January 1993
Vol. 5/No. 1
Membership of Congress changes significantly
Br Fred W. Weingarten
CRA Staff

A though incumbent candidates were better in the November election than was expected, the membership of Congress has changed significantly. Congress has 118 new members, and some key members were defeated or retired, so there will be quite a bit of change in the membership of committees and subcommittees concerned with research.

House of Representatives
Rep. George Brown (D-CA), chair of the House Committee on Science, Space and Technology, who narrowly won a race many expected him to lose, most likely will continue to chair the science committee. For many years he has been considered one of the most knowledgeable members of the House on science policy. His acumen for priority setting, increased accountability, and demonstrated social benefit from research investments have alarmed some members of the basic science community. However, the community considers him a strong supporter of science and his warnings an attempt to improve science policy.

Rep. Rick Boucher (D-VA), chair of the House Science, Space and Technology Subcommittee on Science, also was re-elected. He has proven to be an effective and well-informed chair, but given his tenure in the House and his rising political star, he may not remain active in R&D policy. Boucher also served on the Energy and Commerce Telecommunications and Finance Committee, where he expressed a great deal of interest in stimulating the creation of a broadband, digital national information infrastructure. This interest has been reflected in his ongoing support of the National Science Foundation’s management of the National Research and Education Network (NRE)

A change this year by Bob Traxler (D-MI), who is particularly critical for the computing research community. The subcommittee will consider NSF’s reauthorization, a process that will help define the agency’s mission and organization for the next several years. The subcommittee will continue its oversight of the High-Performance Computing and Communications Act and conduct hearing on the future of US R&D policy, as well as the full committee’s Task Force Report on the Health of the US R&D Enterprise released last year.

The House science committee often has a heavy turnover in members because it is viewed as a “major” committee. This year, with all the attention on high-technology, the committee possibly will attract more members. But it will never have the attraction or political power of the Energy and Commerce Committee, the Ways and Means Committee or the Appropriations Committee. If any subcommittee has the potential to attract political capital and where to wait for a better time, it is the Appropriations Committee. 

Rep. Traxler and Green were considered to be the two most knowledgeable members of the House Appropriations Committee, which is a key committee to chair a subcommittee.

NSF reauthorization

The National Science Foundation (NSF) will be considered one of the most critical issues for the science and technology community this year. There are expected to be several hearings on the future of US R&D policy, as a follow up to the full committee’s Task Force Report on the Health of the US R&D Enterprise released last year. The subcommittee will continue its oversight of the NSF, conduct hearings on NSF’s reauthorization, and actively participate in the political debate over NSF’s management of the High-Performance Computing and Communications Act and conduct hearings on NSF’s reauthorization.

The research community will be responsible for helping create public and political support for S&T initiatives, and actively participating in the political debate over NSF’s management of the High-Performance Computing and Communications Act.

S&T policy

S&T policy will be emphasized and restructured over the next few years, both for reasons detailed in recent issues of CRN and because science and technology was a serious focus for the Clinton/Gore campaign.

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News Analysis
How will S&T policy fare in new administration?
Br Fred W. Weingarten
CRA Staff

Political transitions, particularly ones reflecting a major political shift, are times when great hopes—and fears—are raised about possible changes in all areas of public policy, ranging from the most fundamental, such as national prosperity and security to the most arcane. This transition has been no different. Because President-elect Bill Clinton’s campaign emphasized change, the research community has been active in local politics, have any S&T policy experience.

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Consensus
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CRN welcomes letters from its readers. Letters may be edited for space and clarity. Send them to Joan Bass, Managing Editor, CRN, 1875 Connecticut Ave. NW, Suite 718, Washington, DC 20009. E-mail: jbass@cs.umd.edu. Letters must include your name, address and telephone number or E-mail address.

By Rob Kling

By John McCarthy

CS community reacts to NRC report

Effective CS researchers must compute for the future

Merging CS and CE disciplines is not a good idea

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Childcare an issue for conference attendees

By Elaine J. Weyuker

Childcare, or the lack thereof, is an ever present and often stressful concern for both the working parent and the corporate world. In fact, it is not unusual for the real challenges to still loom. How do you arrange for childcare in an unfamiliar, distant place? I could locate a babysitter who would agree to see our daughter securely with a caregiver you have never met? Frequently, large hotels list babysitting as an available service. However, my personal experiences are that babysitters rarely exist. My daughter was 5 months old when I took her with me for the first time. It was the most important conference in my field. I was on the program committee, and I had a paper in the conference. I would not have missed it for the world. I phoned the hotel and they said they had a babysitting service and that no reservations were needed. When we arrived, I learned there really—maybe they were thinking of someone I could phone and tell them they wanted to come to the hotel and babysit. A bit more discussion, they concluded they could not think of anyone. My daughter was therefore not seen by anyone from the conference. Needless to say, it affected my ability to participate.

It is situations like these that often are the deciding factor, that is the traveling expenses of a child. Expenses include:

- airfare (full fare starts at age 2);
- childcare (in addition to normal childcare expenses at home, which must be paid whether or not the child attends);
- meals (for logistical reasons, these must be bought at the not so expensive hotel restaurant);
- additional hotel costs.

Usually, none of these costs are reimbursable by an expense grant or employer. These costs are not tax-deductible, although they are mandatory for the employee to attend the conference. It is not unusual for it to cost $1,000 to take my child to a conference. How many conferences can a parent afford to attend with this type of financial burden? How many people

child for the necessary day(s)? If not, could they ask their caregiver for a recommendation? If this does not produce leads, I look for other childminders members near the conference and ask them to ask students if they would like to earn extra money babysitting. I also ask colleagues whether their friends/family are interested in babysitting and might be interested in babysitting. It is a lot of work, and it is not for the faint-hearted. I have had some wonderful luck, but on other occasions, I come up empty-handed and simply decided there was no solution, and that I would just have to miss the conference.

The bottom line is this: I am a fairly senior researcher and much better able to absorb the costs than many other people. Being senior, I know lots of people around the country and therefore have good contacts. Still, travel to a country where English is not the primary language seems impossible to me now. I simply do not submit papers to conferences in this area, and do not attend those conferences.

It is certainly true that there are people who are single parents or the primary caregivers for their children, and who face these problems. And there are women whose situation allow them to travel without their children. Still, at the present time, childcare responsibilities, especially for young children, fall disproportionately on women, and therefore women suffer most often and most directly.

How many women face these situations and find them inescapable? How does it affect their career? Are they taken less seriously because they cannot attend meetings, and therefore publish less than their male colleagues? Are they considered unprofessional if they attend with a young child who is not the only way they can attend? I frequently manage to attend and arrange childcare. I could find out whether their caregiver would take an extra (wonderfully bright, easy-going, ever-cheerful)

Page 3
Committee responsible for all CISE directorates

By Jean Smith

The newly restructured National Science Foundation Computer and Information Science and Engineering (CISE) Advisory Committee met for the first time in Washington in late November. This was the committee’s first meeting since NSF’s Assistant Director A. N. I. O. abermann, who heads CISE, changed the advisory committee structure. Previously, each of the six CISE division had its own advisory panel, which abermann reported was cumbersome and ill-equipped to deal with cross-cutting directorate issues. The 15-member advisory committee, chaired by a f ree A. A. Cochran, was formed so it would have directorate-wide responsibilities.

abermann said at the meeting that the committee was formed because computing science is now a mature discipline and the committee’s recom-

mendations will carry considerable weight. He mentioned that NSF’s strategic planning exercise, which has five basic themes: intellectual integra-

tion, partnerships, people, an agile organization and accountability. He told the committee that the first choice offers limited growth, essentially supporting by basic research; the second allows for incre-

cemental growth, representing a continua-

tion of current operations; and the third suggests broader mission for NSF to meet critical societal needs.

abermann outlined two topics to be addressed: how could NSF increase the discipline and human resources? Intellectual integration includes encouraging and supporting cross-disciplinary connections with other research fields indus with industrial researchers. He asked the committee to consider how the discipline is regarded; whether other disciplines should be included or excluded; whether other supercomputer centers, networks, science and engineering centers and the like should be emulated; whether intellectual integration is affordable and achievable; whether there are obstacles to such integration; and what actions CISE should take.

In the area of human resources, the basic goal is to ensure that, in the future, there will be people with knowledge, skills and understanding of science and technology, not only at the Ph.D. level, but across a much broader population. The committee was asked to consider goals, working conditions and relevant issues such as whether NSF should support industrial employment at universities, connections between academic tenure and sabbatical and industry.

Susan Gerhart, director of the CISE Division of Computer and Information Science and Engineering Research, presented an outline of the restructured mission report in theory and software. She discussed what could be learned from past examples, such as the computer and information initiative (cross-disciplinary research), formal methods in system engineering (transfer from theory to practice), and Science and Technology Centers (High-Performance Computing (institutional support)). A n important integration theme is to create problem-solving environments including high-perfor-

mance computational research. John C. Chen, head of the CISE Office of Cross-Disciplinary Activities (OADA), discussed human resource programs in cross-disciplinary activities. He reviewed the problems being addressed in CDA in faculty training and education, new researcher opportunities, graduate student education, undergraduate education, K-12 activities and underrepresented groups. In his view, several major questions must be addressed:

• How can opportunities for minority men and women in information technology careers be increased?

• Is CISE involved enough — or too much — in education?

• What information on mathematics and science training needs will teachers have in 2010 and beyond?

• How can sharing responsibilities through the levels of the educational enterprise be encouraged?

Following the presentations, there was a general discussion by the committee.

On the second day, the committee broke into three groups to develop recommendations. One group, led by D. Deng, stated that software engineering is a core technology for U.S. industry, and CISE should play a lead role among federal agencies in co-sponsoring basic academic research in this area. Such research might include new parallel architectures, distributed computing and software development collaboration.

The group identified examples of grand-challenge problems and looking forward to the next “high-performance” era. They recommended that planning for the initiative should begin now. Pilot projects and a workshop were suggested.

Grand-challenge projects that combine CISE and non-science applications should be evaluated according to their promise of contribut-

ing significant new knowledge in computer science and engineering and the impact or interest inherent in the application. There was support for convening special sections similar to those used by the National Academy of Engineering, if necessary, to adequately review such proposals.

The second group examined intellectual integration involving CISE and other disciplines. It cautioned that such applications should have substantial computer science intellectual content, and that both multidisciplinary and interdisciplinary research should be considered. Discussion did not include arts, humanities, entertainment or business, but the group recommended that these areas be considered in the future. The group warned that the multidisciplinary applications should not eclipse the focus on computer science.

Policy News

S&T community interested in report on the future of NSF

By Fred W. Weingarten

In late November, as scheduled, the Special Commission on the Future of the National Science Foundation (NSF) issued its report to the National Science Board (NSB). The commission was co-chaired by William D. Anderson, chairman of the Washington University in St. Louis, and Robert Galvin, chair of the executive committee of Motorola and former chief executive officer of that company. NSF Director Walter H. buyere requested that the commission be established to examine how the agency’s mission and programs could change due to major shifts in the political, economic, and social environment for science (November C R N, Page 4). The commission’s report originally was intended to serve as input to the NSF strategic planning process. However, the commission’s work attracted more attention in the scientific community than expected when prominent scientists said they feared the commission was a stalking-horse plan to turn NSF into a technology agency that will redirect money away from basic research.

Despite these fears, the 11-page report remained objective. It strongly upheld the importance of continuing NSF’s responsibility for supporting long-term basic research. The report also acknowledged the validity of the political and social forces that have forced the increasing examination of NSF’s role and raised questions about the structure of government science and technology policy.

The commission did not seem to raise exactly these positions. It recommended two basic objectives for NSF research support:

• The agency will support first-rate research at many points on the frontiers of knowledge, which will be identified and defined by top researchers.

• In response to scientific opportunities to meet national goals, resources in strategic research areas will be allocated fairly.

It then turned its interest to pursue both goals with vigor and in a balanced way. The health of resources should be shown regularly with these goals in mind. Positive emphasis on both goals will enhance the standing of science.

The commission also seemed to say, in careful language, that redif-

inition of mission was not solely NSF’s responsibility. The commission’s first general recommendation was: “A strong and coherent policy wherein science and engineering can contribute more fully to America’s strength.”

NSB encouraged to work with the president, his science adviser and the Federal Coordinating Council on Science, Engineering and Technol-
ogy to broadly assess the health of science and engineering and generate a stronger policy into which the HACF strategy fits.

Given that the new administration already has committed itself to restructure federal R & D policy, such an effort can be seen as a sensible caution to NSF and Congress to move toastnly on redefining NSF’s mission.

The commission also stated that although NSF controls only a minuscule fraction of the overall federal R & D budget ($30 billion at $70 billion), it historically has played a dominant role in federal support for basic research. The commission said the US has a good record overall of capitalizing on the results of research. That success, coupled with a growing convergence between science and technology, strongly suggests an even greater need and emphasis on long-term fundamental research.

The commission recommended that “the board and foundation’s key role in the support of research in science and engineering should be strongly reaffirmed.” This recom-

mendation was followed by more specific recommendations on NSF research support.

The commission’s report also focused on science education, and identified it as “major priority” for NSF, not only in curricula but in “methodologies of teaching and training for research.” The commis-

sion recommended a focus on undergraduate education as “critical areas needing improvement.”

The commission acknowledged that its recommendations implied a real need for more resources for NSF, not a reallocation of existing funds. But it said the case was strong and the links to national priorities clear.

The original purpose of the report, and one that may assuage some criticism of NSF, was to provide a long-term NSF strategic planning exercise. However, political events may put more weight on the recommendations.

In mid-December, NSF was expected to submit its revised spending plan to congressional appropriations committees to show how the final appropriated funds will be allocated within the agency. The Senate Appropriations Committee told NSF to take the commission report into consideration when revising its spending plan.
Policy News

Transition from page 1

As a result, to speak effectively on S& T policy, we need to be able to reach agreements on consensus within the research community. The computing research community needs to use mechanisms such as workshops, studies and conference sessions to determine our own research priorities and needs.

We also need to work more closely with colleagues in other disciplines, because restructuring science policy is not a zero-sum game. Since joining CISE, I have been astounded at how seldom the scientific communities have worked together on issues affecting them. Even more broad-based scientific organizations such as the National Academy of Sciences and the American Association for the Advancement of Science focus primarily on discipline studies and do little cross-cutting policy work.

At this level we get bland, generic and unconvincing paeans to the wondrousness of science. Below that level, the discussion is usually cut off. When we face problems such as redefining NSF’s mission, structuring civil technology and science and between industry and the government, the discussion is usually cut off. What we need is a way to articulate clearly, first among ourselves, what is fundamental to the process of research and what is negotiable, and what we need to understand about the future.

One of the characteristics of politics is that there is a need to negotiate and compromise. Since there is no international organization that immediately engages in political negotiations to create the “contract” with the public. The first step is to acknowledge the validity of the public’s concerns and that R&D support be tied more closely to some observable benefit or output. It is, after all, the taxpayer’s money.

Furthermore, the NSF is only “left alone,” as some have urged, will not do. We need to articulate clearly, first among ourselves, what is fundamental to the process of research and what is negotiable, and what we need to understand about the nature of the other side’s demands. For example, if the current political debate is any guide, there are inevitable new agenda settings.

We need to establish a relationship between NSF and the research community. NSF is expected to continue as a resource for reauthorization and renewal of a variety of programs.

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Overall

A major implication of these changes is that the research community must make a great effort to educate the public and Congress. With few exceptions, the names of the research organizations and their empirical manifestations. Effective computer interfaces must rest on sound theoretical foundations. Although foundations of the discipline, although interesting, are changing. In some sense, it is not a zero-sum game. What we need is a way to articulate clearly, first among ourselves, what is fundamental to the process of research and what is negotiable, and what we need to understand about the nature of the other side’s demands.

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CISE from page 4

pure computer science research.

CISE and the Computing Research Association (CRA) are the principal groups in the computing research community. The central goal of CISE is to ensure that computer science research is funded at a level that is commensurate with the importance of the field.

For example:

- Some obsessive expect that the new administration will immediately request a supplement for NSF’s current budget. (The agency suffered a 2% cut in its budget last year.)

- NSF’s reauthorization will be up for debate soon. (EHR) to ensure that more staff members are hired. The CRA has already written to the NSF Director urging that CISE influence the appointment of new program directors in the NSF Director of Computing, Information, and Communication Sciences.

- The high-performance Computing and Communications initiative would be an example of the need for increased funding for these programs. NSF and the other science agencies will go through the usual appropriation process. But cuts will be severe, as in last year’s appropriations, particularly for large-scale, complex projects.

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- The debate over experiments will take many forms. The new administration is likely to introduce legislation promoting the development of a broadband, digital national information infrastructure.

- Some version of the Information Infrastructure and Technology bill (S 2937), submitted last year by Sen. Gore, likely will be resubmitted and sponsored by Sen. Rockefeller.

CISE from page 4

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The third group considered education. For K-12, it recommended that CISE influence the appointment of program directors within the NSF Director for Education and Human Resources (EHR) to ensure that more staff members are hired. The CRA has already written to the NSF Director urging that CISE influence the appointment of new program directors in the NSF Director of Computing, Information, and Communication Sciences.

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Kling from page 2

operating systems.

Kling from page 2

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For each of these topics, a new research agenda was identified. For example, the concept of computer science could point to as “the foundations” of the computer system.

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Workshop attendees tackle research problems

By Barbara Liskov

A workshop held in the fall of 1991 on improving research in experimental computer science resulted in a recommendation that attempts to correct current problems in university computing research. The workshop was cosponsored by the Office for Naval Research, the National Science Foundation, the Defense Advanced Research Projects Agency (DARPA), and other science agencies that participate in the Federal Coordinating Council on Science, Engineering and Technology (FCCSET).

A session on benchmarking, measuring, and comparing focused on techniques for evaluating system performance. A group particularly noted the difference between benchmarks, which are a way of comparing the performance of systems, and workloads, which are a way of evaluating how a particular system performs.

The group made several recommendations:

- Incentives, funding and professional recognition should be granted for creating and disseminating benchmarks and instrumentation tools. Journals should have a section in which papers on such things as new workload-gathering tools could be published.
- Benchmarks need to be discarded periodically and replaced with new ones to avoid the problems of system instability and benchmark work well on particular benchmarks.
- Researchers need better methodology to build and understand benchmarks. In particular, we need scalable benchmarks that allow extrapolation from short runs to larger systems and interpolation from long runs to intermediate points.
- Reports on benchmarks need to be presented in enough detail to permit reproduction by those skilled in the state of the art.

The session on industry-university collaboration discussed examples of success in encouraging university-industry collaboration and technology transfer, and what changes would make such collaboration easier. The panel also discussed the differences in time frames for projects undertaken in industry and academia.

The panel suggested ways to improve collaboration:

- A code of behavior should reward techniques for increasing trust and take that into account when making promotion decisions.
- The reward system in industry should encourage people to spend time working in academia with research groups.
- The session on funding discussed the need for proposals to be presented at a conference so that the work is helpful to other researchers.

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- C. make a collection of great examples of experimental research in each field of computer science, in essence developing a paper role model for ongoing follow. The papers should be summarized and compiled into books.
- A curriculum should be developed for a course in experimental methods and statistics for computer science research, and offered in university departments.
- A session on infrastructure and funding focused on how projects should be organized to maximize results, and what form funding should take. This group has discussed various forms of infrastructure, including support staff, hardware and software artifacts. Such infrastructure might be shared within a single large research group, among many groups at a university or even nationally.

Charged atmosphere

The session founded a small award of about $100 to support research that could be presented at the conference. The award was to motivate the creation of a new workshop and to encourage younger researchers to present their work. The workshop was suggested by attendees who felt that the CER grants had not been as effective as had been hoped, even though there had been some conspicuous successes, and that the adoption plan might work better.

The broad agreement that the goal now is not to increase the number of Ph.D. recipients, but rather to increase the quantity of education and research in computer science of competent system people (who are scarce).

The funding of entry-level research is a good way of increasing the number of good experimentalists.

- A variety of funding models is needed.
- Competing proposals should be funded.
- Funding agencies should be careful not to micro-manage research.
- A particular concern was the emphasis in some funding agencies on dividing up a project area into subparts and assigning the subparts to individual institutions. This is not a sensible approach to doing research, and it is likely to be time-consuming and unfruitful.

- Standards must not dictate research. For example, M class as a good platform for applications being built today, but research is needed to ensure the platforms of tomorrow.

University should not be treated as development organizations.

The session on theory and practice discussed ways to increase the interaction between researchers in the two areas. The group agreed that such interaction was important. Theoricians benefit by discovering interesting problems to work on, and experimentalists obtain useful products, such as algorithms and impossibility results.

The group suggested several approaches for fostering interaction between theory and practice:

- The best paper from a systems conference should be presented at a theory conference, in the hope that it will trigger theoretical research.
- The dual proposal of presenting a top theory paper at a systems conference and a proposal of funding a project at an industrial institute would receive a large amount of money with relatively little direction on how it would be spent, most likely the project would span university and focus on work in a particular area. Something like this has been tried in Canada at the Canadian Institute for Advanced Research. A new institute would free people from having to write proposals as frequently. Attendees felt that writing proposals consumes too much time. Also, an institute would free people to follow new paths.

However, attendees disagreed about whether such an institute would be a good idea. Some people believed the money would be wasted and that funding specific, more directed proposals would be better.

- A related proposal was to support collaboration between theoretical and practitioners. Proposals for joint work should be encouraged. A new possible organization is to have theoreticians as consultants on systems projects.
- Encourage teaching and use of engineering analysis in computer science. Engineering analysis involves the careful use of approximation at each step. It can be contrasted to the more common pattern for computer science, in which an initial large approximation is made in creating the abstract model of a problem. Subsequent analysis is precise and rigorous, but the problem at hand is not intended to practitioners may be lost in the initial abstraction.

- Identify good examples of fruitful interaction between theory and practice.
- Encourage experimentalists to propose simple models that can be tractable for theoreticians. This might motivate theoreticians to work in an
SIGACT trying to get children excited about CS

By Michael R. Fellows and Ian Parberry

A new approach to computer science education is being developed by the Association for Computing Machinery's Special Interest Group on Algorithms and Computation Theory (SIGACT). The goal is to create a curriculum for schoolchildren that makes computer science accessible and exciting. This is particularly important as computer science education is lagging behind in many countries, particularly in the Third World. SIGACT is working with universities in the Third World to develop a curriculum that is accessible to children. SIGACT is also working with computer scientists to create a newsletter that serves as a network and clearinghouse for ideas and projects. The newsletter is also a resource for teachers introducing computer science in their classrooms. SIGACT is also working with the National Council of Teachers of Mathematics to develop a curriculum for schoolchildren that makes computer science accessible and exciting.

Problems for children

Children who have built-in abstraction abilities that seem to get lost before they become adults. They have no trouble imagining that a block of wood is a house and a piece of driftwood is a boat. Experience has shown that children can imagine that a dot on a piece of paper is a house, that lines connecting them are streets, and that numbers labeling the streets represent distances. With these representations in mind, the children are ready for the "Muddy City Problem."

The children are given a map of Muddy City and told the story of its construction. The map consists of only paved roads. The children are then given a problem to solve: how can they travel from one house to another by a path that is as small as possible? The problem is solvable in polynomial time and the solution can be found by a quick and simple algorithm. The problem does not seem to lend itself to solution by a quick and simple algorithm. The problem can be solved by a quick and simple algorithm. The problem can be solved by a quick and simple algorithm.

The second step is to "disguise" this easy-to-solve problem by adding more edges. The problem does not increase the number of vertices required in a dominating set, but it does increase the number of vertices required in a vertex cover. This is a nice example of the idea of a one-way function. The children may look forward to trying out on their parents the process of creating a graph for which they secretly know a difficult-to-match solution. (One-way functions such as graph matching are the basis of modern cryptography.)

Collective efforts

The Association for Computing Machinery's Special Interest Group on Algorithms and Computation Theory (SIGACT) has formed a committee with the idea of compiling a compendium of theoretical computer science topics for children. SIGACT is working on a comprehensive project to be presented at the SIGACT Seminar on Computer Science and Mathematics for Children in December 1993. The project is a collective effort at science popularization, by one of the modern branches of mathematical science.

SIGACT project joins a number of recent initiatives by professional science organizations to bring "live" science more directly to children. The project is a collaborative effort, with the involvement of computer scientists, mathematicians, and educators. SIGACT is working with the National Council of Teachers of Mathematics' new curriculum standard for school mathematics, which emphasizes the importance of mathematical thinking. SIGACT is also working with the National Council of Teachers of Mathematics to develop a curriculum for schoolchildren that makes computer science accessible and exciting. SIGACT is also working with the National Council of Teachers of Mathematics to develop a curriculum for schoolchildren that makes computer science accessible and exciting.
University of Washington
Department of Computer Science and Engineering

The Department of Computer Science and Engineering at the University of Washington wishes to have one or more tenure-track openings in computer science, computer systems engineering, or who bring significant new research strength to our department.

A moderate teaching load is available for qualified applicants willing to do some research, and an outstanding record of research is expected.

Interested applicants should send a letter of application, a resume and the names of four references to:
Department of Computer Science and Engineering
University of Washington, Seattle, WA 98195. Applications will be accepted until Feb. 15.

University of Albany, State University of New York
Department of Computer Science

Subject to administrative approval, the Department of Computer Science invites applications for faculty positions at the assistant professor level, although applications at all ranks may be considered. Candidates must be graduates of a computer science or related field and have demonstrated research capability in a systems, software or applications areas.

Applications are requested for positions in the applications in the applied areas of databases, operating systems, programming languages, software engineering, distributed computing, networking, and architecture. We also welcome applications involving interdisciplinary research combining computing with traditionally non-CS fields. The department has an active research program, a Ph.D. program, bachelor’s, masters and doctoral degrees.

Applications should be sent to:
Professor Frank Tompa, Chair, Faculty Search Committee,
Department of Computer Science and Engineering,
University at Albany, 100 Washington Ave.
Albany, NY 12222.

University of Waterloo
Department of Computer Science

The University of Waterloo is a top research and teaching university with one of the largest computer science programs in Canada. The department has 14 faculty members, a current faculty of 37 and a research budget of $35 million. The Department of Computer Science offers a 4 year BSc degree, a 5 year Double Honours degree, and a 2 year MSc program. The department is the largest in Canada and one of the top centers for high technology research and development. It has more than 10000 students. The Department of Computer Science, with a research faculty of over 100, is one of the largest in Canada and one of the top centers for high technology research and development. The department has more than 10000 students.

Applications for two tenure-track faculty positions at all levels and in all areas of computer science, computer engineering, and related fields are encouraged. Applicants should submit a vita and at least three letters of reference to:
Professor Schwan, Chair, Faculty Search Committee,
Department of Computer Science and Engineering,
University of Waterloo, Waterloo, Ontario, Canada N2L 3G1.

Applications are reviewed until positions are filled.

The University of Waterloo is subject to the availability of funds.

University of Arizona
Department of Computer Science

The Department of Computer Science at the University of Arizona invites applications for a tenure-track faculty position at the assistant professor level, with the possibility of promotion to associate and full professor, to begin in August 1993. The University of Arizona is located in Tucson, Arizona, and enjoys a warm and pleasant climate.

The University of Arizona is an equal opportunity/affirmative action employer. Women, minority, handicapped persons and special disabled or Vietnam-era veterans are especially welcome.

Applications for assistant professor will be accepted until positions are filled, and applications for associate or full professor will not be accepted.

Applications should be sent to Professor Frank Tompa, Chair, Department of Computer Science and Engineering, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1; and E-mail: m-ownpaj@uwatloo.ca.

In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and permanent residents. Applications from Canadian citizens and permanent residents of the University of Waterloo encourages applications from qualified women and men, members of visible minorities, Native peoples and persons with disabilities. This suspension is subject to the availability of funds.

Ohio State University
Department of Computer and Information Science

The Department of Computer and Information Science is seeking highly qualified candidates for faculty positions at all levels and in all areas of computer science, computer engineering, and related fields. Applicants should submit a vita and at least three letters of reference to:
Chair, Faculty Search Committee,
Department of Computer and Information Science,
Ohio State University, Columbus, OH 43210-1277.

Applications are reviewed until positions are filled.

Ohio State University is an equal opportunity/affirmative action employer.

George Mason University
Department of Computer Science

We invite applications for faculty at all ranks, permanent and visiting. We are particularly interested in applicants who are dedicated to teaching, research and professional service. Our priorities are research in software engineering, distributed computing, networking, and architecture. A Ph.D. in computer science or a closely related field is required. The successful applicant must have demonstrated potential for successful research and teaching career.

Applications should be submitted to:
Professor David C. Petri, Chair, Faculty Search Committee,
Department of Computer Science,
George Mason University,
Fairfax, VA 22030-4444.

Applications may be submitted by fax at (703) 588-7194 or by email.

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University of Arizona
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George Mason University is an equal opportunity/affirmative action employer.
Professional Opportunities

Chair, Department of Computer Science, University of Arizona, Tucson, AZ 85721. A position at the Assistant Professor level is beginning Jan. 15, but the positions will remain open until filled.

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

University of Texas, Arlington
Computer Science Engineering Department

You are invited to apply for tenure-track or visiting faculty positions in all areas of computer science and computer engineering. Applicants with expertise in one or more of the following areas will be given preference: database systems, networks, telecommunications, parallel and distributed systems, programming languages, robotics, and intelligent systems, software engineering, and VLSI and digital systems.

Rank is open. An earned doctorate and a commitment to teaching and scholarly research are required. 0-90% of time is expected for September. Applications will be accepted until all positions are filled. Interested persons should send a resume and a list of references to Bill G. Carroll, Professor and Chair, Computer Science Engineering Department, PO Box 19015, University of Texas at Arlington, TX 76019. Tel. 817-275-3787; fax: 817-275-3784; E-mail: carroll@cse.uta.edu.

The University of Texas at Arlington is an equal opportunity, affirmative action employer.

University of Michigan
Electrical Engineering and Computer Science Department

The Department of Electrical Engineering and Computer Science at the University of Michigan invites applications for positions at all levels in its Computer Science and Engineering Division.

Our emphasis is on operating systems, distributed systems and networks, database systems, programming languages, computer vision, robotics, graphics and artificial intelligence. Exceptional candidates in other areas of computer science and engineering will also be considered. A Ph.D. in Computer Science and/or Electrical Engineering or a closely related field is required. The University of Michigan offers bachelor's, master's and doctoral degrees. The department offers a distinguished and continuing record in research and teaching and has a strong commitment to teaching and will continue to do so in the near future.

T h e U n i v e r s i t y o f M i c h i g a n i s a n e q u a l o p p o r t u n i t y , a f f i r m i v e a c t i o n employer.

University of Oklahoma
Department of Computer Science

The University of Oklahoma invites applications for the position of a Chair of the Department of Computer Science to begin fall 1993. A candidate for this position must have an earned doctorate in computer science or a closely related field, a distinguished and continuing record in research and teaching, and a commitment to service. The successful candidate will be expected to participate in the administrative and scholarly activities of the university. The University of Oklahoma offers bachelor's, master's, and doctoral degrees in computer science.

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

University of Wisconsin–Madison
Computer Sciences Department

The Department of Computer Sciences at the University of Wisconsin–Madison invites nominations and applications for the chair of the Department of Computer Sciences. The position, a tenured position at the Associate Professor level, will be available on or about Sept. 1, 1993. The successful candidate will manage the academic programs in the Department of Computer Sciences, including undergraduate, graduate and continuing education. The successful candidate will also perform computer science research and will be eligible for university or external support.

The University of Wisconsin–Madison is an equal opportunity, affirmative action employer.

The University of Wisconsin–Madison invites nominations and applications from outstanding faculty members who have demonstrated ability in relevant scholarly research. Of particular interest are applications with research interests in operating systems, networks, parallel and distributed systems, artificial intelligence, and computational intelligence. A position in these areas will be considered for a candidate at the assistant professor level.

The department has active research projects in a broad number of areas, including artificial intelligence, computer architecture and VLSI, database systems, mathematical programming, modeling and analysis of computer systems, networking and distributed systems, numerical analysis, operating systems, parallel processing, programming environments, programming languages and compilers, and the theory of computing.

The department has received three National Science Foundation Coordinated Experimentation Infrastructure Grants. The two projects emphasized loosely and tightly coupled parallel computing. O ur new project, PRISM, addresses parallel processing on machines that offer credible paths to teraflop computing.

Research computing equipment is plentiful. The department has several hundred DEC, H, R, IBM and Sun workstations, plus numerous micro and special-purpose devices for computer vision and computer architecture. Equipment for research in parallel computing currently includes two Thinking Machines CM-5s, three Sequoia shared-memory multiprocessors, an Intel SPARC/2 and a Tandem C.L.K multiprocessor. A new Silicon Graphics machine is scheduled to arrive early in the year.

Additional information about the department and the position can be obtained from the Chair of the Department of Computer Sciences, Professor T oby J. Jenkins, School of Computer Science, University of Wisconsin, Madison, WI 53706. T o ensure full consideration, applications and nominations should be sent to the Department of Computer Sciences, University of Wisconsin, Madison, WI 53706. Completed applications and nominations should include the curriculum vitae and the names of four references.

Applications and nominations should be sent to the Department of Computer Sciences, University of Wisconsin, Madison, WI 53706.

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Organization__________________________
Type of Organization

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Auburn University
Department of Computer Science and Engineering

The Department of Computer Science and Engineering invites applications for one or more tenure-track faculty positions at the assistant professor level, beginning September 1993. Responsibilities include research, teaching, and graduate and undergraduate advising. Applications are especially encouraged from women, minorities, and handicapped persons. Applications should include a curriculum vitae, samples of publications or technical papers, and names, addresses, and telephone numbers of three references. Applications will begin Jan. 15 and continue until the position is filled.

State University of New York at Stony Brook

Computer Science Department

A PhD or equivalent degree is required in computer science or a related discipline. The starting date is negotiable. The department operates extensive computer facilities (many Sun file/compute servers, a 64-processor Ncube 2 and many supercomputers, and a national computer network). Candidates should have strong research records. The department has approval for significant research space. Candidates must have a PhD in computer science or a closely related field, and a strong research record. The starting date is negotiable.

University of California at Berkeley

Department of Electrical and Computer Engineering

The department has approval for significant research space. The starting date is negotiable.

Purdue University

Department of Computer Science

The Department of Computer Science has more than 30 faculty members in operating systems, networks, programming languages, databases, systems, robotics, software engineering and artificial intelligence, computing and numerical analysis. We invite applications from all professional levels in any area of computer science.

The department has several joint programs with the Computer Science Department of Carnegie-Mellon University in Pittsburgh. Please send resume and names of three references to: Professor Arie Kaufman, Chair, Faculty Recruiting Committee, Computer Science Department, University of California, Berkeley, CA 94720.

Colorado State University

Computer Science Department

The Computer Science Department seeks to fill one or more tenure-track faculty positions at the assistant professor level beginning in Fall 1993. This position is being advertised on an as-needed basis and is subject to final budgetary approval. The Assistant Professor will teach courses in computer science and information technology. The University is especially interested in connections to science, engineering, business and the arts. The successful candidate will be expected to develop an active research program and to teach courses in the undergraduate and graduate curricula.

Send materials in a letter of application, a curriculum vitae, and three letters of recommendation to: Chair, Computer Science Department, Colorado State University, Fort Collins, CO 80523.
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and make the results more relevant to practical problems.

- Find ways to evaluate researchers whose work spans more than one area. University promotion policies encourage researchers to do interdisciplinary work in a single field. The former Bell Laboratories ranking system was an exception, although it is not clear how it could be applied in other settings. In reality, all researchers in the laboratory were ranked in a single list. This was accomplished by a specific merit system. Line managers ranked their own people, then the lists were merged to give a ranking for the next level in the hierarchy. Because managers were expected to support their own people, moving ahead in the system required support from other managers. Such a system encourages interdisciplinary work.

Effective research

A session on large-scale systems and experimentation focused on finding ways to increase the effectiveness of researchers in the field. There were identified two reasons for undertaking large-scale projects: the size itself may be necessary, or a large-scale system is needed to further research.

Participants agreed that effective systems projects, particularly in hardware prototyping projects, almost is a necessity. Identifying the limitations of university researchers and exploiting the talents of industry professionals is key to the success of large hardware projects.

- Large-scale projects must build upon previous work as much as possible. Researchers should focus on their intellectual efforts and resources on the novel aspects of their systems. This includes building on previous research projects and commercial systems.

- Researchers should reduce the scale of the research project by raising the level of abstraction whenever possible.

A way to evaluate people who work on large collaborative projects is to understand the infrastructure, which computing researchers claim should be shared, often is the competitive advantage of the research group that developed it. A way to encourage people to share and reward researchers for sharing and supporting the infrastructure.

University of Colorado at Boulder

Department of Computer Science

The Department of Computer Science at the University of Colorado invites applications for faculty positions. The department is most interested in candidates in the areas of databases and numerical and parallel computer systems, although exceptions in other areas may also be considered. Preference will be given to candidates with experience at the assistant professor level. A candidate should show promise in both research and teaching.

The Department has 44 faculty and about 180 graduate students. It has strong research programs in artificial intelligence, databases, numerical and parallel computation, software systems, theoretical computer science and user interfaces. The computing environment includes lab workstations and a variety of parallel computers. The department is the recipient of five consecutive five-year National Science Foundation Institutional Infrastructure (previously CER) grants that support distributed computing infrastructure and collaborative research among its faculty. The department is the recipient of a new NSF grant and Challenger application Group that includes research in both databases and numerical and parallel computing.

A position is available now for an assistant professor level. Candidates must hold a doctorate in computer science or related discipline, or show evidence that the doctorate will be completed by the end of the first year of appointment. A position is available now for a tenure-track assistant professor starting Sept. 1. Requirements include a doctorate in computer science or closely related discipline, evidence of scholarly training and experience in more than one of the following areas: operating systems, parallel and distributed systems, networking and data communications. Candidates also must demonstrate the ability to participate in teaching undergraduate and graduate courses in computer science and supervision of research projects for master's degree candidates concentrating in computer science.

Send curriculum vitae and three letters of reference to Professor Kenneth Schaller, Chair, Department of Computer Science, University of Colorado, 1215 4th Street, Boulder, CO 80309-0430. One-page statements of research and teaching interests should be enclosed. Review of applications began on Jan. 1, but all applications postmarked before March 1 are eligible for consideration. Earlier applications will receive first consideration.

A position can begin as early as August. The University of Colorado Boulder has a strong institutional commitment to the principle of diversity in all areas. In that spirit, we especially interested in receiving applications from a broad spectrum of people, including women, members of ethnic minorities and disabled individuals.
Conference News

Kling from page 11

have provided value to people and organizations. The tough question is whether the overall productive or subjective value of these investments has been worth the overall acquisition and operation costs. In the last few years, economists have found it hard to provide unambiguously affirmative answers to this question. The tough question has been termed "The Productivity Paradox," based on a comment attributed to Nobel laureate Robert Solow who said, "computers are showing up everywhere except in the [productivity] statistics."

There are many potential slip-ups in translating high-performance computing into cost-effective veterinary systems to improve organizational performance. Some technologies require extensive technical support that provides hidden costs. Some technologies are superb for well-trained experts, but are difficult for less-experienced people or "casual users." A significant body of empirical work has shown that the social processes by which computing systems are introduced and organized make a substantial difference in their value to people, groups, and organizations. Most seriously, some computer applications do not fit a person on group/work practices. While the applications may make sense in a simplified world, they can be costly and difficult to realize in real-world computing research communities about 30,000 computer scientist every year, and many of them find employment on organizational information systems projects. Unfortunately, few of them have developed an adequate conceptual basis for understanding when information systems will actually improve organizational performance. The NRC report anchors the value of CS research on the belief that the most scientifically interesting new technologies certainly will yield significant economic and social value. The research is not on what will happen in the case of every new computing technology, but is on what will happen to specific communities, organizations, or society. The report sets the stage for a broader discussion of the value of the CS discipline and the role of the CS academic community in providing a significant body of trustworthy research to help answer these kinds of questions.

Organizational informatics

The report places a dual responsibility on computer scientists. One responsibility is to produce a significant body of applicable research. The other responsibility is to educate a significant fraction of the CS students to be more effective in conceiving and implementing systems that will enhance organizational performance. Most of the thousands of people who earn a bachelor's or master's degree in computer science and engineering have opportunities for systematic exposure to reliable knowledge about the value of computing in a social world.

A substantial fraction of these students go on to work for organizations attempting to produce or maintain systems that improve organizational performance. Yet many of these people do not have a good conceptual basis for their work. Consequently, many of them develop systems that underperform, and sometimes are even counterproductive, in organizational terms.

Organizational informatics includes studies of the usability of computerized information systems and communication systems in organizations. It also includes studies of their effective implementation, use, organizational value and consequences for people and an organization's clients. It is an intellectually rich and also practical research area.

In the last 20 years, a substantial body of scientific activity in organizational informatics has developed. The basic body of knowledge has been built by faculty in the information systems department in business schools and by scattered social scientists. But the body of research and teaching cannot be left to business school "sociologists." They rarely ask questions with attention to fine-grained technological variations, which are important for computer science, and they do not teach CS students.

The report is permeated with interesting claims about the social value of recent and emerging computer-based technologies. Whether these observations are of a kind that should rest on an empirically grounded scientific footing, computer scientists have developed themselves of access to such research. Consequently, many of the obvious claims about the value of various computing technologies that we cannot compute matters make are more akin to the lore of home remedies for curing illness. Some are valid; others are unfounded speculation. Moreover, the practical basis for conducing home medical remedies is new computer technologies not advanced without a having sound research programs.

What is needed

The report sets the stage for a broader appreciation of the value of organizational informatics within computer science. It bases the expansion of the discipline in a rich array of applications in which many of the effective technologies and concepts are more akin to illustrate biochemical systems for providing a cost-effective value for multimillion-dollar public investments. The CS community needs to include a computer science curriculum that produce a reliable body of knowledge about the usability of computerized systems and the conditions under which computer systems improve organizational performance. The CS curriculum must include opportunities for students to learn the most reliable knowledge about the organizational dimensions of systems development and use. While the study of organizational informatics builds upon both the traditional information foundations of computer science and the social sciences, it is not a sustainable topic within the social sciences alone.

Other discipline will not do our important work for us. Mathematics departments may be willing to teach graph theory, but CS students must learn the theoretical basis for algorithms. We must teach students that they do not have a good conceptual basis for their work.