Profiles Survey

1997-1998 CRA Departmental Profiles Survey

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In spring 1998, the Computing Research Association conducted a survey of U.S. and Canadian Ph.D. granting departments of computer science and engineering to collect data on budget, staff support, space, faculty teaching loads, and graduate student support. The survey asked for the data for the most recent annual period for which the data were available. In most cases this meant the period from July 1, 1996 to June 30, 1997. The results of the survey were reported in a workshop at the 1998 CRA Conference at Snowbird.

The survey was sent to 186 Ph.D. granting programs in computer science and computer engineering. The response rate for U.S. programs was 52.2%, with 89 out of 170 programs responding. The response rate for the Canadian programs was 50%, where 8 out of 16 programs responded.

When analyzing the results of the survey, we divided the U.S. programs into four groups according to the most recent NRC ranking: CS departments ranked 1 – 12 (7 responses), CS departments ranked 13 – 24 (9 responses), CS departments ranked 25 – 36 (9 responses), and CS departments ranked 37 or higher (60 responses including 4 not ranked by the NRC). In a different analysis, we divided the U.S. computer science and computer engineering programs into public (65 responses) or private (24 responses) institutions.

Some departments responding to the survey did not provide answers to all the questions. However, the proportion of missing values was small, only sporadically exceeding 10%. We believe that these response rates are sufficiently high for the aggregate results of the survey, presented below, to be meaningful.

Too few (four) computer engineering departments responded to the survey to allow us to report the results for this group separately and

maintain the anonymity of the respondents.

Finally, we want to emphasize that this article presents only a statistical summary of the results of the survey. We did not attempt to give a detailed interpretation of the data for two reasons. First, there are significant differences among academic institutions in handling budgets, space, and personnel. We feel that although these differences are important, averaging over many responses decreases their effect and yields meaningful aggregate data. Second, since this was the first survey of its kind in many years, there is no temporal data to substantiate any conjectures about longitudinal trends.

Support staff

Table 1 presents the average 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. The results show that for the categories of secretarial support staff and research programmers, this ratio is higher for the U.S. programs than for the Canadian ones. The ratio is higher for the Canadian programs for computer support staff. Further, privately funded institutions have generally higher levels of staff support per FTE than institutions supported by public funds. Finally, the ratio of staff support is generally higher in top ranked departments.

Budget

Table 2 presents the average ratio of annual department expenditures for the most recent complete fiscal year (in thousands of U.S. dollars) to the number of FTE faculty. (Please note that all Canadian dollars were converted to U.S. dollars for comparison and analysis.) Total expenditures include the regular departmental budget expenditures (salaries,

including TA stipends, equipment purchases, and maintenance, and operating expenses), expenditures of funds from external grants and contracts and from discretionary accounts, and expenditures of overhead funds returned to the department. Total expenditures do not include the value of equipment donations. There are no significant differences between the three groups of top-ranked U.S. programs. However, the average expenditure per FTE in a U.S. program ranked 37 or higher is about 40% lower than the same average for programs ranked 1 – 36. There is also a striking difference between U.S. and Canadian programs, with the average expenditure per FTE in Canadian programs being more than 50% lower than in the United States.

Table 3 summarizes the findings on the rate of external funding per faculty member. Unlike other results of the survey, there is a significant

difference here between private and public institutions.

The rate of external funding is also higher in the U.S. than in Canada. It is also higher for top-ranked departments than for departments ranked 37 and higher.

The survey also asked about the structure of the budget. These data are summarized in Table 4. The data show that external funding plays a smaller role in the budgets of the Canadian programs compared with the U.S. Similarly, the portion of the budget that comes from external funds in the U.S. departments ranked 37 and up is lower than in the programs ranked 1 – 36.

Table 5 presents the average ratio of annual departmental expenditures for instructional and research laboratories to the number of FTE faculty (in thousands of U.S. dollars). These expenditures include mainte-

Table 1. Support Staff per Faculty Member

	Secretarial Staff	Computer Staff	Research Programmers
Private	.48	.24	.18
Public	.32	.19	.13
US CS Ranked 1-12	.87	.34	.20
US CS Ranked 13-24	.40	.25	.22
US CS Ranked 25-36	.56	.40	.20
US CS Other	.28	.15	.13
US	.37	.20	.14
Canadian	.27	.26	.07

Table 2. Annual Budget per Faculty Member (thousands of US dollars)

Private	$286
Public	224
US CS Ranked 1-12	337
US CS Ranked 13-24	358
US CS Ranked 25-36	337
US CS Other	202
US	240
Canadian	109

Table 3. External Funding per Faculty Member (thousands of US dollars)

Private	$168
Public	92
US CS Ranked 1-12	206
US CS Ranked 13-24	205
US CS Ranked 25-36	157
US CS Other	81
US	110
Canadian	53

Table 4. Budget Composition

	Private	Public	US CS Ranked 1-12	US CS Ranked 13-24	US CS Ranked 25-36	US CS Other	US	Canadian
Overhead	2 %	2 %	1 %	1 %	3.5 %	2 %	2 %	7 %
Discretionary	4	2	4	5	3.5	2	2	0
External	40	36	44	52	46	32	37	19
Regular Budget	54	60	51	42	47	64	59	74

Table 5. Annual Lab Expenditures (per Faculty Member)

	Private	Public	US CS Ranked 1-12	US CS Ranked 13-24	US CS Ranked 25-36	US CS Other	US	Canadian
Instructional	$5,000	$10,000	$11,000	$5,000	$17,000	$28,000	$9,000	$12,000
Research	20,000	18,000	28,000	24,000	47,000	12,000	19,000	11,000

Table 6. Instructional Lab Expenditure Structure

	Private	Public	US CS Ranked 1-12	US CS Ranked 13-24	US CS Ranked 25-36	US CS Other	US	Canadian
Maintenance	15 %	12 %	15 %	17 %	7 %	12 %	13 %	7 %
Equipment Purchases	49	43	31	40	49	45	45	33
Staff	36	45	53	43	44	43	42	60

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Table 7. Research Lab Expenditure Structure

	Private	Public	US CS Ranked 1-12	US CS Ranked 13-24	US CS Ranked 25-36	US CS Other	US	Canadian
Maintenance	11%	10%	26%	13%	6%	9%	11%	1%
Equipment Purchases	57	57	22	62	61	58	57	1
Staff	32	33	52	25	33	33	32	1

Table 8. Equipment Donations

	top 25%	median	bottom 25%
Instructional Lab	$400,000 or more	$180,000 or more	$17,000 or less
Research Lab	$500,000 or more	$123,000 or more	$45,000 or less

Table 9. Space—Sources of Funding

	New	Renovated	Planned
Institutional	88%	72%	70%
State	32	28	40
Federal	6	0	0
Industrial	0	12	12
Private	6	4	21

nance costs, equipment purchases, and personnel costs . The value of donated equipment is not included. It is noteworthy that the ratio for instructional laboratories is higher in Canada than in the U.S., but that the ratio for research laboratories is lower in Canada. Further, the per-FTE level of support for research laboratories in the U.S. departments ranked 1 – 36 is two to four times higher than for the remaining U.S. programs.

The survey also gathered data on the structure of expenditures for instructional and research laboratories. These data are presented in Tables 6 and 7. As might be expected, staff and equipment purchases predominate.

Equipment donations to instructional and research labs provide substantial support to many computer science programs. Thirty-four U.S. computer science programs reported donations of instructional equipment. The same number of U.S. computer science programs reported research equipment donations. The first quartile, median, and the third quartile of the estimated value of these donations are given in Table 8. Five Canadian programs (out of 8 responding to the survey) reported donations of instructional equipment with an estimated value ranging from $5,000 to $255,000. Three Canadian programs reported donations of research computing equipment.

Space

The survey asked about use of space in the departments. We found no clear trends as a function of type (public vs. private), ranking, or country. We thus report the average space use over all responses. The results are shown in Figure 1 below.

The survey indicates significant activity with respect to added or forthcoming space allocated to U.S. computer science departments. Out of 89 U.S. departments, 21 reported acquiring new space in the past year. The amount of new space ranged widely (minimum 41 sq. ft., median 1,600 sq. ft., maximum 8,690 sq. ft.). Five departments reported loss of space.

Twenty-five U.S. departments reported renovation of existing space. The scope of renovation differed substantially among programs (minimum 260 sq. ft., median 1,912 sq. ft., maximum 10,000 sq. ft.). The survey asked respondents to indicate funding sources for the newly acquired or renovated space. The results are shown in Table 9. Institutional and state funding were listed most often by far, with federal, industrial, and private funding being mentioned only sporadically.

As many as 33 U.S. departments expect new space to become available to them by 2005. Of these, 26 (79%) expect new space by the end of 2000. The departments are rather optimistic about timely delivery of the new space. Over 60% expect it to

Table 10. Total Space

per Faculty Member in sq. ft.	
Private	1,212
Public	1,154
US CS Ranked 1-12	1,801
US CS Ranked 13-24	1,425
US CS Ranked 25-36	1,411
US CS Other	946
US	1,156
Canadian	1,166

be available on time or expect it is likely to be available on time. Once again, institutional and state sources are the two most commonly listed (Table 9).

Table 10 presents the ratio of the total departmental space available to the number of FTE faculty. The total departmental space consists of faculty, staff, and graduate student offices, conference and seminar rooms, and research and instructional laboratories operated by the department. There is little difference between the U.S. and Canada, and little difference between U.S. private and public institutions. However, there are significant differences between top-ranked U.S. departments and those ranked 37 and higher. The departments ranked 1 – 12 report almost twice as much space per FTE (1,801 sq. ft.) as those departments ranked 37 and up (946 sq. ft.).

Useof the planned space is similar to the use of the space currently available to the programs. However,

Table 11. Teaching Load

per Faculty Member Official	
Private	2.8
Public	3.5
US CS Ranked 1-12	2.2
US CS Ranked 13-24	2.5
US CS Ranked 25-36	2.6
US CS Other	3.7
US	3.4
Canadian	3.4

there appears to be a greater emphasis on laboratory space, with half of the planned space allocated to research and instructional labs (Figure 2 below).

Too few responses were received from the Canadian departments about recently acquired, renovated, or planned space to report aggregate statistics. Out of 8 Canadian departments responding, two reported a gain of new space and one reported a loss of space. Two Canadian departments reported renovation of some of the existing space during the reporting period. Finally, three Canadian departments expect new space by the end of 2005.

Teaching loads

Data submitted from departments using the quarter system were converted to semesters, using the following conversion: 1 quarter

Table 12. Graduate Stipends (median)

	Private	Public	US CS Ranked 1-12	US CS Ranked 13-24	US CS Ranked 25-36	US CS Other	US	Canadian
Teaching Assistant	$9,500	$10,500	$11,425	$11,316	$11,000	$9,970	$10,500	$6,172
Research Assistant	11,053	10,919	11,939	12,500	11,163	10,500	10,959	5,752
Fellowship	12,000	12,673	13,000	14,000	13,630	12,000	12,586	10,540

Table 13. Graduate Student Support

students with support / total full-time students	
Private	.70
Public	.65
US CS Ranked 1-12	.86
US CS Ranked 13-24	.77
US CS Ranked 25-36	.77
US CS Other	.62
US	.66
Canadian	.75

Offices

Research Labs

Instructional Labs

Conference Rooms
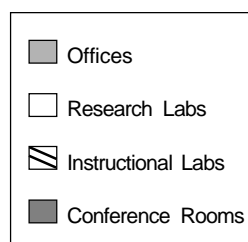
Current Space   **Planned Space**

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course = 0.67 semester courses. An official teaching load of 3 semester courses per year was reported by 31% of the respondents, and an additional 31% reported an official teaching load of 4 semester courses per year. The minimum reported was 0.67 and the maximum reported was 8.

Table 11 on page 7presents the average *official* teaching loads. Teaching loads are correlated with the rank. In particular, official teaching loads in departments ranked 1 – 36 are about 50% lower than in the departments ranked 37 and higher. Teaching loads reported by programs at private universities are about 20% lower than those reported by departments at public institutions. *Actual* teaching loads reported are generally lower than official loads. However, due to technical problems with the survey form, the data on actual teaching loads are not reliable and will not be reported.

Ninety-five percent of the departments that responded to the survey allow for teaching load reductions. Of these, 86% allow for reduction as part of startup packages

for new faculty members. Other commonly cited reasons for load reductions are: administrative duties, course buyout, and strong research program, cited respectively by 83%, 76%, and 44% of the departments that permit load reductions. The average reported buyout was 19% of annual salary. One-quarter of the departments also listed type and size of class as reasons for load reduction.

Graduate student support

One of the goals of the survey was to determine typical work requirements for teaching and research assistants. We found that for 78% of the U.S. programs, the standard work requirement for a TA is 20 hrs/week, with the mean being close to 20 hrs/week for all classes of programs. In contrast, the Canadian respondents report a mean standard work requirement for a TA of only 12 hrs/week. In the case of research assistants, 80% of the U.S. programs report 20 hrs/week as the standard work requirement. The mean standard work requirement for an RA reported by the Canadian programs was 17.6 hrs/week.

The survey asked for the net value of stipends (stipend for a nine-

month assignment minus tuition and fees) for teaching assistants, research assistants, and fellowship holders. Since there was significant variability in the reported stipends, we decided to report the median stipend values, which are less sensitive to inaccuracies in the reported data. The median net stipends are shown in Table 12. The results show that there are no significant differences in net stipends among different categories of programs. However, teaching and research assistantship stipends reported by the Canadian programs are substantially lower (by about 40%) than those reported by the U.S. institutions. The results in Table 12 also show that teaching assistantship stipends are slightly lower than for research assistantships and these, in turn, are lower than for fellowships.

Academic progress was the factor given most frequently (63%) in determining stipend amounts. Others commonly reported included: passed qualifier (50%), differences in the source of funding (48%), recruitment enhancements (26%), and GPA (15%).

In the survey, we also gathered information on the number of supported graduate students. Table 13 presents the ratio of the number of graduate students with support to the number of full-time graduate students for various categories of programs.

The survey provided interesting insights into recruitment incentives used to attract new graduate students. Forty-one percent of U.S. programs and 65% of Canadian programs reported first-year stipend enhancements. Guaranteed multi-year support was reported by 51% of programs, with 44% guaranteeing support for 2 years and 16% of them guaranteeing support for 3 years. Paid visits to campus were reported as an incentive by 44% of programs, with a median

amount per visit of $500 and a maximum of $1,000. Finally, guaranteed summer support was reported by 28% of the programs. The median amount of summer support was $3,600 for a U.S. program and $3,332 and for a Canadian program.

Conclusions

The initial feedback from the Snowbird workshop where the results of the survey were presented indicates that such data are of great interest to computer science and computer engineering departments. It was a common sentiment that the survey needs to be conducted regularly every two or three years so as to provide meaningful data for the temporal analysis of changes in resources available to computer science and engineering programs. At the same time, discussions at the workshop and e-mail correspondence received by the authors indicated several shortcomings in the survey design and in the implementation of web-based survey forms. The survey is currently under review by the CRA Board with the goal of making it more precise, streamlining it, and making it easier to complete. It is expected that the survey will be repeated in two years.

Acknowledgments

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Research Priorities

The bulk of the report concentrates on four research priorities: software, scalability, high-end computing, and socio-economic and workforce impacts (notably, many of PITAC's suggestions are similar to those made at CRA's May 1997 workshop, "Research Challenges for the Next Generation Internet").

Software –– Declaring software "the new physical infrastructure of the information age," PITAC recommends additional funding for software in computer science engineering and applications.

Historically, reports PITAC, federal programs have underestimated the amount of money needed for software development and testing. Today, demand for software outpaces U.S. ability to produce it and companies still depend on users to identify bugs.

And despite previous failures to establish national software libraries, PITAC believes these endeavors are

so important that they should be tried again.

Scalability –– Noting how the Internet's popularity and our dependence on it are increasing daily, PITAC warns that "we cannot safely extend what we currently know to more complex systems." PITAC calls for greater investment in "core software and communications technologies."

Additionally, the Committee recommends "broadening" the NGI infrastructure testbed to include information, commerce, and other services. It also urges formation of additional industry partnerships to finance projects on a scale large enough to examine design and deployment issues.

High-End Computing –– The Advisory Committee prefaces recommendations in this area by briefly recounting the nation's evolution from high-performance computing to high-end computing. The Committee then calls for more