Proposal to Establish a Computer Science Department at CWRU

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1. Purpose

This document presents the case for establishing a Computer Science Department at CWRU, in order to foster the development of internationally recognized programs in Computer Science research and education. Computer Science is a major academic discipline with a unique vision and with important responsibilities to students and to society. Computers are changing our world and the way people think. The development of ever faster and cheaper microelectronic devices has made computing widely available, but it is software that has brought about the IT revolution. The growth of the global information society dictates that Computer Science, as an independent scientific and engineering discipline, will continue to flourish. These facts have led most other universities to establish a Computer Science Department or School (see Appendix 1). Creating a Computer Science Department at CWRU will have several important benefits. It will give our Computer Science program much-needed visibility and help position the University to take advantage of the substantial funding that is now available for Computer Science research. It will signify a commitment by CWRU to excellence in Computer Science, which will be extremely helpful in recruiting high-quality faculty and graduate students and in obtaining research funding. It will promote the cohesion and unity of purpose that are necessary for the development of successful research and academic programs. Finally, it will produce an outpouring of productive energy and creativity from the Computer Science faculty.

2. Mission

The Computer Science Department's primary mission will be excellence in research and education on the development of software systems and applications and on foundations of Computer Science. This mission is determined by the economic importance of computer software, the demand for software engineers,[1] and the large amount of funding available for Computer Science research. The Computer Science Department will achieve excellence in research by focusing primarily on three important areas: Bioinformatics (including Computational Genomics and Computational Neuroscience), Computer Networks/Distributed Systems, and Information Systems. (See Section 3.) We will provide our students with a rigorous, up-to-date education in all fundamental areas of Computer Science.

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[1] In its *Occupational Outlook Handbook* [1], the U.S. Department of Labor states that software engineers held about 697,000 jobs in 2000 (whereas computer hardware engineers held only about 60,000) and that software engineering is projected to be the fastest growing occupation from 2000 to 2010. In the same report, it explains that the typical degree for software engineers is one in Computer Science or Computer Information Systems.

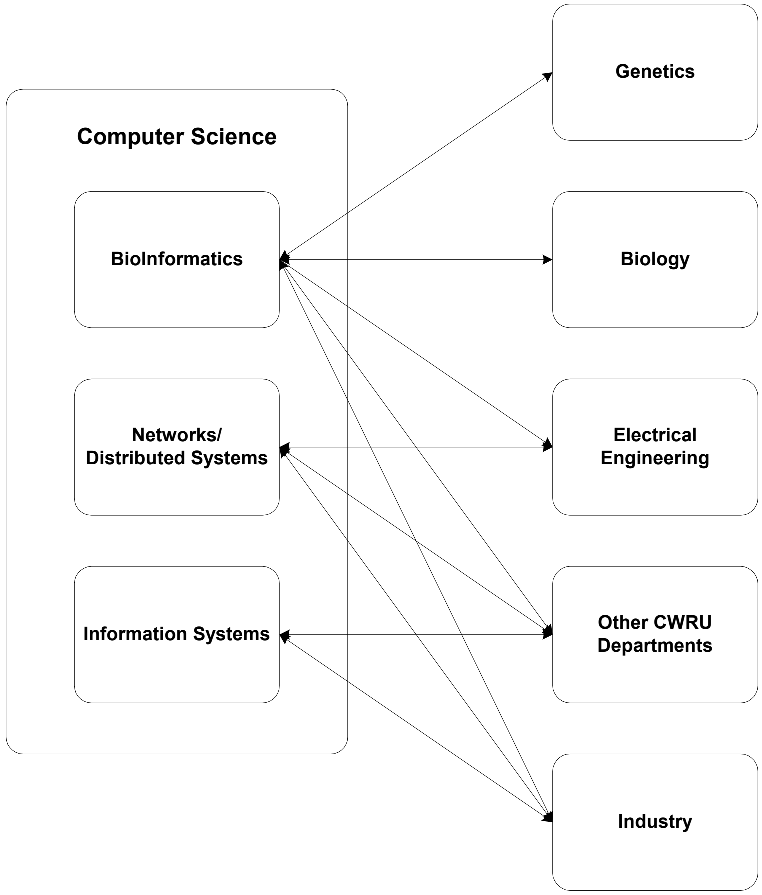

Figure 1: Computer Science Department Relationships

3. Vision and Goals

We envision a Computer Science Department at CWRU with the following characteristics: strong, nationally-recognized research programs in selected focus areas; highly-ranked graduate and undergraduate academic programs in Computer Science and Bioinformatics[2]; robust levels of research funding; synergistic research collaborations within the Computer Science Department and with other departments at CWRU; and important service contributions to the University. In the remainder of this section, we elaborate on these goals and describe the steps that must be taken to achieve them.

Research Focus Areas: The Computer Science faculty envision three main focus areas in the Computer Science Department. These areas, which are important nationally, are *Bioinformatics* (including *Computational Genomics* and *Computational Neuroscience*), *Computer Networks/Distributed Systems*, and *Information Systems*. In each area, the Department will build on existing strengths. Bioinformatics is a "natural" for CWRU, given the University's reputation for biomedical research, its hospital affiliations, and

[2] To be developed in collaboration with the CWRU Center for Computational Genomics.

the importance of biotechnology in Cleveland. It is likely to be the most distinctive feature of the Computer Science Department. Our research focus in Bioinformatics is also very much in line with the CWRU Bioinformatics initiative, and both CWRU and Case School of Engineering goals for achieving research excellence in Bioinformatics. Several Computer Science faculty are active members of the CWRU Center for Computational Genomics. In collaboration with faculty from the Center, they have made a strong start by generating new external funding in addition to substantial startup funding for the Center. A faculty member in Computational Neuroscience has already established a nationally-recognized research program in biologically-inspired robotics, in collaboration with colleagues in Biology and Mechanical Engineering. Computer Networks/Distributed Systems is the most dynamic area of Computer Science research and is likely to remain so for some time. It is the area of greatest interest for both graduate and undergraduate students. There are currently two excellent junior faculty around which to build strength in the area, as well as senior faculty with relevant expertise. Information Systems has long been a central area of applied Computer Science, and its scope has increased with the growth of the Internet and World Wide Web. It includes the subareas of Database Systems, Information Storage and Retrieval, and Human-Computer Interaction. There is also a close relationship between Information Systems and Bioinformatics. In the area of Information Systems, there are currently two well-known senior researchers with a history of achievement in the field, both of whom are now engaged in Bioinformatics research.

Research Funding: One of the most important goals for the Computer Science Department will be to significantly increase the amount of funding for Computer Science research at CWRU. In the last few years, large amounts of new funding have become available for Computer Science research through programs such as the NSF's *Information Technology Research* (ITR), *Biological Databases and Informatics* (BDI), and *Biological Information Technology and Systems* (BITS) programs. Obtaining substantial funding from such programs typically requires assembling teams of computer scientists with *complementary* expertise. Until very recently, CWRU has had limited success in obtaining this funding, because it lacked a critical mass of Computer Science researchers. Having increased the number of Computer Science faculty to just ten – an extremely small number by national standards – CWRU has recently experienced more success, as evidenced by recent NSF awards to Computer Science Faculty. Considering *only* the currently active NSF awards, Computer Science faculty are PI's in eight NSF grants with a total funding of ~2.7M. Current-year funding from these grants is ~1M. To put this in perspective, the total number of currently active NSF grants for all departments at CWRU (including the School of Medicine) is 88. (See https://www.fastlane.nsf.gov/a6/A6Start.htm.) While research funding for Computer Science has lagged behind that of other engineering school departments for several years, recent funding figures show a significant improvement. YTD funding for Computer Science faculty is almost double their total funding for last year. It is now significantly higher than the figure for two other engineering departments and is comparable to those of most others.[3] It is also worth mentioning that almost all Computer Science grant funds are subject to full overhead recovery and are used to support faculty and graduate students.

We envision that with additional hires in our research focus areas, the Computer Science Department will achieve an average funding level of more than \$200K/faculty/year[4] within five years, which exceeds the average funding level for Computer Science Departments ranked in the top 30 according to the most recent CRA survey of CS departments [2]. Our long range goal is to have an average funding level of ~\$275K /faculty/year by 2012. In line with current CS funding trends [2], we expect that NSF will be our largest

[3] There are only two departments with more than 100K current YTD funding.

[4] Dollar amounts given in this section are in year 2002 dollars.

source of research funding, accounting for more than 1/3 of all funding.[5] The target level of funding will support about 2.5 doctoral students per faculty member and almost all funding will be subject to overhead recovery.

Faculty Size and Composition: A key to achieving a successful Computer Science Department is providing it with enough high-quality faculty to do productive research while still meeting its teaching responsibilities. In order for the Computer Science Department to be able to both compete successfully for research funding in its focus areas and fulfill its teaching responsibilities, the number of Computer Science faculty will need to grow somewhat. We envision the Computer Science Department growing to 15 faculty within five years. This growth will make the teaching load of the Computer Science faculty comparable to that of faculty in other departments of the Case School of Engineering, in terms of credit hour taught per faculty member. Currently, the Computer Science faculty teach an average of about 400 credit hours per faculty member, which is substantially more than most other CSE departments. This is due to the large sizes of Computer Science classes, which in turn is due to high demand for these classes from both majors and non-majors.

It is important to recognize that the most successful Computer Science departments are ones that are *internally cohesive,* yet exhibit some *diversity* of focus. Such departments are better able to respond effectively to new research opportunities and to meet the needs of students than are narrowly specialized departments. Our research focus areas – Bioinformatics, Networks/Distributed Systems, and Information Systems – were carefully chosen to achieve research synergies both within the Computer Science Department and with other departments at CWRU. Note that achieving sufficient cohesion and diversity in research does not require a very large Computer Science Department, although it does call for one that is somewhat larger than the current Computer Science program at CWRU.

Current Educational Programs in Computer Science: Last year 43 Computer Science baccalaureate degrees were awarded at CWRU. This number should not decrease because the demand for Computer Science majors is expected to remain strong [2]. However, growth will be limited because the total number of undergraduates at CWRU probably will not change significantly. Our goals are to award 48 Computer Science baccalaureate degrees in 2007 and to award 53 after 10 years. The new Bioinformatics program that we propose below is expected to contribute to these increases.

A very important goal is to significantly increase the size of the Computer Science PhD program to at least 50 students by 2012. The size of the PhD program is primarily dependent on the amount of research funding and the number of faculty in the Computer Science Department. As explained above, we anticipate significant increases in the latter two measures. A major portion of these increases will be in Bioinformatics, which is an interdisciplinary area. Thus, the Computer Science PhD students will be supervised not only by Computer Science faculty but also by faculty in the biological/health sciences with whom we collaborate. This leveraging of assets is one of the factors that will enable us to achieve national and international recognition without a very large increase in faculty size.

Innovative Educational Programs in Bioinformatics: We plan to develop educational programs in Bioinformatics at both the undergraduate and graduate levels, in collaboration with the CWRU Center for Computational Genomics. Our approach is to add biological/health sciences courses to existing Computer Science degrees rather than to develop entirely new degrees. This is possible because of strong programs in

[5] Over the last 20 years, NSF research funding has increased steadily and it is projected to increase further next year (see http://dellweb.bfa.nsf.gov/nsffundhist_files/frame.htm).

these areas at CWRU, and because Computer Science students can take the existing courses in these areas. One option at the undergraduate level is to exploit the flexibility of the existing B.A. degree in Computer Science to define a Bioinformatics Concentration. Such a degree would be attractive in itself and as part of a double major with the second degree being in either biology or biochemistry. This option requires only minor changes to the Computer Science B.A. program. Another option is to add a Bioinformatics track to the B.Sc. degree in Computer Science, which gives the students a stronger education in Computer Science. Preliminary analysis shows that this is possible because some existing biological/health sciences courses that are important for Bioinformatics have very few prerequisites. At the graduate level, it also appears feasible to accommodate Bioinformatics concentrations within our existing degrees by incorporating requirements from the biological/health sciences. Such innovative educational programs will give students excellent backgrounds for doing research in Bioinformatics. In addition to these basic educational programs, we will also develop new courses on research topics in Bioinformatics that are pertinent to our research programs.

Distinctiveness: What will distinguish the Computer Science Department at CWRU from other Computer Science departments around the country? The single most distinctive aspect of the department is likely to be its strength in Bioinformatics research and education and its close collaborations with CWRU colleagues in the biological and health sciences. As described above, we intend to establish nationally recognized research and educational programs in this area.

4. Relationships

Nationwide, computer science faculty collaborate extensively with researchers in other disciplines and with industry. Indeed, Computer Science is distinguished by the variety of its collaborations. The most important collaborations are with disciplines that apply Computer Science ideas, such as business, engineering, the sciences, and medicine. It is notable that computer scientists do not collaborate primarily with electrical engineers or computer hardware engineers. In fact, a primary thrust of Computer Science research has been methodology for developing computer software that is not dependent on specific computer hardware designs, and the adaptability of software is a major reason for its economic importance. The Computer Science faculty envision having a wide variety of collaborations with departments inside and outside of the Case School of Engineering, including Genetics, Biology, Biomedical Engineering, Electrical Engineering, Mechanical Engineering, Mathematics, and Statistics.

Computer Engineering Program: The Computer Science faculty make a substantial contribution to the Computer Engineering B.Sc. degree. Although the latter degree is computer-hardware oriented and has only two required Computer Science courses, many Computer Engineering majors take additional Computer Science courses as technical electives. Historically, more than half of the Computer Engineering majors have had a de-facto concentration in software systems. Computer Science faculty are involved in advising these students and in some cases supervising their senior projects. Currently, Computer Science faculty participate in the Computer Engineering Curriculum Responsibility Group. With the creation of a Computer Science Department, the involvement of Computer Science faculty with Computer Engineering major would not change significantly, although primary responsibility for the Computer Engineering degree will fall to the Electrical Engineering Department. The current B.Sc. degree in Computer Science includes two required Computer Engineering courses, and this is expected to continue for the foreseeable future.

Other Educational Collaborations within CWRU: Several other undergraduate programs in engineering have a Computer Science track, as does Mathematics. Majors in these programs take a number of Computer Science courses, and Computer Science courses are popular electives for other non-CS majors as well. In addition, several Computer Science courses (including the courses on databases, bioinformatics, and software engineering) attract graduate students from other engineering departments (e.g., Biomedical, Chemical, Mechanical and Civil Engineering), as well as from the School of Arts and Sciences and the Medical School. This is one of the reasons why the enrollments in Computer Science courses are so large. One of the responsibilities of the new Computer Science Department will be to continue, and perhaps expand, the education of non-CS majors.

Currently, the introductory programming course (ENGR 131) is not taught by Computer Science faculty, because of other teaching commitments. Consequently, its content has changed in recent years to place less emphasis on mainstream programming methodology and more on assembly language, computer organization, and robotics. If the Case School of Engineering wishes to provide students with thorough training in mainstream programming methodology, it is advisable to have Computer Science faculty teach this course. In any case, other schools within CWRU are not well served by the current version of ENGR 131. Increasing the number of Computer Science faculty as described above will allow the Computer Science Department to better meet the educational needs of other parts of the University, e.g., by offering an Introduction to Computer Science course. Such a course would serve as an important vehicle for steering talented Arts & Sciences students toward Computer Science and Bioinformatics.

We also envision the Computer Science Department offering graduate and undergraduate programs in Bioinformatics in collaboration with the CWRU Center for Computational Genomics, as explained in Section 3.

Research Collaborations: The Computer Science faculty already has a wide range of research collaborations with faculty in other engineering departments, as well as with faculty in the Medical School and the School of Arts and Sciences. These include collaborations with faculty in Genetics and Epidemiology and Biostatistics on Computational Genomics research, with faculty in Biology, Electrical Engineering, and Mechanical Engineering on Computational Neuroscience research, with Mathematics and Statistics faculty on Computer Security and Software Reliability research, and with Electrical Engineering faculty on Internet Robotics research. Several Computer Science faculty also have research collaborations with investigators from other leading universities and companies, including MIT, Carnegie Mellon, University of Pittsburgh, Dresden University in Germany, AT&T, NEC, and IBM. We envision maintaining our current partnerships and developing important new ones with scientists and engineers from within CWRU and from other leading institutions.

The Computer Science Department will also participate in the ATC (Advanced Technology Common) initiatives at CWRU. These initiatives will benefit both Computer Science and other departments by permitting them to compete effectively for funding of large-scale multidisciplinary projects.

Collaborations with Industry: Although Cleveland is not known as a center for the software industry, a substantial amount of software development is done in the area, and large numbers of software engineers work here. Computer Science faculty have enjoyed productive research collaborations with such companies as Eveready Battery Company and Rockwell. We intend to work to establish strong relationships between the Computer Science Department and local industry, e.g., through an industrial affiliates program that will foster opportunities for collaborations involving research, training, and consulting. We are especially interested in developing relationships with biotechnology companies.

5. Star Faculty Hiring Strategy

"Star" hiring is a top-priority goal for the Computer Science Department, because it is crucial to improving the ranking of the Computer Science program and to attracting more research funding. A senior researcher with prestigious awards (e.g., the Turing award), many high-quality publications, and a strong record of professional service is usually considered a star, as is a system developer with substantial funding and a strong record of research productivity and service. Unfortunately, such stars are in high demand and usually have a choice of successful Computer Science departments to join. In order to attract such faculty to CWRU, it will be necessary to improve the infrastructure for Computer Science as described in this proposal, to grow and diversify our faculty, and to strengthen our research programs. Thus, our primary focus in the near term will be recruiting and retaining excellent junior faculty, although we will pursue opportunities to recruit star faculty as they arise. In addition, we will make a concerted effort to locate rising stars in our research focus areas and make an all-out effort to recruit them. Finally, we shall be flexible in hiring and willing to take some well-considered risks.

6. Drawbacks of the Current Structure

Achieving our vision requires enhancing our existing Computer Science research and educational programs and in some cases developing new ones. In our view, such progress is virtually precluded by the current organizational structure in which Computer Science is a part of the Department of Electrical Engineering and Computer Science (EECS). This structure is characterized by unproductive competition between the four programs within EECS (EE, CS, CE, and Systems/Control) for limited resources. Although there is a separate "Computer Science Curriculum Responsibility Group" within the EECS department, this committee has very little power in making important decisions about academic and research programs in Computer Science. Rather many important decisions get bogged down in bureaucratic details.

The inadequacy of the current structure is most apparent in recruiting highly qualified new faculty. Computer Science faculty candidates have expressed concern to us about the current structure and whether it indicates a lack of commitment to Computer Science at CWRU. Naturally, these candidates are aware that almost all top ranked universities have separate Computer Science departments. (Among the top 50 universities in the U.S. News and World Report rankings, there are only 5 EECS departments. The rest have either a Department or a School of Computer Science, with the exception of one that has a CS-Math department. See Appendix 1 for a complete list.) Even when this hurdle can be overcome, the process of approving a formal offer to a candidate has in some cases been difficult because of the fact that the four groups within the EECS Department have widely different visions and priorities. The proposed Computer Science Department will not only remove this impediment, but it will provide Computer Science with the identity, independence and visibility it needs to achieve its goals.

7. References

1. United States Department of Labor. *Occupational Outlook Handbook*, www.bls.gov/oco/.
2. CRA Profiles CS/CE PhD Granting Departments, Computing Research News, Computing Research Association Newsletter, Nov. 2000, http://www.cra.org/CRN/issues/0005.pdf.
3. Research-Doctorate Programs in the United States: Continuity and Change, National Research Council, National Academy Press, 1995.

Appendix 1
Structure for Computer Science in Top 50 U.S. Universities

The ranking in the table below is from the most recent *US News and World Report*:

CS departments: 45

EECS departments: 5 (MIT, Berkeley, CWRU, Vanderbilt, Tulane)

CSMA (Computer Science and Math): 1 (Emory)

EECS departments which split in the last two years: 4 (Michigan, Wake Forest, Tufts, Lehigh)

Rank	Dept	University
1	CS	Princeton University
2	CS	Harvard University
	CS	Yale University
4	CS	California Institute of Technology
	CS	Duke University
	EECS	MIT
	CS	Stanford University
	CS	University of Pennsylvania
9	CS	Dartmouth College
10	CS	Columbia University
	CS	Northwestern University
12	CS	University of Chicago
	CS	Washington University in St. Louis
14	CS	Cornell University
15	CS	Johns Hopkins
	CS	Rice University
17	CS	Brown University
18	CSMA	Emory University
	CS	University of Notre Dame
20	EECS	University of California-Berkeley
21	CS	Carnegie Mellon
	EECS	Vanderbilt University
23	CS	University of Virginia
24	CS	Georgetown University
25	CS	UCLA
	CS	University of Michigan (new split)
	CS	Wake Forest University (new split)
28	CS	Tufts University (new split)
	CS	Univ. of North Carolina-Chapel Hill
30	CS	College of William and Mary
31	CS	Brandeis University
	CS	Univ. of California—San Diego
	CS	University of Southern California
	CS	Univ. of Wisconsin--Madison
35	CS	New York University
36	CS	University of Rochester
37	**EECS**	**Case Western Reserve University**
38	CS	Georgia Institute of Technology
	CS	Univ. of Illinois-Urbana-Champaign
40	CS	Boston College
	CS	Lehigh University (new split)
	CS	Yeshiva University
43	EECS	Tulane University
	CS	University of California-Davis
45	CS	Pennsylvania University
	CS	Univ. of California--Irvine
47	CS	Pepperdine University
	CS	Rennselaer Polytechnic Institute
	CS	Univ. of California—Santa Barbara
	CS	University of Texas
	CS	University of Washington

Appendix 2
What is Computer Science?

> "*Science discovers the laws of nature--the 'what is' of nature. Engineering uses the laws of nature to create physical artifacts. In contrast, computer science discovers and uses the laws of "how to" compute and "how to" organize information to create computational and information artifacts. Computer science is also concerned with the organization – that is, the architecture -- of the physical artifacts that perform computations and that store and transmit information.*"
>
> Foley[6] [Foley02]

Denning[7] lists [Denning97] the key intellectual themes in computer science, central to all subfields in it, as

1. Algorithmic thinking,
2. Representation, modeling, access, and storage of information, and
3. Computer software architectures and programs.

Denning also gives [Denning97] a taxonomy of subfields in computer science as

1. Algorithms and Data Structures
2. Programming Languages
3. Architecture
4. Operating Systems and Networks
5. Software Engineering
6. Databases and Information Retrieval
7. Artificial Intelligence
8. Graphics
9. Human Computer Interaction
10. Computational Science
11. Organizational Informatics
12. Bioinformatics

Each subfield involves elements of theory, abstraction and design. Computer science produces truly enabling and central technologies. The above-listed core subfields are highly important in new application fields such as web computing applications, computing for earth sciences, digital libraries, and mobile computing.

Foley [Foley02] defines Computing as simply computer science with an additional emphasis on understanding the ways and domains in which computers are used, and the ways in which computational engines are engineered:

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[6] Chair of the highly prestigious Computing Research Association Organization

[7] Peter Denning is a noted leader in computer science education and the past president of Association for Computing Machinery.

Computing is concerned both with deep theoretical questions about the nature of computing and information, as well as with new and creative ways to use computers to solve problems. That is, computing simultaneously looks inward to solve fundamental problems, and looks outward to solve real-world problems and to work collaboratively with other disciplines to solve problems that neither computer science nor the other discipline alone could solve. Indeed, in some cases they are problems that neither discipline could even recognize without collaborating, and in some cases the collaboration leads to fundamentally new ways of thinking about problems.

Denning describes [Denning98] the growth of computing, and discusses the basis, practices, innovations, and boundaries of computing as a profession. Figures 1 and 2 by Foley [Foley02] illustrate the structure of the discipline of computing and interdisciplinary research.

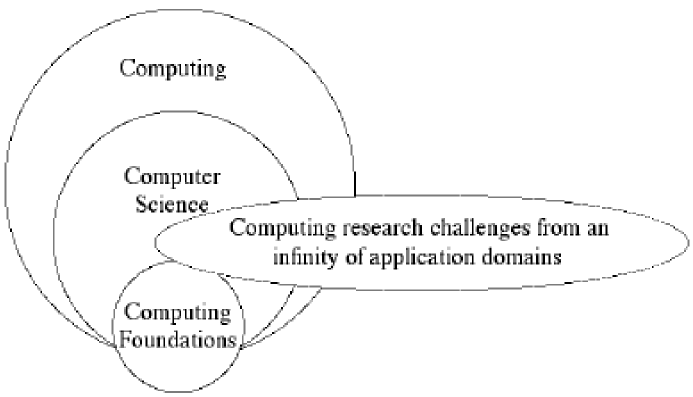

Figure 1. A Structure for the Discipline of Computing.

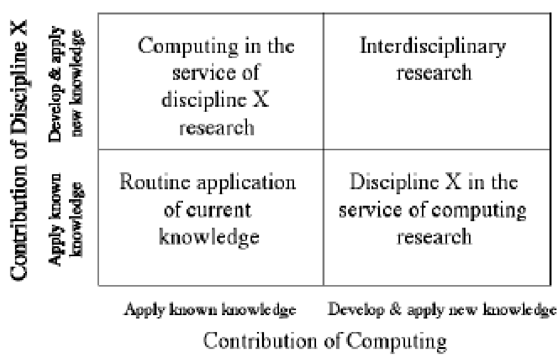

Figure 2. Interdisciplinary research occurs when new knowledge is being discovered in both disciplines.

References

[Denning97] Denning, P. “Computing Science: The Discipline”, August 1997 (appeared in Encyclopedia of Computer Science, 2000), available at http://cne.gmu.edu/pjd/PUBS/cs99.pdf

[Denning98] Denning, P., “Computing the Profession”, in Computer Science and Engineering Education, 1998, available at http://cne.gmu.edu/pjd/PUBS/ProfComp.pdf

[Foley02] Foley, J. “Computing > Computer Science”, Computing Research News, Vol. 14/No. 4, p. 6., 2002, available at http://www.cra.org/CRN/articles/sept02/foley.html

Appendix 3

CRA Profiles CS/CE PhD Granting Departments, Computing Research News, Computing Research Association Newsletter, Nov. 2000

Please see the next page.

CRA Profiles CS/CE Ph.D.-Granting Departments

By Stephen Seidman and Mirek Truszczynski

In spring 2000, the Computing Research Association conducted its second survey of North American Ph.D.-granting programs of computer science and engineering to collect data on budget, research funding, staff support, space, faculty teaching loads, and graduate student support. The survey requested data for the most recent annual period for which the data were available. In most cases this meant the period from July 1, 1998 to June 30, 1999. The results of the survey were reported in a workshop at the 2000 CRA Conference at Snowbird in July.

The survey was sent to 186 Ph.D.-granting programs in computer science and computer engineering. Because the response from Canadian programs and computer engineering programs was both small and unrepresentative, their data were not included in this report. The response rate for US programs was 55.7 percent, with 88 out of 158 programs responding to the survey.

The US CS programs are divided into four groups according to the most recent National Research Council ranking: departments ranked 1 to 12 (6 responses); departments ranked 13 to 24 (9 responses); departments ranked 25 to 36 (10 responses); and departments ranked 37 or higher (63 responses). In a different analysis, we divided the US CS programs according to whether the corresponding institutions are public (64 responses) or private (24 responses).

Support Staff

Table 1 presents the mean and median ratio of the number of secretaries, computer support staff, and research programmers to the number of full-time equivalent (FTE) faculty for all categories of programs described above. Privately funded institutions have generally higher levels of staff support per FTE than institutions that are publicly supported, and staff support is generally better in higher ranked departments. Table 2 shows the percentage distribution in sources of support for department staff (means over all responding units in each group).

Budget

Table 3 presents the mean and median annual department expenditures per faculty member (in thousands of US dollars). The variation between the categories is extremely wide. For example, the median department expenditure per FTE for a program ranked 37 or higher is more than 60 percent lower than the same measure for programs ranked 13 to 24. Some of the variation may be due to differing interpretations of the survey question.

Table 4 summarizes the survey data on the amount of external funding per FTE faculty member. There is a significant difference between private and public institutions and between top-ranked departments and departments ranked 37 and above.

Table 5 illustrates the role of various funding agencies in providing external research funding. Overall, NSF and DARPA provide about 50 percent of research funds, but the breakdown varies significantly across the groups of programs. NSF provides the highest proportion of funding in all program groups. DARPA plays a significant role in funding for programs ranked 1 to 36. In other programs, sources other than DARPA play a more important role in supporting research.

Space

Table 6 summarizes the survey data on departmental space. There are significant differences between US private and public institutions, and between top-ranked US departments and those ranked 37 and higher. For example, the category means suggest that private institutions have nearly 35 percent more space per faculty member than public institutions. (If category medians are used, the corresponding margin is 20%.) Similar differences appear when data for department ranking are used. For example, departments ranked 1 to 36 report approximately 1300 sq. ft. per FTE faculty member (using median data), while departments ranked 37 and up report 1035 sq. ft. per FTE.

In the survey, we also asked about the use of departmental space. Since we found no clear trends as a function of type or ranking, the average space usage over all responses is reported in Table 7.

The survey indicates significant activity with respect to recent or forthcoming space allocated to US computer science departments. More than half (51%) of the US departments expect to gain new or newly renovated space, and 81 percent of these departments expect to have the new space by the end of 2003. The amount of the anticipated new space ranged widely (median 20,800 sq. ft., mean 31,503 sq. ft.). Department rank played a major role: the mean anticipated new space was 62,713 sq. ft. for departments ranked 1 to 36, and 18,299 sq. ft. for departments ranked 37 and higher.

The survey asked respondents to indicate sources of funding for newly acquired or renovated space. The responses are summarized in Table 8. Institutional and state funding were listed most often, 58 percent and 51 percent, respectively, followed by private (42%) and industrial (20%) funding. Federal funding was reported only sporadically.

Teaching Loads

Data submitted from departments using the quarter system were converted to semesters (1 quarter course = 0.67 semester course). An official annual teaching load of between 2 and 3 semester courses was reported by 52 percent of the respondents, and an additional 35 percent of the respondents reported an official load of between 3 and 4 semester courses. The minimum reported was 1.33 and the maximum reported was 8 semester courses. In Table 9, the data indicate that both official and actual teaching loads are strongly correlated with department rank. Teaching loads reported by departments at private universities are lower than those reported by departments at public institutions.

Table 1. Support Staff per Faculty Member

	Secretarial Staff		Computer Staff		Research Staff	
	mean	median	mean	median	mean	median
Private	0.47	0.46	0.23	0.21	0.41	0.20
Public	0.36	0.31	0.23	0.18	0.17	0.08
US CS Ranked 1-12	0.54	0.49	0.38	0.40	0.22	0.14
US CS Ranked 13-24	0.58	0.60	0.25	0.20	0.47	0.47
US CS Ranked 25-36	0.56	0.56	0.37	0.34	0.22	0.22
US CS Other	0.33	0.29	0.19	0.14	0.21	0.05
US	0.39	0.33	0.23	0.19	0.24	0.09

Table 2. Institutional/External Support Staff Funding, Proportion of Total

	Secretarial Staff		Computer Staff		Research Staff	
	Inst	Ext	Inst	Ext	Inst	Ext
Private	0.89	0.11	0.83	0.17	0.06	0.94
Public	0.90	0.10	0.83	0.17	0.06	0.94
US CS Ranked 1-12	0.95	0.05	0.66	0.34	0.22	0.78
US CS Ranked 13-24	0.78	0.22	0.58	0.42	0.06	0.94
US CS Ranked 25-36	0.81	0.19	0.75	0.25	0.22	0.78
US CS Other	0.92	0.08	0.90	0.10	0.00	1.00
US	0.90	0.10	0.83	0.17	0.06	0.94

Of the departments that responded to the survey, 93 percent permit teaching-load reductions. Of these departments, 85 percent allow for reduction as part of startup packages for new faculty members. Other reasons commonly cited for load reductions are: administrative duties, course buyout, strong research program and type and size of class (cited by 88%, 78%, 37%, and 28% of the departments, respectively). The average reported buyout was 22 percent of annual salary; the median buyout rate reported was 20 percent.

Of the departments that responded to the survey, 72 percent permit teaching-load increase; of those reporting, 78 percent reported a shift in primary responsibility to teaching as the reason for the increase.

Table 3. Annual Operating Budget per Faculty Member (thousands of US dollars)

	mean	median
Private	$29	$22
Public	38	16
US CS Ranked 1-12	15	13
US CS Ranked 13-24	50	43
US CS Ranked 25-36	71	33
US CS Other	30	14
US	36	18

Table 4. Annual Expenditure from External Sources per Faculty Member (thousands of US dollars)

	mean	median
Private	$237	$200
Public	116	82
US CS Ranked 1-12	187	182
US CS Ranked 13-24	287	224
US CS Ranked 25-36	164	151
US CS Other	113	75
US	144	90

Graduate Student Support

For 84 percent of US programs, the standard work requirement for teaching assistants is 20 hrs/week, with the mean being close to 20 hrs/week for all categories of programs. For research assistants, 88 percent of the US programs report 20 hrs/week as the standard work requirement. There were no significant differences between public and private institutions or between institutions of different rankings.

Table 10 gives the number of TAs and RAs per FTE faculty member. The TA ratio was higher for public institutions, while the RA ratio was higher for private institutions. Highly ranked programs also tended to have higher ratios for both TAs and RAs. Table 10 gives the ratio of students on full fellowship to the number of FTE faculty. This ratio is higher for private institutions than for public ones, and, once again, highly ranked programs tended to have higher ratios.

The survey also asked for the net value of stipends (stipend minus tuition and fees) for teaching assistants, research assistants, and those with fellowships. The mean and median net stipends are shown in Table 11. Once again, there is some variation in net stipends between public and private institutions, and also among programs of different rank. The data also show that while TA stipends do not differ much from RA stipends, both are lower than fellowship stipends.

In response to a survey question on factors affecting the amount of the stipend, academic progress was given most frequently (57%). Other commonly reported factors are: passed qualifier (49%), differences in the source of funding (45%), recruitment enhancements (32%), and GPA (15%).

The survey provided interesting insights into recruitment incentives used to attract new graduate students. Stipend enhancements were reported by 45 percent of the US programs; the mean and median amounts were $4,854 and $3,000. Guaranteed

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Table 5. External Sources of Support, Percent of Total Expenditure

	US	Private	Public	Ranked 1-12	Ranked 13-24	Ranked 25-36	Other
NSF	37%	35%	38%	42%	31%	38%	37.4%
DARPA	13%	21%	11%	31%	24%	20%	8.3%
NIH	2%	2%	2%	0%	3%	3%	2.1%
DOE	3%	1%	3%	3%	0%	7%	2.3%
State Agencies	11%	3%	13%	4%	2%	3%	14.2%
Industrial Sources	12%	16%	11%	9%	7%	15%	12.9%
Other Defense Research Agencies	4%	4%	4%	1%	8%	1%	4.3%
Other Mission-Oriented Federal Agencies	13%	17%	12%	10%	20%	11%	12.1%
Other	5%	1%	6%	0%	5%	2%	6.5%

multi-year support was reported by 51 percent of programs; 20 percent of these programs offered support for 2 years, 14 percent offered support for 3 years, and 59 percent offered support for more than 3 years. Paid visits to campus were reported as an incentive by 51 percent of programs, with a median amount per visit of $500 and a maximum of $1,500. Finally, guaranteed summer support was reported by 30 percent of the programs; the mean and median amounts reported were approximately $4,000.

Conclusions

We have not attempted to provide any comparison of the results of this survey with those of the 1998 survey, since we are still working to develop a body of questions that can consistently generate useful and reliable results. For example, we have had difficulty in phrasing questions that deal effectively and reliably with faculty teaching loads. We have asked for data on "official" and "actual" teaching loads. The ways in which departments treat graduate seminars and advising are extremely variable, and it is hard to find words that can pin this down in a uniform manner. Department budgets and operating expenditures raise similarly complex issues that are difficult to resolve in the brief text of a question.

The results of the survey were presented at a workshop at the CRA Conference at Snowbird in July. The initial feedback from the workshop suggests that the survey data are of great interest to computer science and computer engineering departments.

The CRA Board is considering the future of the Profiles Survey. One possibility would be to incorporate some of the Profiles questions into the annual Taulbee Survey.

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Stephen Seidman and Mirek Truszczynski, who also oversaw the 1998 Profiles Survey, chair the computer science departments at Colorado State University and the University of Kentucky, respectively. ■

Table 6. Departmental Space (in sq. ft.)

	Total Space		Space per Faculty	
	mean	median	mean	median
Private	23,359	20,561	1,506	1,250
Public	23,580	17,600	1,118	1,045
US CS Ranked 1-12	47,371	46,148	1,439	1,381
US CS Ranked 13-24	32,170	31,760	1,318	1,310
US CS Ranked 25-36	31,171	24,532	1,217	1,279
US CS Other	18,620	16,118	1,199	1,035
US	23,516	19,253	1,230	1,103

Table 7. Space Allocation, Percent of Total

	Offices	Research	Instructional	Conference
Current space	54.0%	21.0%	18.0%	7.0%
Planned Space	46.5%	30.0%	16.0%	7.5%

Table 8. Source of Funding for Construction/Renovation Project

Institutional	58%
Federal	2%
State	51%
Industrial	20%
Private	42%

Table 9. Faculty Teaching Load (Semester Courses)

	Official		Actual	
	mean	median	mean	median
Private	3.07	3.00	2.75	2.26
Public	3.63	3.17	2.93	3.00
US CS Ranked 1-12	2.58	2.75	2.41	2.40
US CS Ranked 13-24	2.74	3.00	2.08	2.00
US CS Ranked 25-36	2.54	2.58	2.17	2.00
US CS Other	3.85	4.00	3.15	3.00
US	3.49	3.00	2.88	2.87

Table 10. Number of FTE Students Per Faculty

	Teaching Asst.		Research Asst.		Fellowship	
	mean	median	mean	median	mean	median
Private	1.26	1.06	2.26	1.71	0.79	0.38
Public	1.46	1.17	1.32	1.15	0.30	0.24
US CS Ranked 1-12	1.81	1.74	1.76	1.51	0.61	0.55
US CS Ranked 13-24	0.87	0.85	2.55	1.99	0.37	0.13
US CS Ranked 25-36	1.38	1.17	1.78	1.60	0.25	0.17
US CS Other	1.44	1.08	1.38	1.12	0.49	0.25
US	1.41	1.09	1.56	1.31	0.45	0.27

Table 11. Graduate Student Stipends

	Teaching Asst.		Research Asst.		Fellowship	
	mean	median	mean	median	mean	median
Private	$10,568	$12,000	$12,134	$13,185	$14,273	$14,175
Public	9,925	11,064	10,268	11,074	12,561	13,500
US CS Ranked 1-12	14,459	14,500	14,239	14,500	16,012	16,800
US CS Ranked 13-24	12,369	12,857	13,679	13,806	14,871	14,588
US CS Ranked 25-36	10,503	12,805	10,489	12,497	14,955	13,870
US CS Other	9,350	10,165	10,065	10,620	11,394	12,625
US	10,088	11,250	10,723	11,950	12,989	13,884

White House Names New Director of National Coordination Office for Computing, Information, and Communications

Neal Lane, the President's Science Advisor, has named Cita Furlani as Director of the National Coordination Office for Computing, Information, and Communications, effective October 1, 2000.

Ms. Furlani has been the Acting Deputy Director of the Advanced Technology Program at the National Institute of Standards and Technology. Previously she directed the interagency Committee on Applications and Technology of the former Information Infrastructure Task Force on behalf of the NIST Director, helping to create the Administration's National Information Infrastructure Agenda for Action and supporting the work of the NII Advisory Council.

The National Coordination Office, established under the White House Office of Science and Technology Policy's National Science and Technology Council, is responsible for coordinating the federal interagency IT R&D programs. As part of this effort, the National Coordination Office works closely with the Interagency Working Group (IWG) for IT R&D to formulate implementation plans and a unique crosscutting budget to assure that the overall federal information technology research is properly focused on the research priorities established by the IWG. The National Coordination Office also supports the influential President's Information Technology Advisory Committee, which provides guidance to the President on key issues related to IT research.

Ms. Furlani has been a NIST employee since 1981. She holds a Master of Science degree in Electronics and Computer Engineering from George Mason University and a Bachelor of Arts degree in Physics and Mathematics from Texas Christian University. ■