mean	Median	Maximum	Total
US CS 1-12	6,270	42,444	32,390	131,000	508,333
US CS 13-24	10,867	27,298	22,738	52,331	300,281
US CS 25-36	11,824	18,690	17,466	36,416	186,900
US CS Other	2,000	10,625	8,110	52,500	1,030,630
US CE					
Total US	**2,000**	**15,609**	**10,535**	**131,000**	**2,200,834**
Canadian	576	1,597	1,253	3,435	25,544

Table 53. Departmental Space for Conference and Seminar Rooms (net sq. ft. US, net sq. meters Canadian)

Department, Rank	Minimum	Mean	Median	Maximum	Total
US CS 1-12	1,939	8,686	5,117	26,743	104,230
US CS 13-24	0	4,644	2,206	15,280	51,089
US CS 25-36	681	3,167	3,200	6,811	31,666
US CS Other	0	1,252	864	5,000	121,487
US CE	0	1,484	1,314	4,186	16,321
Total US	**0**	**2,203**	**1,243**	**26,743**	**324,793**
Canadian	0	196	182	418	3,141

Table 54. Departmental Space for Research Labs (net sq. ft. US, net sq. meters Canadian)

Department, Rank	Minimum	Mean	Median	Maximum	Total
US CS 1-12	4,570	17,244	10,013	62,000	189,685
US CS 13-24	2,010	9,680	8,230	25,677	106,476
US CS 25-36	0	9,042	6,579	25,928	90,418
US CS Other	0	6,611	5,096	35,058	628,015
US CE	1,160	17,028	10,776	54,953	187,304
Total US	**0**	**8,709**	**6,000**	**62,000**	**1,201,898**
Canadian	90	1,237	1,104	2,757	19,792

Departmental Support Staff *(Tables 48-50)*

Support staff has not changed much from the data reported three years ago. All categories (administrative, computer, and research) show mean values that are similar to those reported the last time these data were collected.

Space *(Tables 51-63)*

Higher ranked U.S. computer science departments have more total space than lower ranked departments (Table 51). Median space growth during the past three years is generally 5% to 6%, except that median space grew by 16% for top 12 departments. Most of the growth appears to have been in office space and research lab space. Median instructional lab space grew for lower ranked departments, while it declined for higher ranked departments.

While half of the departments planned to get additional space three years ago, only about one quarter plan for space growth now. Where new space is being planned, it generally is office space and research lab space.

Concluding Observations

Ph.D. production continues to set records, and the forecast is for this to continue for the next year or two. More Ph.D. graduates are going to industry than to academia, and more are taking positions outside of North America. Total faculty sizes and research funding levels have temporarily, at least, hit a plateau, and there is as yet no evidence of increasing rates of faculty retirement.

While total undergraduate enrollments and degree production continue to decline, the decline in the number of new students at the bachelor's level seems to have ended. If the enrollments of new

Taulbee Continued on Page 21

2005-2006 Taulbee Survey

Table 55. Departmental Space for Instructional Labs (net sq. ft. US, net sq. meters Canadian)

Department, Rank	Minimum	Mean	Median	Maximum	Total
US CS 1-12	571	8,788	5,890	24,296	105,462
US CS 13-24	0	3,742	2,164	11,627	41,159
US CS 25-36	879	4,637	3,696	11,451	46,371
US CS Other	0	4,456	3,416	19,654	418,865
US CE	0	7,506	6,088	24,018	75,058
Total US	**0**	**5,014**	**3,755**	**24,296**	**686,915**
Canadian	212	781	724	1,476	10,932

Table 56. Definite Departmental Plans to Gain or Lose Space

Department, Rank	Gain Space	No Change	Lose Space	No Answer
US CS 1-12	25.0%	66.7%	0.0%	8.3%
US CS 13-24	25.0%	75.0%	0.0%	0.0%
US CS 25-36	41.7%	58.3%	0.0%	0.0%
US CS Other	26.8%	63.4%	2.7%	7.1%
Canadian	10.0%	85.0%	5.0%	0.0%
US CE	33.3%	58.3%	0.0%	8.3%
Total	**26.1%**	**66.1%**	**2.2%**	**5.6%**

Table 57. Year Departments Plan to Add or Lose Space

2007		2008		2009		2010		2011	
No.	%	No.	%	No.	%	No.	%	No.	%
16	37.2%	9	20.9%	8	18.6%	3	7.0%	1	2.3%

Table 58. Total Expected Additional Space of Departments Adding Space (net sq. ft. US, net sq. meters Canadian)

Department, Rank	Minimum	Mean	Median	Maximum	Total
US CS 1-12	12,231	83,077	117,000	120,000	249,231
US CS 13-24	360	20,679	5,000	56,676	62,036
US CS 25-36	9,632	37,831	34,000	73,691	151,323
US CS Other	300	7,086	5,000	36,445	177,149
US CE	2,000	59,250	42,500	150,000	237,000
Total US	**300**	**22,480**	**6,171**	**150,000**	**876,739**
Canadian	*	*	*	*	*

Table 59. Total Expected Additional Office Space for Faculty, Staff, and Grad Students (net sq. ft. US, net sq. meters Canadian)**

	% Adding None***	Minimum	Mean	Median	Maximum	Total
US CS 1-12	0.0%	2,333	35,107	40,000	63,000	105,322
US CS 13-24	33.3%	*	*	*	*	*
US CS 25-36	0.0%	3,325	13,826	9,144	33,692	55,305
US CS Other	20.0%	-2,333	2,394	1,154	12,315	47,884
US CE	25.0%	320	14,280	17,520	25,000	42,840
Total US	**17.9%**	**-2,333**	**8,022**	**2,410**	**63,000**	**256,711**
Canadian		*	*	*	*	*

* Numbers not reported due to low number of respondents
** Numbers include only those departments adding additional office space
***Percentage is among all departments adding total space

Table 60. Total Expected Additional Conference and Seminar Space (net sq. ft. US, net sq. meters Canadian)**

Department, Rank	% Adding None***	Minimum	Mean	Median	Maximum	Total
US CS 1-12	0.0%	1,044	16,681	9,000	40,000	50,044
US CS 13-24	66.7%	*	*	*	*	*
US CS 25-36	0.0%	300	4,229	3448	9720	16916
US CS Other	28.0%	0	594	355	2640	10695
US CE	25.0%	0	15,567	5,000	41,700	46,700
Total US	**25.6%**	**0**	**4,288**	**662**	**41,700**	**124,355**
Canadian		*	*	*	*	*

*Numbers not reported due to low number of respondents
**Square footage numbers include only those departments adding additional conference and seminar space
***Percentage is among all departments adding total space

Taulbee from Page 20

undergraduate students in computer science programs do, in fact, trend upward, faculty growth again should be possible. In the near term, however, the market looks very good for those departments who are able to hire new Ph.D.s.

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, 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, Louisiana State, Michigan State, Michigan Technological, Mississippi State, Montana State, Naval Postgraduate School, New Mexico State, New Mexico Technology, North Carolina State, North Dakota State, Northeastern, Northwestern, Nova Southeastern, Ohio State, Oklahoma State, Old Dominion, Oregon Health and Science, Oregon State, Pace, Pennsylvania State, Polytechnic, Portland State, Rensselaer Polytechnic, State University of New*

2005-2006 Taulbee Survey

York (Binghamton), Stevens Institute of Technology, Syracuse, Texas A&M, Texas Tech, Toyota Technological Institute (Chicago), Tufts, Vanderbilt, Virginia Tech, Washington State, Washington (St. Louis), Wayne State, West Virginia, Worcester Polytechnic, and Wright State.

University of: *Alabama (Birmingham, Huntsville, and Tuscaloosa), Albany, Arkansas (Little Rock), Buffalo, California (at Davis, Riverside, Santa Barbara, and Santa Cruz), Central Florida, Colorado (at Boulder and Denver), Connecticut, Delaware, Florida, Georgia, Hawaii, Illinois (Chicago), Iowa, Kansas, Kentucky, Louisiana (Lafayette), Louisville, 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: *Iowa State, Northeastern, Princeton, Purdue, Rensselaer Polytechnic, Santa Clara, Virginia Tech, and the Universities of California (Santa Cruz), Houston, New Mexico, Southern California, and Tennessee (Knoxville).*

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

Table 61. Total Expected Additional Research Laboratory Space (net sq. ft. US, net sq. meters Canadian)**

Department, Rank	% Adding None***	Minimum	Mean	Median	Maximum	Total
US CS 1-12	0.0%	2,473	17,491	20,000	30,000	52,473
US CS 13-24	33.3%	*	*	*	*	*
US CS 25-36	0.0%	2,448	19,776	23,188	30,279	79,102
US CS Other	16.0%	0	2,869	2,074	14,018	60,252
US CE	0.0%	680	18,258	6,175	60,000	73,030
Total US	**12.8%**	**0**	**7,810**	**2,496**	**60,000**	**265,537**
Canadian		*	*	*	*	*

*Numbers not reported due to low number of respondents
**Square footage numbers include only those departments adding research laboratory space
***Percentage is among all departments adding total space

Table 62. Total Expected Additional Instructional Laboratory Space (net sq. ft. US, net sq. meters Canadian)**

Department, Rank	% Adding None***	Minimum	Mean	Median	Maximum	Total
US CS 1-12	0.0%	6,392	13,797	15,000	20,000	41,392
US CS 13-24	66.7%	*	*	*	*	*
US CS 25-36	100.0%	*	*	*	*	*
US CS Other	12.0%	0	1,200	2,203	9,450	48,460
US CE	50.0%	1,000	18,608	6,715	60,000	74,430
Total US		**0**	**4,978**	**1,400**	**60,000**	**164,282**
Canadian		*	*	*	*	*

*Numbers not reported due to low number of respondents
**Square footage numbers include only those departments adding research laboratory space
***Percentage is among all departments adding total space

Table 63. Sources of Funding for Additional Space

	Percent** of Departments Using Funds from Source				
Department, Rank	Institutional	Federal	State/ Provincial	Industry	Private
US CS 1-12	100.0%	33.3%	33.3%	33.3%	100.0%
US CS 13-24	100.0%	0.0%	0.0%	0.0%	0.0%
US CS 25-36	100.0%	0.0%	80.0%	20.0%	0.0%
US CS Other	76.7%	10.0%	50.0%	10.0%	33.3%
US CE	50.0%	0.0%	75.0%	25.0%	100.0%
Total US	**73.3%**	**8.9%**	**51.1%**	**13.3%**	**37.8%**
Canadian	*	*	*	*	*

*Numbers not reported due to low number of respondents
**Percentage is among all departments adding total space

Acknowledgments

Betsy Bizot once again provided valuable assistance with the data collection, tabulation, and analysis for this survey. Jean Smith and Moshe Vardi 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. ∎

Congress on Track from Page 5

federal science agencies, a process that will begin in late May or June as the first appropriations bills see introduction and consideration at the committee level. The Democratic leadership on the appropriations committee has already demonstrated its commitment to science funding by deeming increases at NSF, DOE, NIST and NIH "national priorities" that merited inclusion in an otherwise parsimonious final appropriations for FY 07 in February 2007 (see *CRN*, Vol. 19/No. 2, March 2007). The science advocacy community is already working hard to ensure that the same attitudes about the need for federal support of research persist throughout the FY 08 appropriations process.

House Approves HPC R&D Act

Members of the House approved a bill in March to amend the *High Performance Computing and Communications Act of 1991*, responsible for establishing what became the interagency Networking and Information Technology Research and Development (NITRD) program. The *High-Performance Computing Research and Development Act* (H.R. 1068) aims to provide sustained, transparent access for the research community to federal HPC assets, assure a balanced research portfolio, and beef up interagency planning. Various versions of the bill have been introduced over the last four Congresses without passing the Senate. The latest version contains two noteworthy provisions that would change the *status quo*. The first directs the Director of the White Houses Office of Science and Technology Policy to develop and maintain a research, development, and deployment roadmap for the provision of federal HPC systems. This requirement originally appeared as a recommendation of the Presidents Information Technology Advisory Committee (PITAC) in 2005, and is an attempt to get the agencies to work better together to facilitate technology transfer across the various R&D programs and a clear strategy for advancing the next-generation technologies.

The second noteworthy provision of the act is an explicit requirement that the Presidential advisory committee for IT (currently the Presidents Council of Advisors for Science and Technology [PCAST]) review the goals and funding levels of the NITRD program every two years and report back to Congress. This requirement is, in part, a response to frustration from the community over the lack of timely, independent reviews of the NITRD program, and the hope that an explicit requirement to review the funding will allow the community to assess whether the current federal investment is adequate.

The Senate is likely to consider its own version of the HPC R&D Act in the coming months. There appears to be bipartisan support for the action, so the computing community is cautiously optimistic that the act will find its way into law before the expiration of the 110th Congress.

For all the latest on the budget and the HPC R&D Act, check CRAs *Computing Research Policy Blog* (http://cra.org/blog). ∎

Professional Opportunities

CRN Advertising Policy

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

College of Staten Island
Department of Computer Science
Assistant Professor of Computer Science

The College of Staten Island invites applications for two anticipated tenure-track positions as Assistant Professor, beginning Fall 2007. PhD in Computer Science or a closely related area required.

Go to http://www.csi.cuny.edu for full description of position.

Review of applications will begin immediately and continue until the position is filled. Send letter of application, a curriculum vitae, a statement of teaching and research goals, and the names, addresses, and telephone numbers of three references to:

Professor Miriam Tausner
Department of Computer Science, 1N-215
College of Staten Island
2800 Victory Blvd
Staten Island, NY 10314

Michigan Technological University
Department of Computer Science
Visiting Faculty Position

Applications are invited for a nine-month visiting faculty position beginning August 2007. The primary responsibility of this position will be teaching. Applicants for an Instructor position must have an M.S. degree in computer science or closely related field. Candidates with a Ph.D. will be considered for an appropriately ranked visiting position. The ability to teach courses in computer organization, a junior level computation theory course, or introductory programming is preferred.

Michigan Technological University, designated as one of four Michigan research universities, has over 6,500 students and 400 faculty. The Department has 16 faculty members and offers B.S., M.S., and Ph.D. degree programs.

Michigan Technological University is located in Houghton in Michigan's scenic Upper Peninsula. Surrounded by Lake Superior and nearby forests, the community offers year-round recreational opportunities.

Review of applications will continue until the position is filled. Women and minorities are particularly encouraged to apply. Further information is available at http://www.cs.mtu.edu/.

Applicants should send a resume, e-mail address, and a list of at least three references to:

Linda M. Ott, Chair
Department of Computer Science
Michigan Technological University
Houghton, MI 49931
Email: linda@mtu.edu
Phone: 906-487-2209

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

Naval Research Laboratory
Computer Science
Federal Career Position

The Naval Research Laboratory at Stennis Space Center, MS (NRL-SSC) seeks applications for a computer scientist position that will serve as a lead developer in the area of adaptive sensor technologies with specific focus on the application of artificial intelligence techniques to the problem of adaptive operation and deployment of oceanographic sensor and vehicle systems.

Salary ranges from $52,423 to $98,221.

Interested applicants should send their resumes to:

Naval Research Laboratory
Code 7402, 1005 Balch Blvd.
Stennis Space Center, MS 39529-5004
Attention: Ms. Carolyn Gilroy

The Naval Research Laboratory is an Equal Opportunity Employer.

NEC Laboratories America, Princeton, NJ
Robust & Secure Systems - Autonomic System Management Research
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, NEC Group employs more than 148,000 people across 293 subsidiaries in 27 countries and had net sales of approximately $45 billion in the fiscal year that ended March 2005. Please see more information about NEC Labs at http://www.nec-labs.com.

Robust & Secure Systems Group is seeking a member to work in the area of autonomic system management. The focus of the team is to create innovative technologies to simplify and automate the management of complex IT systems, fixed and mobile networks, software and services. Candidates must have a PhD in CS/CE with solid background and research/publication record in related areas. Candidates must be proactive in developing innovative technologies and have a "can-do" attitude.

The group engages in foundational as well as applied research in the following areas:

- Autonomic computing
- Distributed systems and networking
- IP network management
- Mobile network management
- System reliability and security
- QoS management and analysis
- Data mining and machine learning
- Software reliability and testing

Expert-level skills in one or more of the above areas are required. Knowledge of information theory, signal processing, system and control theory is a plus. For consideration, please forward your resume and a research statement to:

recruit@nec-labs.com

and reference "ASDS-RSM" in the subject line.

Purdue University
Computing Research Institute
Director

Purdue University seeks an individual with vision and leadership skills to be the Director of the Computing Research Institute. The Institute's mission is to champion high performance computing at Purdue. The Director will provide leadership for activities designed to promote and facilitate research in high performance computer systems and their applications in science, engineering or any other unit on campus; lead development of collaborative relationships with government and industry; assist faculty in identifying high performance computing research opportunities; and organize multidisciplinary research programs.

Applicants must have a Ph.D. in a science or engineering discipline and must have demonstrated effective leadership of multi-disciplinary research programs. Administrative and academic experience should be commensurate with an appointment to a Full Professor faculty position in the appropriate academic department and college. A named professorship is possible for a candidate with appropriate qualifications. Applicants should have a strong funding history as well as an ongoing active research program. The appointment is full-time with a minimum of half-time effort devoted to Institute leadership.

Nominations or applications should be submitted via e-mail to:

Dr. Robert Bernhard
Search Committee Chair
Email: bernhard@purdue.edu

Applications should include a letter of interest that outlines qualifications and vision for the position, curriculum vitae, and the name of three references (including their postal and e-mail addresses, and phone numbers). Review of applications will begin April 1, 2007 and will continue until the position is filled.

Questions should be addressed to Dr. Bernhard at bernhard@purdue.edu or 765-496-1938.

Purdue University is committed to working with and accommodating dual career couples.

Purdue University is an Equal Opportunity/Equal Access/Affirmative Action Employer fully committed to achieving a diverse workforce. Women and underrepresented individuals are encouraged to apply.

University College Cork
Computer Science
Professor

UCC seeks an outstanding candidate for the award of a proleptic Chair in Computer Science. Candidates will be required to apply, no later than 15 June 2007, for a Science Foundation Ireland (SFI) Principal Investigator award (applications can be made for up to 5 million euro) that will pay their salary as a full time research professor for the first five years. A proleptic contract for a permanent full Professorship, to be taken up upon the normal termination of the SFI award, will be offered to the most suitable candidate who is deemed appointable and receives such an award. Preference will be given to candidates whose research is in the field of Constraint Programming, but applications from candidates in other fields of Computer Science who have strong potential for collaboration with Constraint Programming research at UCC will also be considered.

Applicants should be world-class researchers. They should be well suited to take up, after the initial five year research professorship, any teaching and administrative responsibilities that accompany the permanent full Professorship, while maintaining an active research program. Experience and interest in academic/industry collaboration is highly desirable.

The UCC Computer Science Department has received approximately 30 million euro in external research funding in the past 5 years. UCC has been selected as Ireland's University of the Year by The Sunday Times twice in the past 4 years. Cork is located on the south coast of Ireland, with convenient air and sea access to continental Europe.

Informal enquiries may be made to Professor Eugene Freuder, Director, Cork Constraint Computation Centre to whom applicants should forward a copy of their SFI proposal.
Email: e.freuder@4c.ucc.ie.
Website: www.4c.ucc.ie.

Salary scale [new entrants]: 109,104 – 140,385

Closing date for receipt of applications: Friday, 15 June 2007

Application forms and further details are available on our website at: http://hr.ucc.ie/EmploymentOpportunities or

Department of Human Resources
University College Cork Ireland
Tel: + 353 21 490307
Email: recruitment@per.ucc.ie
Fax: + 353 21 4276995

University College Cork is an Equal Opportunities Employer.

University of Cincinnati
Department of Computer Science
College of Engineering
Head

(26UC2097) The University of Cincinnati's College of Engineering invites applications for the position of Head of the Department of Computer Science (CS). The Head is expected to have a strong commitment to advancing research and education, to lead the development of innovative programs, especially joint ventures with other academic units, and to foster and strengthen external research support of the faculty from national funding agencies and academic partnerships with industry.

Qualifications for the Head position include a doctoral degree in computer science or a closely related field; a distinguished record in research and education; a clear vision for the future of the discipline; and an established leadership and interpersonal skills. The Head is responsible for overall program administration, including taking a leadership role in directing the growth and development of the department. The Head is also expected to play an active role in fostering the recruitment of high quality students and faculty, and overseeing the implementation of the ongoing revitalization of the curriculum. The position is a tenured faculty position, which after a startup period includes an agreed upon teaching requirement not to exceed one course per quarter.

The CS Department offers undergraduate and MS degrees in computer science, and PhD in computer science and engineering (CS track) that is shared with the department of electrical and computer engineering. The Head will have significant opportunity to build a top tier computer science department. The department has well-equipped research and teaching laboratories, including research space in the Engineering Research Center.

The University has completed a major building campaign designed to make it one of the finest urban settings in American higher education. A compact campus permits easy access to all resources and other colleges. The University of Cincinnati is a state-supported, comprehensive Research 1 institution with an endowment of approximately $1 billion, the tenth largest among public institutions in the nation.

Interested applicants must go to: http://www.cs.uc.edu/CSHeadSearch.

Each application must include a cover letter, curriculum vitae and contact information of three references. The position will remain open until filled.

Additional information is available on the departmental web site: http://www.cs.uc.edu.

The University of Cincinnati is an affirmative action/equal opportunity employer. The University of Cincinnati is a smoke-free environment.

University of New Orleans
Department of Computer Science
Bioinformatics/Information Assurance

The Computer Science Department at the University of New Orleans invites applications for tenure-track positions as Assistant Professor effective Fall 2007.

Go to:
http://www.cs.uno.edu/News/faculty_position.html
for full description of the positions.

University of Tennessee-Oak Ridge National Laboratory
Joint Institute for Computational Sciences
Governor's Chair in Computational Sciences

Science of the 21st century demands computational capability well beyond that which is available today. Exceptional computational scientists are needed to help build and guide that capability for scientific research. The nation's continued success in R&D requires leadership in high performance computing. The University of Tennessee, in partnership with the Oak Ridge National Laboratory, is conducting a search for world-class candidates to fill Governor's Chair appointments in the Joint Institute for Computational Sciences, with access to some of the most advanced scientific and computational tools available to the scientific research community today. Highly qualified candidates are sought with expertise in computer science applications as well as science and engineering applications. For more information, please visit:

http://www.tennessee.edu/governorschairs/

Applications should be submitted to:
Norma J. Manning
Email: JICSGovernorChair06-07@jics.utk.edu

in electronic form, and should include a current curriculum vitae, the names and full contact information for five references, and a cover letter comparing the applicant's strengths and experience to the required qualifications. Initial consideration will commence in January 2007 and will continue until all available positions are filled.

The University of Tennessee is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA institution in the provision of its education and employment programs and services. The university welcomes and honors people of all races, creeds, cultures, and sexual orientations, and values intellectual curiosity, pursuit of knowledge, and academic freedom and integrity.

Professional Opportunities

University of Utah
SCI Institute
Assistant/Associate Professor

The University of Utah's Scientific Computing and Imaging Institute seeks applicants for tenure-track faculty positions at the level of assistant or associate professor in the area of **Computational Probability, Computational Statistics and Computational Biostatistics**. Applicants should have earned a Ph.D. in Statistics, Biostatistics, or a closely related field. The successful candidate will be expected to work with engineers and clinical researchers in the Scientific Computing and Imaging Institute and Brain Institute at the University of Utah. The applicant should have a demonstrated track record in one or more of the following areas: the design of clinical studies, analysis of imaging studies in the context of biological experiments or medical studies, applications of statistics to areas of scientific computing and analysis of error, novel research in the area of computational statistics and an interest in technology commercialization. The successful candidate will have a tenure track appointment in the Colleges of Engineering, Sciences, and/or Medicine.

This position is part of the Utah Science, Technology and Research Initiative (USTAR) which was funded by the Utah State Legislature to attract focused teams of outstanding researchers who have the potential helping build major research programs and creating new technology that can ultimately lead to commercial products and/or new industries for Utah. The Scientific Computing and Imaging Institute is known for its pioneering role in scientific computing, visualization, and multidimensional image analysis. The institute includes large, multi-investigator efforts addressing large-scale problems of significant impact in the above areas, as well as a number of individual investigator research activities. Research areas and course offerings benefit from the quality and breadth of our faculty and emphasize interdisciplinary research in which fundamental research in applied to important problems in diverse fields such as biology, physiology, medicine, defense, and energy.

The University of Utah is located in Salt Lake City, the hub of a large metropolitan area with excellent cultural facilities and unsurpassed opportunities for outdoor recreation only a few minutes' drive away. Additional information about the Scientific Computing and Imaging Institute can be found at www.sci.utah.edu.

Please send curriculum vitae, a research goals statement, a teaching goals statement, and names and addresses of at least four references to:

SCI Institute
Faculty Recruiting Committee
c/o Deb Zemek
deb@sci.utah.edu via email in PDF format

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

University of Utah
SCI Institute
Assistant/Associate Professor

The University of Utah's Scientific Computing and Imaging Institute seeks applicants for tenure-track faculty positions at the level of assistant or associate professor in the area of **biological image analysis**. The successful candidate will be a faculty member conducting research in the Scientific Computing and Imaging Institute and have a tenure-track appointment in one of the departments in the College of Engineering, for example: Bioengineering, Electrical and Computer Engineering, School of Computing. Applicants should have earned a Ph.D. in Computer Science, Electrical or Biomedical Engineering, or a closely related field. We especially seek a candidate in the area of image analysis with a particular emphasis on applications to problems in biology and microscopy. The candidate should have a demonstrated track record of successful, funded projects with biological collaborators and an interest in technology commercialization.

This position is part of the Utah Science, Technology and Research Initiative (USTAR) which was funded by the Utah State Legislature to attract focused teams of outstanding researchers who have the potential helping build major research programs and creating new technology that can ultimately lead to commercial products and/or new industries for Utah.

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SCI Institute Faculty Recruiting Committee
c/o Deb Zemek
deb@sci.utah.edu via email in PDF format

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

CRA-W/CDC Programming Languages Summer School

May 9-11, 2007

http://www.cs.utexas.edu/users/mckinley/pl-summer-2007/

UNIVERSITY OF ALBERTA
EDMONTON, ALBERTA, CANADA

www.careers.ualberta.ca

Assistant or Associate Professor, Computing Science

The Department of Computing Science at the University of Alberta is seeking a qualified individual to fill a position at the level of Assistant Professor or Associate Professor in a research area that has direct applicability to health-related applications. The successful candidate with be working in a large support environment, including the resources of a teaching hospital, an emerging health informatics program, and a supportive regional health care organization.

Candidates are required to have a PhD in Computing Science, Health Informatics, or a related discipline. Some areas of interest include data management (warehousing, electronic health records, ontologies), data mining, data security, data visualization, user interfaces, and decision support systems. The successful candidate must have an established track record of applying their research to health-related applications. Experience working in the health sector is desirable. Salary is commensurate with experience. The University of Alberta offers competitive salaries and an extensive benefits package.

The candidate is expected to establish their own research program, supervise graduate students, and teach at both the graduate and undergraduate level. The Department highly values curiosity-driven research. Strong communication skills, project management, inter-personal skills, and team leadership are important qualities.

The Department is well known for its collegial atmosphere, dynamic and well-funded research environment, and superb teaching infrastructure. Its faculty are internationally recognized in many areas of computing science, and enjoy collaborative research partnerships with local, national, and international industries. The University of Alberta, located in the provincial capital of Edmonton, is one of Canada's largest and finest teaching and research institutions, with a strong commitment to undergraduate teaching, community involvement, and research excellence. As a population center of over one million people, Edmonton offers a high-quality, affordable lifestyle that includes a wide range of cultural events and activities, in a natural setting close to the Canadian Rockies. Alberta's innovative funding initiatives for supporting and sustaining leading-edge IT research have attracted world-class researchers and outstanding graduate students to our Department and to the campus. Further information about the Department and University can be found at www.cs.ualberta.ca.

The competition will remain open until a suitable candidate is found. Candidates should submit a curriculum vitae, a one-page summary of research plans, a statement of teaching interests, reprints of their three most significant publications, and the names of references (with contact information) electronically to everitt@cs.ualberta.ca or by mail to:

Iris Everitt, Administrative Assistant
Department of Computing Science
University of Alberta
Edmonton, Alberta, Canada T6G 2E8

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

Computational and Life Sciences

EMORY UNIVERSITY
Atlanta, Georgia

Emory is seeking to make multiple faculty appointments within a Computational and Life Sciences (CLS) initiative (http://www.cls.emory.edu/). CLS is part of a University-wide Strategic Plan that has uniquely positioned Emory for significant growth in a number of key areas (https://admin.emory.edu/StrategicPlan/). CLS encompasses three broad focus areas: Computational Science and Informatics, Synthetic Sciences, and Systems Biology. This interdisciplinary initiative will bridge and build upon Emory's highly regarded strengths in the physical, biological, and health sciences.

Faculty applications at all academic ranks across Computational Science and Informatics, Synthetic Sciences, and Systems Biology are invited from individuals with a PhD in a relevant discipline and proven record of accomplishment in research and scholarship. Ideal candidates will span more than one CLS focus area and have joint appointments across departments/schools. We also invite queries from small teams of collaborating scientists who bring complementary strengths to the CLS initiative. Applications consisting of a CV, research and teaching statements, and three letters of recommendation directly from recommenders should be sent via email to cls@emory.edu. Informal inquiries are also invited by email. Screening starts May 1, 2007 and will continue until all positions are filled. For further details on the CLS initiative please see: http://www.cls.emory.edu/

Emory University is an Affirmative Action/Equal Opportunity Employer and welcomes applications from women and members of minority groups.