CRA Information Technology Worker Study Released

By Peter Freeman and William Aspray

As announced in the November 1998 issue of Computing Research News, CRA has undertaken a study to improve the understanding of the supply of and demand for information technology (IT) workers in the United States, as well as the surrounding contextual issues. The report, "The Supply of Information Technology Workers in the United States," was written by Peter Freeman and William Aspray on behalf of the Interindustry Study Group on Information Technology Workers, with financial support from the National Science Foundation. An intensive eight-month effort led to a completed report in April. Individual copies of the report are available upon request from CRA. You can also download a copy from www.cra.org.

There are four main contributions in this study:

1. Evaluation of data. The report identifies and evaluates all the major sources of statistical information relevant to this subject. The study group found that federal data are by far the most important and reliable, but that they have some serious shortcomings related to untimely reporting, occupational descriptions that are out of date and based on ambiguous job titles, and incompatibilities between supply and demand data collected by different agencies.

2. There are other data sources. However, it is questionable whether data from geographically restricted studies can be generalized to the national level, and many of the national studies done by private organizations have methodological weaknesses.

2. Definition of IT Worker. This report outlines a way of distinguishing IT workers from a much larger class of workers whose jobs are enabled by information technology. One of the problems with the national debate is that IT workers have been treated as a single, undifferentiated mass. However, the phrase “information technology worker” encompasses many different occupations that require a wide array of skills and knowledge. It would be helpful in future discussions to segment the class of IT workers into classes of occupations that have similar levels of knowledge and skill.

3. Description of the Supply System. A detailed description of the supply system is presented, which includes not only majors in twenty different IT-related disciplines at the associate, bachelor’s, master’s, and doctoral levels, but also many people majoring in science, engineering, business, and even non-technical disciplines who often take some course work in IT subjects. The supply system also includes an increasingly important and rapidly growing continuing education element.

4. A naysayer’s shortcoming. The report evaluates the question of whether there is a shortage of IT workers in the United States. The study group determined that the data are inadequate to ascertain what mismatch there is, if any, between national supply and demand. Therefore the report makes use of a variety of other quantitative and qualitative kinds of evidence. These include: secondary indicators such as wage growth and labor certificates awarded, based on federal data; quantitative studies specific to geography and private studies on the national level as mentioned previously, anecdotal evidence about how employers have acted in their search to recruit or retain workers; or take alternative solutions such as refusing work or replacing workers by machines, and other kinds of qualitative evidence.

The preponderance of evidence suggests that there is a shortage of IT workers, or at least a tight labor market. None of this evidence has the certainty of a direct count of supply and demand, and without this kind of direct count it is impossible to distinguish an actual shortage from a mere tightness in the labor market.

Supply Continued on Page 6

IT2 Tops Federal R&D Priorities for 2000

By Lisa Thompson

Since the March 1999 issue of CRN, further analysis of the FY 2000 R&D budget request reveals additional agency details about the IT2 initiative, as well as its place in the overall budget.

The FY 2000 budget request for R&D, including facilities and equipment, totals $78.2 billion, about 1 percent below estimated R&D spending in FY 1999. Eliminating defense-sector development — which is projected to decrease by 6 percent — from the equation, aggregate spending on the remaining components would increase by 2 percent. Looking only at basic research, civilian basic research would increase by 4 percent, to more than $17 billion, while defense basic research is projected to decrease by 1 percent.

A summary of the report’s key findings:

- Information Technology for the Twenty First Century (IT2): The budget provides a total of $1.8 billion, a 28 percent increase, for IT2 and High Performance Computing and Communications. IT2 is a new initiative, funded at $366 million in FY 2000 budget requests.

According to the NSF budget documents, the IT2 activities "build upon NSF's previous substantial investments within the Computer and Information Science and Engineering activity, as well as investments under its theme of Knowledge and Distributed Intelligence and other information technology-related projects, which amount to almost $700 million in FY 1999."

FY 2000, to keep America at the cutting-edge of the Information Revolution by increasing support for fundamental, long-term research, advanced applications, and research on the economic and social implications of information technology.

- Strong Support for Basic Research: A 7 percent increase in the National Science Foundation research budget, a 5 percent increase in the Department of Energy science budget, and a 4 percent increase for NASA’s space science research.

- Research and Experimentation Tax Credit: The budget proposes extending this credit for one year through June 30, 2000, at a cost of $2.4 billion over five years.

- Most of the other emphasis is in the R&D budget is programs continuing from previous years, meaning that IT2 is the only major new initiative for FY 2000. Following are descriptions of the FY 2000 budget requests of the key agencies involved in information research, including their overall budget numbers and their planned computing activities, with emphasis on their roles in IT2.

National Science Foundation (NSF):

The National Science Foundation budget request for FY 2000 is the...
Expanding the Pipeline

The Coalition to Diversify Computing

By Andrew Bernat and Sandra Johnson Baylor, Co-Chairs

The continuing low percentage of minorities in computer science and engineering at all stages of the educational pipeline is an untenable situation. Prior to 1998, the NSF had joined with the AAU to develop the CREED (Computing Research Education and Employment Development) program, which has been highly successful in increasing the percentage of Hispanic students from entering high school to graduation. As of now, more than 50 percent of all minority students come from Hispanic populations. This is an increase of 10 percent in just two years. The Coalition to Diversify Computing (CDC) was organized to further this effort.

In this article, we present an overview of CDC activities. Initial funding for these activities has been provided by EOT-PAC1, which is a joint national educational program led by the National Computational Science Alliance (Alliance) and the National Partnership for Advanced Computational Infrastructure (NPA C1). Additional funding also has been received from NSF’s Research in Undergraduate Institutions (RUI) program.

Global Activities

- Develop a CDC website to serve as a repository of information on programs of value to minority researchers. It will also serve as a focal point for CDC activities, and allow the sharing of relevant ideas and resources.
- Lead member: Charles Isbell
- Host a "Workshop on Best Practices in Minority Student Recruiting and Retention" in computing research careers. Bring together individuals who have demonstrated successful programs and discuss what is known to work in a form that is accessible and valuable to the entire community.
- Lead member: A. N. B. Nerran
- Conduct a study of why minorities are not going into research careers and/or academia. Is it as simple as the fact that the money in industry is so much better? For example, according to the Taubee Survey there were forty-one new African-American Ph.D.s in CS in 1996, but only one went into academia. A well-conducted study of tenure decisions for those minorities who did go into academic C/S/CIE positions.
- Lead member: Bryant York

Activities for High School Students

Similar to the successful CRA-W "Women in Computer Science" brochure, the CDC's "Faces of Computer Science" brochure will feature the successes of from twelve to twenty minority scientists who have insightful, interesting personal histories -- histories that serve to inspire high school students as they are considering their future careers.

This brochure will be available in print and on the Web, and widely advertised and distributed.

Lead member: Jesse Emery

Activities for Undergraduate Students

Develop materials for encouraging minority students to continue with graduate education and assemble a team of four to five members to visit schools with large populations of African Americans, Hispanic, and African-American students.

Lead members: Forbes Lewis and Ramon Vasquez Espinoza

Activities for Undergraduate and Graduate Students

Provide regular support for minority students and faculty to participate in the annual ADMI and biennial CRA Conference at Snowbird. The participants will be selected based on their achievements, and will be encouraged to take full advantage of the conference's educational, networking, and research opportunities, as well as present the results of their work.

Lead members: Ramon Vasquez Espinoza

Activities for Graduate Students and Faculty

- Develop a database of minority graduate students and faculty to be used as a resource for disseminating information about CDC activities and NPA C1 and Alliance programs and activities. The database will serve as an excellent resource to increase the participation of minorities in the various NPA C1 and Alliance Programs.

- Develop a database of contacts who have an interest in helping minorities pursue careers in computing, in addition to information on minority students themselves. This will help build an information infrastructure to be used by CDC to initiate projects, inform people about CDC activities, and build a network of individuals with common goals. The database will be incorporated into the CDC website and will help those supportive of CDC's goals to stay informed.

Lead member: Valerie Taylor

Important websites:

- CDC: www.npaci.edu/Outreach/CDC
- EOT-PAC1: www.eot.org/Alliance
- NPA C1: www.npaci.edu
- For further information, contact S. Johnson Baylor, E-mail: sandra@iub. indiana. edu; IBM T. J. Watson Research Center Center and A. Nerran, E-mail: abernat@cs.utep.edu, U of Texas at El Paso

CRA has a new look!
Service Award Winners

CRA presents two awards, usually annually, to individuals for outstanding service to the computing research community. The first, the Distinguished Service Award, recognizes service in the areas of government affairs, professional societies, publications, or conferences, and leadership that has a major impact on computing research.

The second award honors the late A. Nico Habermann, who headed NSF’s Computer and Information Science and Engineering Directorate until his death. Dr. Habermann was deeply committed to increasing the participation of women and underrepresented minorities in computing research. This award is given to an individual who has played a leadership role in aiding members of underrepresented groups within the computing research community. It recognizes work in areas of government affairs, educational programs, professional societies, and public awareness.

CRA Distinguished Service Award

Bill Joy, Sun Microsystems, Inc., and Ken Kennedy, Rice University, have been selected as co-recipients of the 1999 CRA Distinguished Service Award for their vision of computing in the new millennium and for making up the government’s role in fulfilling that vision. Joy and Kennedy chaired the President’s Information Technology Advisory Committee (PITAC). They led PITAC through a series of public meetings in which they studied numerous issues, including high-end computing, scalable infrastructure, software, funding modes, research management, and socioeconomic and workforce issues.

The committee on Information Technology and the new century also recognized Bill Joy’s role in making a compelling case regarding the crucial importance of information technology research to the future of this country.

Bill Joy, Chief Scientist at Sun Microsystems, Inc., founded the company in 1982. At the University of California, Berkeley, 1975-1982, he was the principal designer of Berkeley UNIX, for which he received the ACM Hopper Award from the Association for Computing Machinery. In 1993, the USENIX Association awarded him its Lifetime Achievement Award for his service to the UNIX community. Bill Joy is also a Member of the National Academy of Engineering.

Bill Joy is the inventor/co-inventor of many of Sun’s technologies, including Sun’s Network File System, Sparc Microprocessor Architecture, Java, and Info technologies and business strategies (open systems, “The Network is the Computer,” Java licensing strategy, Community Source licensing for Info technologies).

Joy’s current research involves new uses of distributed computing enabled by using Java and Jini, new methods of human-computer interaction, new microprocessor and system architectures, and theories in computing of scientific advances in areas such as complex adaptive systems, quantum computing, and the cognitive sciences.

Ken Kennedy is the A. Nico and John DeEr Professor in Computational Engineering at Rice University. He founded the Department of Computer Science at Rice in 1984 and served as Chair until 1988.

Throughout his career, he has conducted research on the optimization of code compiled from high-level languages, especially Fortran. He has been an active researcher on virtual memory and parallelization. Kennedy was one of the proposers of the Center for Research on Parallel Computation, which he has directed since its inception in 1989.

Professor Kennedy has served as a member of a number of National Research Council, National Academies of Engineering, and a Fellow of the American Association for the Advancement of Science, the Institute of Electrical and Electronics Engineers, and the Association for Computing Machinery.

CRA A. Nico Habermann Award

Sheila Humphries has been selected to receive the 1999 A. Nico Habermann Award. Dr. Humphries currently is the Academic Coordinator for the National Center for Research on Parallel Computation (SUPERB) at Berkeley, an undergraduate research and mentoring program targeting underrepresented students which has been used as a model by other departments.

Sheila Humphries is currently initiating a local science fair and an Internet-based information system to help local high school students prepare for admission to UC Berkeley under new Proposition 209 guidelines.

Sheila’s other awards committee includes Marcia Ackerman (University of Illinois/Urbana-Champaign), Robert Broome (University of California, Los Angeles), Corky Cartwright (Rice University), and Valerie Taylor (Northwestern University).

Community Highlights

CRA convened its fourth annual Computing Leadership Summit in Washington, DC, on March 10. The presidents, executive directors, and other senior leadership of CRA and its five affiliate societies — AAAI, ACM, IEEE-CS, SIA and S-USENIX — gathered to discuss issues of common concern. The primary focus of this year’s event was the proposed Information Technology for the 21st Century Initiative (IT-21) which would increase support for computing and communications research by $366 million (see article, page 1).

Three of the principals involved in coordinating the multiagency initiative spoke with the group about their agencies’ plans: David Tenenhouse, Director of the Information Technology Office at DARPA; Rama Banerji, a Substantive Director for the Computer and Information Sciences and Engineering Directorate at the National Science Foundation; and Martha Krebs, Director of the Office of Science at the Department of Energy. The computing community’s O2 plans to emphasize research on automated systems, embedded systems, and deeply networked systems.

Summit Continued on Page 9
Federal Funding Agencies

DOD/Army Research Office

Mathematics & Geosciences Directorate

Director
Clifford E. Rohades, Jr.
202-767-5025
cifford.rhoades@afosr.dod.gov

AI Program Manager
Abraham Waksman
202-767-7953
abraham.waksman@afosr.dod.gov

Software and Systems
Program Manager
James Hendler
202-767-5025
james.hendler@afosr.dod.gov

DOD/Air Force Office of Scientific Research

110 Duncan Ave., Suite B115
Bolling Air Force Base
Washington, DC 20332-0001
http://web.fie.com/fedix/afosr.html

Mathematics & Geosciences Division

Associate Director
Julian Wu
919-549-4254
jiwu@ae-ehm1.army.mil

Applied Analysis
John Lavery
919-549-4253
lavery@ae-ehm1.army.mil

Computational Mathematics
Stephen Davis
919-549-4284
davis@ae-ehm1.army.mil

Probability & Statistics
Robert Launer
919-549-4309
launer@ae-ehm1.army.mil

Systems & Control
Linda Bushnell
919-549-4319
bushnell@ae-ehm1.army.mil

Software & Knowledge-Based Systems
David W. Hislop
919-549-4252
hislop@ae-ehm1.army.mil

Statistics, Probability, and Stochastic Analysis
Robert Launer
919-549-4309
launer@ae-ehm1.army.mil

DOD/Defense Advanced Research Projects Agency

3701 N. Fairfax Drive
Arlington, VA 22203-1714
http://www.darpa.mil

Technology Offices

Director, Information Systems Office
William Mularie
703-696-7438
wmularie@darpa.mil

Director, Information Technology Office
David Tennenhouse
703-696-9229
dtennenhouse@darpa.mil

DOD/Office of Naval Research

Ballston Center Tower, 800 N. Quincy St.
ONR Code 311
Arlington, VA 22217-5660
http://www.onr.navy.mil

Mathematical, Computer, & Information Sciences Division

Director
Andre van Tilborg
703-696-4312
avantil@itld.nrl.navy.mil

Applied Analysis
Wen Masters
703-696-4314
masters@itld.nrl.navy.mil

DOD/Office of Naval Research, cont.

Artificial Intelligence
Michael Shneier
703-696-4303
shneierm@onrnhq.onrn.navy.mil

Command & Control
Paul Quinn
703-696-5753
quinnp@onrnhq.onrn.navy.mil

Discrete Mathematics
Donald Wagner
703-696-5131
wagner@onrn.navy.mil

Numerical Analysis
Richard Lau
703-696-4316
lau@onrnhq.onrn.navy.mil

Operations Research
Donald Wagner
703-696-4313
wagner@onrnhq.onrn.navy.mil

Probabilities & Statistics
Wendy Poston
703-696-4320
postonw@onrn.navy.mil

Robotics
Teresa McMillen
703-696-3163
mcmulti@onrnhq.onrn.navy.mil

Software
Ralph Wachter
703-696-4304
wachter@itld.nrl.navy.mil

Scientific Visualization
Lawrence Rosenblum
202-767-5333
rosenblum@itl.nrl.navy.mil

Department of Energy

Office of Science
SC-30
19901 Germantown Road
Germantown, MD 20874-1290
http://www.doe.gov

Director
Martha A. Krebs
202-586-5430
martha.krebs@science.doe.gov

Office of Advanced Scientific Computing Research

Associate Director
Patricia Dehmer (Acting)
301-903-7486
patricia.dehmer@er.doe.gov

Acting Director, Mathematical, Information & Computational Sciences Division
Daniel Hitchcock
301-903-6767
daniel.hitchcock@ornl.gov

National Institute of Standards & Technology

Building 225, Room A231
Gaithersburg, MD 20899
http://www.nist.gov

Information Technology Laboratory

Director
Shukri Wadid
301-975-2900
swadid@nist.gov

Office of Science & Technology Policy

17th Street & Pennsylvania Avenue NW, Room 424
Washington, DC 20502

Director, Assistant to the President for Science & Technology
Neal Lane
202-456-7116

Associate Director for Science
Arthur Bienenstock
202-456-6130

Associate Director for Technology
Duncan Moore
202-456-6046
Federal Funding Agencies

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<td>Deputy Division Director</td>
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| **Advanced Networking Infrastructure & Research (ANIR)** |
| Division Director        | Aubrey Bush (Acting) |
|                         | 703-306-1950         |
| Deputy Division Director | Aubrey Bush          |
|                         | 703-306-1950         |
| Advanced Networking Research | William Decker |
|                         | 703-306-1950         |
| International Networking | Steven Goldstein     |
|                         | 703-306-1950         |
| Networking Research      | Karen Solins         |
|                         | 703-306-1950         |

| **Computer & Communications Research (CCR)** |
| Division Director        | Michael Evangelist   |
|                         | 703-306-1940         |
| Deputy Division Director | S. Kamal Abdali      |
|                         | 703-306-1912         |
| Software Engineering & Languages | Frank Anger |
|                         | 703-306-1911         |
| Computer Systems Architecture | Laxmi Bhuyan |
|                         | 703-306-1936         |
| Signal Processing Systems | John Cozzens         |
|                         | 703-306-1921         |
| Design Automation        | Robert Grafton       |
|                         | 703-306-1936         |
| Operating Systems & Compilers | Mukesh Singhal |
|                         | 703-306-1918         |
| Theory of Computing      | Zechezkal Zalcstein  |
|                         | 703-306-1914         |
| Communications           | Rodger Ziemer        |
|                         | 703-306-1912         |

| **Experimental and Integrative Activities (EIA) Division** |
| Acting Division Director | Micheal Foster       |
|                         | 703-306-1981         |
| Deputy Division Director | Caroline Wardle      |
|                         | 703-306-1980         |

**Experimental and Integrative Activities (EIA) Division, cont.**

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<td>Training</td>
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**Information & Intelligent Systems (IIS) Division**

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Information Technology

By Larry Snyder

In response to a request from the National Science Foundation, the National Research Council's Committee on Information Technology Literacy undertook a study addressing "What Everyone Should Know About Information Technology." The committee's final report, Being Fluent with Information Technology, asserts that the knowledge and understanding of information technology (IT) needed by citizens in the Information Age must go well beyond the content of traditional computer literacy instruction.

Fluency, A Higher Standard

Standard computer literacy course content tends to be largely "skills based," "there are exceptions. The focus in such courses is instruction in the use of a basic set of contemporary computer applications, such as word processing, web browsing, and so forth. Though such knowledge is valuable - enabling students to "use IT immediately" - the skills learned do have the "staying power" necessary to accommodate the rapid change characteristic of the field.

For example, that web browsing was not a skill included in computer literacy courses as recently as five years ago, though it is a basic requirement today for effective computer use.

In the presence of rapid change, the best educational strategy is to prepare students to be "life-long learners. For that goal, students will require a more fundamental understanding of information technology in addition to the ability to use contemporary IT tools.

The report identifies three kinds of knowledge - skills, concepts, and capabilities - as appropriate for preparing students to be "life-long learners.

- Contemporary skill refers to proficiency with standard IT applications. Importing knowledge of skills approximates traditional literacy instruction. The appropriate "working set" will change over time.
- Foundational concepts are basic ideas underlying the technology, such as digital representation of information, which might be found in a typical computer science curriculum. Concepts enable people to understand the "whys" and "hows" of current IT. They are also the basis for future self-education about IT.
- Intellectual capabilities are higher-level thinking abilities, such as logical reasoning or managing complexity, that are essential to effective use of IT. Capabilities are frequently learned through "life experience" and are applicable to other aspects of life. But the capabilities are so essential to the effective use of IT that they must be explicitly included in the content represented for IT proficiency.

These three coequal forms of knowledge serve different roles in IT preparation. Skills support job-readiness and provide the basis for understanding the other content. Concepts explain phenomena, and capabilities support thoughtful and confident application of IT in personally relevant settings.

This tripartite approach to literacy instruction is beneficial from a suggestion by Yasmin Kafai, a associate professor of Education.

Our study of multimedia technologies revealed in the report that need to be considered in order to make information technology instruction more effective.

- There are also a number of contextual issues revealed in the report that need to be considered in order to gain a full understanding of the supply and demand for IT workers.
- Political context. The specific issues of this report by the National Science Foundation Information Technology Literacy (ITAA) and the Department of Commerce, as well as the criticisms of these reports by the U.S. General Accounting Office (GAO).
- We agree with GAO that the low criticism of these reports by the U.S. General Accounting Office (GAO) and the Department of Commerce.
- The study group evaluated the reports by the National Science Foundation Information Technology Literacy (ITAA) and the Department of Commerce, as well as the criticisms of these reports by the U.S. General Accounting Office (GAO).
- We agree with GAO that the low criticism of these reports by the U.S. General Accounting Office (GAO) and the Department of Commerce.
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- We agree with GAO that the low criticism of these reports by the U.S. General Accounting Office (GAO) and the Department of Commerce.

In the presence of rapid change, the best educational strategy is to prepare students to be "life-long learners. For that goal, students will require a more fundamental understanding of information technology in addition to the ability to use contemporary IT tools.

The report identifies three kinds of knowledge - skills, concepts, and capabilities - as appropriate for preparing students to be "life-long learners:

- Contemporary skill refers to proficiency with standard IT applications. Importing knowledge of skills approximates traditional literacy instruction. The appropriate "working set" will change over time.
- Foundational concepts are basic ideas underlying the technology, such as digital representation of information, which might be found in a typical computer science curriculum. Concepts enable people to understand the "whys" and "hows" of current IT. They are also the basis for future self-education about IT.
- Intellectual capabilities are higher-level thinking abilities, such as logical reasoning or managing complexity, that are essential to effective use of IT. Capabilities are frequently learned through "life experience" and are applicable to other aspects of life. But the capabilities are so essential to the effective use of IT that they must be explicitly included in the content represented for IT proficiency.

These three coequal forms of knowledge serve different roles in IT preparation. Skills support job-readiness and provide the basis for understanding the other content. Concepts explain phenomena, and capabilities support thoughtful and confident application of IT in personally relevant settings.

This tripartite approach to literacy instruction is beneficial from a suggestion by Yasmin Kafai, a associate professor of Education.
Community News

NAE Elects New Members

The National Academy of Engineering (NAE) has again elected members of the computer science and engineering community to the academy. This is an honor reserved for those who make “important contributions to engineering theory and practice, including significant contributions to the literature of engineering theory and practice, and those who have demonstrated ‘unusual accomplishment in the pioneering of new and developing fields of technology.’”

This year there was a total of eighty engineers and eight foreign associates elected to membership. The announcement was made by William Wulf, president of NAE. There is currently a total U.S. membership of 1,984 and the number of foreign associates is now 154.

This year’s newest members from the CS & CE communities:

- Alfredo V. Aho, associate research vice president, communications science division, Bell Laboratories, Lucent Technologies, Holmdel, N.J.
- Paul Y. Chen, professor of Electrical and Computer Engineering, University of California, San Diego.
- Robert W. Bower, professor, department of electrical and computer engineering, University of California, Davis. For inventing the self-aligned, gate ion-implanted MOSFET and for establishing ion implantation to fabricate semiconductor integrated circuits.
- Wesley A. Clark, principal, Clark, Rockoff, and Associates, Brooklyn, N.Y. For the design of early computers.
- James W. Demmel, professor, computer science division, University of California, Berkeley. For contributions to numerical linear algebra and scientific computing.
- Louis V. Gassert Jr., chairman and chief executive officer, IBM Corp., Armonk, N.Y. For technical leadership in enhancing the competitiveness of U.S. industry.
- Bruce H. Ekel, professor, department of electrical and computer engineering, University of Illinois, Urbana-Champaign. For contributions to stochastic systems, communication networks, and control.
- Patrick K. Hanrahan, professor of computer science and electrical engineering, Stanford University, Stanford, Calif. For contributions to computer graphics and to the practice of rendering complex scenes.
- Richard J. Lipton, professor, department of computer science, Princeton University, Princeton, N.J. For application of computer science theory to practice.
- Nelly C. Lo, founder and president, Etron Technology Inc., Hsinchu, Taiwan. For contributions to high-speed dynamic memory chip design and cell array technology, and sustained technical leadership in the VLSI/memory industry.
- Donald W. Peacock, consultant, Houston. For contributions to the development and usage of transient three-dimensional multilevel simulators for predicting performance of petroleum reservoirs.
- Patricia G. Selinger, IBM fellow and director, database integration, IBM Almaden Corp., San Jose, Calif. For leadership and contributions to relational database technology.
- Amir Pnueli, professor of computer science, Weizmann Institute of Science, Rehovot, Israel. For the invention of temporal logic and other tools for designing and verifying software and systems.

Tax Credits for IT Training

Bills to amend the Internal Revenue Code of 1986 to allow employers a credit against income tax for information technology training expenses paid or incurred by the employer, and for other purposes were introduced simultaneously in the U.S. Senate and in the House of Representatives in late February. H.R. 838 and S. 456 were sponsored primarily by Mr. Jerry Moran, Virginia, and Mr. Kent Conrad, North Dakota, respectfully.

“[n]o credit for information technology training program expenses paid or incurred by the taxpayer during the taxable year shall exceed 20 percent of the lesser of $6,000 or twenty percent of information technology training program expenses paid or incurred by the taxpayer during the taxable year.

‘[t]he percentage under [the above subsection] shall be increased by five percentage points for information technology training program expenses paid or incurred by the taxpayer with respect to a program operated...”

Examples of programs that would receive the additional five-percent credit include:
- employment zones or enterprise communities;
- school districts in which at least twenty percent of the students attending school in such districts are eligible for free or reduced-cost lunches under the school lunch program;
- areas designated as minority areas;
- rural enterprise communities;
- Rural Economic Area Partnership Zones.

The amount of information technology training program expenses with respect to an individual that may be taken into account for the taxable year shall not exceed $6,000.

If the legislation is to pass, the amendments made will only apply to tax credits on amounts paid or incurred after the date of enactment of the Act in the taxable year ending after such date.

The House bill has been referred to the Committee on Ways and Means and the Senate bill has been referred to the Committee on Finance.

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three categories having the highest priority. There can be reasonable
differences of opinion as to whether
priority. There can be reasonable
in the report. The report provides a fuller explanation.

Skills:
1. Set up a personal computer
2. Understand basic operating system
3. Use word processing
4. Use graphics, art work, or presentation tools
5. Connect a computer to an ISP
6. Locate information on the WWW
7. Communicate with others electronically
8. Use spreadsheet
9. Organize and query a database
10. Use nonintrusive information

Concepts:
1. Organization of a computer
2. Organization of information systems
3. Networks
4. Digital representation of information
5. Structuring information and searching
6. Modeling phenomena with computers
7. Algorithmic thinking and programming
8. Universality
9. Limitations to computation
10. Social implications of information

Capabilities:
1. Engage in sustained reasoning
2. Manage complexity
3. Test a solution
4. Locate bugs in a faulty use of IT
5. Organize and navigate information structures
6. Collaborate with others using technology
7. Communicate IT concepts to others
8. Expect the unexpected
9. Anticipate technological change
10. Think technologically and reason by analogy

Notice that the entries are not all of "equal size" in terms of the effort to acquire the knowledge.
A key aspect of FITness is that it is not an end state, but rather a continual process of learning and expanding one's knowledge of information technology. A conditionally, the goal of FITness instruction is to provide the foundation that enables students to continue to learn and apply IT more effectively throughout life.

Project-based Learning
Teaching skills is well understood. Teaching the concepts is standard in computer science curricula. But FITness includes the higher-level thinking abilities of intellectual capabilities, and it requires that the three forms of knowledge be taught in a coherent, integrated way. This presents a serious pedagogical challenge. Therefore, we recommend that FITness instruction be project-based, where a project is defined to be a multimodal, hands-on exercise in applying IT to solve a substantial problem. The skills use the skills, provide the context for learning the capabilities, and motivate the concepts. By being a sustained effort, a project provides ample opportunities for applying sustained logical reasoning, debugging and troubleshooting, dealing with unintended consequences, and other complex capabilities. To the extent possible, the report also recommends that FITness be acquired in a discipline-specific setting. This allows projects to be discipline specific. And, the skills list can be revised to better serve a given specialty. For example, C&A tools might be added to the skill set for architects.

A set of FITness-grade project mentioned in the report is an HIV tracking system for a hospital or clinic. The task requires a GUI for entering and viewing data, a database to retain the records, a mechanism (spreadsheet) for presenting summary results, a facility to report to clients and physicians, a focus on security and privacy issues, and a presentation of the system to the users. It is evident that FITness instruction is desirable, if not essential for all current college students. The elements of FITness are valuable throughout college and, as well as being critical to most jobs that college students are seeking. In a steady state, it is likely that K-12 education will include FITness instruction, allowing it to become an entrance requirement for college. In the meantime, college courses must be designed to provide this knowledge to the present college population.

Committee Process
The Committee on Information Technology Literacy was convened by the National Science Foundation (NSF) and signed an agreement to work with the National Research Council (NRC) to establish a national committee to study IT literacy. The Committee on Information Technology Literacy (ITL) was convened by the NRC's Computer Science and Telecommunications Board (CSTB). The committee members were: Lawrence Snyder, University of Washington, Chair.

May 1999
Computing Research News
**FY 2000 IT Agency Budget Proposals**

<table>
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<th>Agency</th>
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<th>Social Implications and Workforce Programs</th>
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**Budget from Page 1**

$3.95 billion, an increase of 5.8 percent.

The total budget request for the Computer and Information Sciences and Engineering (CISE) Directorate is $422.5 million, an increase over estimated FY 1999 spending. Most of the increase, $110 million, would be for the IT2 initiative; an additional $13.8 million would be distributed among the existing divisions. The $110 million increment would be divided as follows: $80 million would support increased individual and team research projects and $30 million would be used to establish new IT research centers.

Beyond the initiative, CISE would also increase funding, by nearly $7 million, for the Partnerships for Advanced Computational Infrastructure (PA CI) program to focus on broadening and accelerating the capability of the research community to utilize PA CI’s advanced technology to work on cutting-edge research problems in all NSF disciplines. CISE would also provide support for research and education efforts associated with the other Foundation-wide efforts, Biocomplexity in the Environment and Educating for the Future. To the former, which is a set of increasingly coordinated activities in environmental science, engineering, and education, CISE would provide $5 million. This would be a 50 percent increase above FY 1999 base funding of $4 million for activities formerly organized under Life and Earth Information Science. CISE also supports a range of programs that encourage innovative approaches to meeting the challenge of educating students for the 21st century. A total of $2.82 million, an increase of $1.75 million over the FY 1999 level, would support such programs, including Research Experiences for Undergraduates (REU), Integrative Graduate Education and Research Training (IGERT), and Faculty Early Career Development Program (CAREER). Of note, $500,000 would be used to initiate a prototype program in Teaching Experience for CISE Students, an experiment in having undergraduate and graduate students help bring the challenges, excitement, and rewards of IT into the K-12 learning environment.

The NSF’s Education and Human Resources budget request includes $6.8 million to be invested in unspecified information technologies activities. The funding could be distributed among education programs, research education programs, and/or the EPSCoR program.

The EHR budget also includes a line item of $33 million to be spent on strengthening the IT workforce with funds coming from the 1-H B Nonimmigrant Petitioner Fees, it is directed to do by the FY 1999 omnibus appropriations bill. At this writing, NSF is still in the process of defining the details and mechanism(s) to be used for these activities. The program will start in FY 1999 (this year) with $27 million in funds from the same source.

**Department of Defense (DoD):**

The FY 2000 budget for the Department of Defense includes $1,113 million for basic research, an increase of 0.5 percent above the FY 1999 level, and $2,959 million for applied research, a decrease of 6.1 percent. DoD would invest $100 million in the IT2 initiative including, $70 million for focused research programs at the Defense Advanced Research Projects Agency (DARPA); $20 million for a new Advanced Research and Development Activity (ARDA), a joint effort of the Defense Department and the intelligence community to support long-term research on problems and enabling technologies relevant to intelligence and information security; and $10 million for fundamental IT research through the DoD-wide University Research Initiative, a competitive program managed through the office of the Director of Defense Research and Engineering.

**Department of Energy (DoE):**

The Department of Energy is requesting an $18.1 billion budget for FY 2000, of which $7.5 billion, or 41 percent, would be used to support increased individual and team research projects and $30 million would be used to establish new IT research centers.

**National Science Foundation (NSF) and DoE: Strategic Computing Initiative**

The Administration budget documents note also that DoD would provide $500 million, a 6.4 percent increase, in R & D funding for advanced critical infrastructure protection technologies, with emphasis combating cyberterrorism.

**Department of Energy (DoE):**

The Department of Energy is requesting an $18.1 billion budget for FY 2000, of which $7.5 billion, or 41 percent, would be used to support increased individual and team research projects and $30 million would be used to establish new IT research centers.
Abilene Christian University
Department of Computer Science

Department of Computer Science invites applications for one or more of the Assistant Professor or Instructor level to begin Sept. 1, 1999. Candidates must have a Ph.D. in Computer Science or a closely related field; a doctorate is preferred. In addition, the successful candidate will have a commitment to teaching in an undergraduate and graduate program and working with an active and engaged research program. A Ph.D. is required in all areas of computer science and computer engineering. Applications are accepted at any point in the calendar year.

Review of applications will begin as soon as they are complete and will continue until the positions are filled. Applicants should submit a curriculum vitae, a statement of teaching philosophy, and transcripts zusammenhängendes Adressbuch. The initial appointment term for tenure-track positions in Computer Science is five years. Candidates should have a commitment to research and teaching in an undergraduate and graduate program. The position must have teaching and scholarship and achievements commensurate with appointments at the rank of an assistant professor. Faculty members are encouraged to apply.

Knox College

Chair

Knox College

To apply, send a curriculum vitae and the names of three references to: Chair, Computer Science Department, Knox College, Galesburg, IL 61401. Review of applications will begin immediately and continue until the positions are filled.

Knox College is an Equal Opportunity/Affirmative Action Employer and encourages applications from women, minorities, disabled persons, and nontraditional students.

California Institute of Technology

Computer Science Department

Chair

California Institute of Technology

Computers, and Distributed Systems.

On the basis of the availability of funds, the position will remain open until filled. Women and minorities are encouraged to apply.

Middle Tennessee State University

Computer Science Department

Chair

Middle Tennessee State University

To apply, send a curriculum vitae, and the names and addresses of three references to: Chair, Computer Science Department, Middle Tennessee State University, Murfreesboro, TN 37132. Women and minorities are encouraged to apply.

New Mexico Institute of Mining and Technology

Department of Computer Science

Chair

New Mexico Institute of Mining and Technology

Computer Science seeks

Applications are being accepted at any point in the calendar year.

Professional Opportunities Ads Available on Web

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May 1999
program. Both the campus and the area offer exciting professional and cultural opportunities. Send the required information to:

ICS A J F. Faculty Position
Attention: Aline Parent
Department of Information and Computer Science
Irving, CA 90479-3402

The University of California is an Equal Opportunity Employer, committed to excellence through diversity.

University of Delaware
Department of Computer & Information Sciences

Existing faculty positions are available to begin September 1, 1999 for the 1999/2000 academic year. Candidates with research interests in all areas of computer science will be considered.

For information about our department and its activities, see our website, http://www.cis.udel.edu. For status of the faculty recruitment see http://www.cis.udel.edu/~wander/facultygenerating.html.

To apply, please send curriculum vitae to:

Dr. B. David Saunders
Chair of the Faculty Search Committee
Department of Computer and Information Sciences
University of Delaware
Newark, DE 19716

In addition candidates should have three confidential letters of reference sent directly to the above address by e-mail to bds@cis.udel.edu.

Applications are due by May 15, 1999, however applications will be accepted until the position is filled.

Qualified minority group members and women are particularly encouraged to apply. The University of Delaware is an Equal Opportunity employer.

University of Houston-Downtown
Department of Computer & Mathematical Sciences

Tenure-track position at the rank of Assistant Professor

A Ph.D. in Computer Science, commitment to excellence in teaching and scholarship required. The deadline for applications is May 1, 1999, and will be reopened at thirty-day intervals. Starting date August 1999. Send statement of interest, curriculum vitae, transcripts, and three letters of recommendation to:

Oongad Sirisaengtaksin
CMS Department
University of Houston-Downtown
One Main Street
Houston, TX 77002
Email: ongad@uhd.edu

University of Illinois at Chicago
Electrical Engineering & Computer Science Department

The Electrical Engineering & Computer Science Department invites applications for tenure-track faculty at all levels, as well as Instructors. A Ph.D. degree in Electrical Engineering, Computer Engineering, or Computer Science is required for the ranks of Professor, Associate Professor, and Assistant Professor for the rank of Assistant Professor.

Applications are due by May 1, 1999, however applications will be accepted until the position is filled.

Qualified minority group members and women are particularly encouraged to apply. The University of Illinois at Chicago is an Equal Opportunity employer.

University of Pennsylvania
Department of Computer and Information Science

Department of Computer and Information Science

Applications are invited for the Chair of the Department of Computer and Information Science at the University of Pennsylvania. The Department has outstanding programs and superb research facilities in algorithms and computational biology, computer graphics and animation, computer vision and robotics, databases, logic and computation, artificial intelligence, networks and distributed systems, programming languages, and real-time systems. In addition the Department is central to several interdisciplinary initiatives across the University through the Institute for Research in Cognitive Science (IRCS), jointy sponsored with the School of Arts and Sciences and the Bioinformatics Center, operated by IRCS and the Institute for Medicine and Engineering (IME). The University is seeking candidates with distinguished research backgrounds interested in leading a significant increase in the size and scope of the Department over the next several years.

The Committee will now begin reviewing applications; the search will remain open until the position is filled. Recommendations and applications, accompanied by a curriculum vitae and appropriate supporting materials, should be sent to Professor David Pope, Chair of the Search Committee, c/o Department of Materials Science and Engineering, School of Engineering and Applied Sciences, University of Pennsylvania, 325 Walnut Street, Philadelphia, PA 19104-6722.

The University of Pennsylvania is an Equal Opportunity/Affirmative Action employer.

University at Stony Brook
Department of Computer Science

http://www.cs.stonybrook.edu

Lecturer in Computer Science

Applications are invited for the position of Lecturer beginning August 1999 or January 2000. Lecturer candidates must hold a graduate degree in Computer Science or closely related field, should have a strong commitment to excellence in teaching, and must have experience teaching computer science at the university level. The starting date is July 1, 1999. Applicants must send a curriculum vitae and three letters of reference to:

Prof. Steven Skiena
Instructor Search Committee
Department of Computer Science
State University of New York
Stony Brook, NY 11794-4400

or E-mail: skiena@cs.sunysb.edu.

We will start the review of applications on May 1, 1999, and will continue to consider applications until the position is filled.

Jobs Continued on Page 12
University of Tennessee

Computer Science Department

Research Positions available at The University of Tennessee in High-Performance Computing and Networking.

The University of Tennessee in Knoxville is seeking qualified people who want to participate in a software environment for high-performance network computing that aggregates distributed computational resources for remote scientific problem solving. We invite applications from capable students, masters level programmers, and persons with experience who want to work and learn in this area.

The successful candidate will also possess excellent leadership, communication, administrative abilities and have broad knowledge of the computer science fields. U.T.A., part of the University of Texas System, is located in the heart of the rapidly growing Dallas-Fort Worth area, the nation's third largest high-technology region, with a flourishing high-technology base and excellent opportunities for industry/university collaboration.

The Department (URL: www.cs.utk.edu) currently has twenty faculty members, six PhD students, 19 undergraduate and 352 graduate students and last year received $2.7 million in external funds. Research areas in the department include telecommunications, encompassing networks and multimedia, database systems, scientific applications, artificial intelligence, software engineering, and systems including architecture and high-performance computing.

To apply please submit: a cover letter and curriculum vitae along with the names, addresses, and telephone numbers of at least five references. We seek to fill the position by August 1999 and applications are due by May 15, 1999.

Professor M. I. Wozy, Chair
ECSE Department Chair Search Committee
Rensselaer Polytechnic Institute
Troy, NY 12180-3590
Phone: 518-276-2269, FAX: 518-276-2487
E-mail: wozy@rpi.edu

If not filled by the Fall 1999 semester, the search will continue until a suitable candidate is found. Rensselaer Polytechnic Institute is an Equal Opportunity/Affirmative Action employer.

The University of Texas at Arlington

Computer Science and Engineering Department

The University of Texas at Arlington (U.T.A.) invites applications and nominations for the position of Chairperson, Department of Computer Science and Engineering in the College of Engineering. Candidates for this position will be located in the University's College of Engineering, Computer Science, Computer Engineering, or a closely related field, as well as a distinguished record in teaching, research and service.

We are searching for a leader who is an internationally recognized researcher with a record of excellence in the field of high-performance, parallel, and distributed computing. The position requires experience in the development of parallel and distributed computing tools, especially in C, C++, Java, and Fortran. Familiarity with scientific computing, parallel architectures, networking, and emerging network technologies is also desired. Responsibilities as a participant in the research team include designing, prototyping, experimentally testing, maintaining, and documenting computer systems related to this project.

This project is supported in part by the NSF, the DARPA CCR Program, and the DOE/DE activities.

More information can be found at: http://www.cs.utdallas.edu.

Professor Michael J. Wozny, Chair
Professor of Computer Science
The University of Texas at Arlington
301 Minnie G. McEachern Hall
325 Woolf Street
Arlington, Texas 76019
Phone: 817-272-2398, FAX: 817-272-2636
E-mail: mwozny@utdallas.edu

Applications will be accepted until the position is filled. Send applications addressed to: Ronald L. Elsenbaumer, Chair, CSE Chair Search Committee, Box 19031, 325 Woolf Hall, The University of Texas at Arlington, Arlington, Texas 76019.

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