1995 CRA Taulbee Survey

New enrollment in Ph.D. programs drops

Results of the 1995 CRA Taulbee Survey on the Production and Employment of Ph.D.s and Faculty in Computer Science and Computer Engineering

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This is the 25th year of publication of the Computing Research Association's annual survey on the production and employment of Ph.D.s in computer science and engineering. A few years ago the CRA Taulbee Survey[1] was expanded to include computer engineering as well as computer science. Last year we began reporting on the areas of Ph.D. study (see Table 5).

Each September this survey is mailed to all organizations included on the CRA Forsythe List of departments in the United States and Canada that offer a Ph.D. in computer science or computer engineering.[2]

The accompanying tables present the results of the 1995 CRA Taulbee Survey. Information was gathered during the fall and early winter. The tables include all responses received by the first week of February.

The response rate continues to be quite high (about 91%). This is excellent for surveys of this kind, although it is not as high as a few years ago.

Information on degree production and enrollment applies to the previous academic year (1994-95). Information on faculty applies to the current fiscal year (1995-96). Faculty salaries reflect those in effect as of Jan. 1, 1996. Readers should keep in mind that survey results are from Ph.D.-granting departments only; there are hundreds more departments that award bachelor's and master's degrees.

This article draws attention to the most significant results of the survey, especially results that are substantially different from last year.

Degree production (Figures 1-2; Tables 1-8)

Although the tables and graphs show a total of 1,006 Ph.D. degrees awarded in CS and CE, CRA staff called the 9% of departments that failed to respond. We found 73 degrees that went unreported, bringing the total number of Ph.D.s to 1,079. Last year's survey indicated 1,005 Ph.D.s, with 8% of departments failing to respond. Because no attempt was made last year to count unreported degrees and because the response rate dropped only one percentage point, one could assume that degree production has remained flat.

Ph.D. production has remained essentially steady throughout the 1990s (see Figure 2). The predicted number for this year is for only slightly more than last year, but predictions have historically been high by about 100. So perhaps only about 1,000 Ph.D.s will actually be awarded in 1996. Far more significant is the drop in new enrollment in Ph.D. programs (see student enrollment section below).

The only significant change in the gender or ethnicity of Ph.D. recipients is that the number of CS and CE Ph.D.s awarded to Hispanics tripled from 9 to 28. However, the percentage of degrees at all levels awarded to females and minorities remains low.

There are no significant differences in the fields of specialization of Ph.D. recipients relative to last year. Once again—and despite student fears—almost all new Ph.D.s appear to have gotten jobs. The number who found jobs in Ph.D.-granting departments or in industry is much higher than it was a year ago, but this could be because the number of "unknowns" is much smaller this year.

The numbers of bachelor's and master's degrees awarded by the Ph.D.-granting departments are down about 8% and 15%, respectively, relative to a year ago. The change in bachelor's degree numbers appears to be transitory; the master's degree numbers appear likely to continue to fall (see below).

Student enrollment (Tables 9-11)

The number of new bachelor's students is up about 4%, but the numbers of new master's and doctoral students both are down almost 25%. The lower doctoral numbers could quite possibly reflect student reaction to the current job market. Also, there is probably a significant correlation between the master's and doctoral numbers in the Ph.D.-granting departments.

Faculty growth (Tables 12-17)

Faculty sizes are down about 3%, and anticipated growth in faculty size is down from 345 to 310 new positions over the next five years. Estimates of growth have always been optimistic, so it is plausible to predict that the total number of faculty positions will remain essentially constant for the remainder of the decade.

Far fewer faculty left their current positions—for whatever reason—than a year ago (178 versus 252).

Faculty salaries (Tables 18-26)

Faculty salaries rose about 3.5% in all ranks relative to a year ago. However, the average salary of a newly appointed faculty member rose only about 2%.

The salary numbers reported here are slightly higher than the preliminary numbers report in the January 1996 *CRN*. (A few more departments responded to the survey.)

For Tables 18-26, each department was asked for the minimum, mean and maximum salary for each category of professor. Because tables show the minimums and maximums of the minimums and maximums reported by each department, these figures reflect salaries of individual professors. Also shown are

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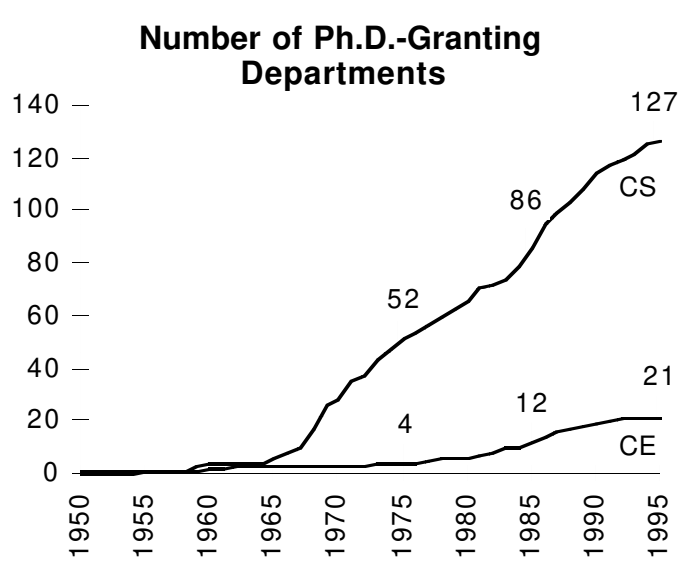
[1]*The title of the survey honors the late Orrin E. Taulbee of the University of Pittsburgh, who conducted these surveys for the Computer Science Board from 1970 until 1984.*

[2]*The CRA Forsythe List is a list of departments in the United States and Canada that grant a Ph.D. in computing—computer science (CS) and computer engineering (CE). It is maintained by the Computing Research Association. This is the ninth year computer engineering departments have been included.*

[3]*Although the University of Pennsylvania and the University of Chicago were tied in the National Research Council rankings, CRA made the arbitrary decision to place Pennsylvania in the second tier of schools.*

DEGREE PRODUCTION IN ACADEMIC YEAR 1994-95



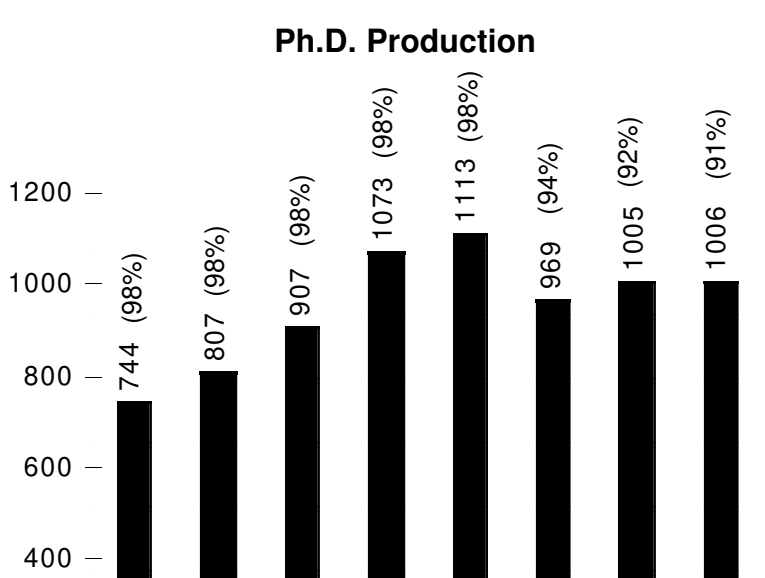


Figure 1 (above) shows a steady growth in the number of departments awarding CS and CE degrees. It does not include 14 CS/CE departments we believe offer Ph.D.s, but that did not respond to the survey. **Figure 2** (right) shows a slight decline or plateau in the total Ph.D. production of CS and CE degrees. However, these historical indications may be slightly inaccurate. First, the survey response rate has dropped, raising the possibility of more unreported degrees. (The response rate is shown in parentheses for each year.) Second, a few electrical engineering degrees may have been included in past statistics. During the last two years, more rigorous attempts were made to include only CS and CE degrees.

1995 CRA Taulbee Survey

Table 1. Ph.D. Production by Ranking

	Ph.D.s Produced	Average per Dept.	Ph.D.s Next Year	Average per Dept.	Passed Qualifier	Average per Dept.
US CS Ranked 1-12	213	17.8	222	18.5	164	14.9
US CS Ranked 13-24	170	14.2	153	12.8	165	16.5
US CS Ranked 25-36	85	7.7	133	12.1	84	10.5
US CS Other	417	5.6	489	6.5	422	6.4
Canadian CS	77	5.1	78	5.2	64	7.1
US CE	44	7.3	74	12.3	84	14.0
Total CS&CE	**1,006**	**7.7**	**1,149**	**8.3**	**983**	**9.4**

Table 2. Gender and Ethnicity of Ph.D. Recipients

	CS			CE			CS & CE		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Nonresident Alien	251	30	281	28	3	31	298	34	332
African American	7	1	8	0	0	0	8	1	9
Native American	0	0	0	0	0	0	1	0	1
Asian	96	19	115	15	0	15	125	24	149
Hispanic	20	7	27	0	0	0	21	7	28
White	286	60	346	15	4	19	325	70	395
Other/Did Not Indicate	66	22	88	3	0	3	70	22	92
Unknown	-	-	6	-	-	2	-	-	0
Total			**726**			**139**			**871**

Total			**61**			**7**			**70**

Total			**848**			**158**			**1,006**

Table 3. Gender of Ph.D. Recipients by Percentage

	CS		CE		CS & CE	
Male	727	(83%)	63	(90%)	843	(84%)
Female	144	(17%)	7	(10%)	163	(16%)
Total	**871**		**70**		**1,006**	

Table 4. Gender of Bachelor's and Master's Recipients

	Bachelor's		Master's	
Male	6,189	(82%)	3,554	(80%)
Female	1,372	(18%)	871	(20%)
Total	**7,561**		**4,425**	

Table 5. Employment of Ph.D. Recipients by Specialty

Ph.D.s Employed Domestically in:	Artificial Intelligence/ Robotics	Hardware Systems/ Architecture	Numerical Analysis/ Scientific Computing	Software Systems	Theory	Other	Total
Ph.D. CS/CE Dept.	63	22	9	49	19	21	208
Non-Ph.D. CS/CE Dept.	10	12	5	18	9	10	67
Non-CS/CE Dept.	3	0	1	4	2	2	12
Industry	47	76	14	89	30	53	336
Government	11	2	2	7	4	3	39
Self-Employed	5	1	2	8	1	1	18
Other Categories:							
Employed Abroad	26	15	8	40	16	16	132
Unemployed	3	2	0	5	3	3	17
Unknown	22	13	4	9	10	38	188
Total	**193**	**143**	**45**	**229**	**94**	**147**	*

Table 6. Ethnicity of Ph.D. Recipients by Percentage

	CS		CE		CS & CE	
Nonresident Alien	281	(35%)	31	(46%)	332	(35%)
African American	8	(1%)	0	(0%)	9	(1%)
Native American	0	(0%)	0	(0%)	1	(0%)
Asian	115	(14%)	15	(22%)	149	(16%)
Hispanic	27	(3%)	0	(0%)	28	(3%)
White	346	(43%)	19	(28%)	395	(42%)
Other	25	(3%)	2	(3%)	27	(3%)
Subtotal	**802**	**(100%)**	**67**	**(100%)**	**941**	**(100%)**
Did Not Indicate	69		3		65	
Total	**871**		**70**		**1,006**	

Table 7. Ethnicity of Bachelor's and Master's Recipients

	Bachelor's		Master's	
Nonresident Alien	525	(11%)	1,457	(38%)
African American	152	(3%)	55	(1%)
Native American	15	(0%)	3	(0%)
Asian	826	(17%)	707	(18%)
Hispanic	145	(3%)	52	(1%)
White	3,063	(63%)	1,507	(39%)
Other	142	(3%)	63	(2%)
Subtotal	**4,868**	**(100%)**	**3,844**	**(100%)**
Did Not Indicate	2,693		581	
Total	**7,561**		**4,425**	

Table 8. Degrees Awarded to People with Disabilities

	Bachelor's	Master's	Ph.D.
CS	20	10	5
CE	4	3	0
CS & CS	24	13	5

Footnotes

All ethnicity tables: "Native American" includes Alaskan natives; "Asian" includes people originating from the Pacific Islands, China, Japan, Korea, the Philippine Islands, Samoa, India and Vietnam; "white" includes people originating from Europe, North Africa and the Middle East.

All tables with rankings: Statistics sometimes are given according to departmental rank. Schools are ranked only if they offer a CS degree and according to the quality of its CS program as determined by reputation. Those that only offer CE degrees are not ranked, and statistics are given on a separate line, apart from the rankings. In Table 1, the "Ph.D.s Produced" column shows the number of CS and CE degrees produced throughout the rankings. While CE degrees are mixed into all rank categories, there are no CS degrees in the CE category.

**Totals do not match:* The reader may find that totals from certain tables do not equal each other, even though theoretically they should. These discrepancies stem from inconsistencies in the way departments answered different questions. We tried to minimize this by calling departments that provided inconsistent answers. The horizontal and vertical totals in Table 5 do not equal each other because many departments could not tell us the specialty area of the Ph.D.s.

Nonresident faculty: A small percentage of faculty were nonresident aliens when they were hired to work in fiscal 1995-96. In many cases, these new employees were gaining residency based on their new employment prospects.

All faculty tables: The survey makes no distinction between faculty specializing in CS versus CE programs. We tried to minimize inclusion of any faculty in electrical engineering.

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the means of the minimums and maximums reported by each department. Finally, the average of all salaries is the average of the means reported by each department. If a department gave only a partial answer for a category of professor, it was discounted. All Canadian salaries are in Canadian dollars.

Rankings

For Tables 18-26, which group Computer Science Departments by the rank of 1-12, 13-24 and 25-36, we based our ranking on information released in the 1995 assessment of research-doctorate programs in the United States done under the auspices of the National Research Council.

Our top 12 schools are Stanford University, the Massachusetts Institute of Technology, the University of California at Berkeley, Carnegie Mellon University, Cornell University, Princeton University, the University of Texas at Austin, the University of Illinois at Urbana-Champaign, the University of Washington, the University of Wisconsin at Madison, Harvard University and the California Institute of Technology.

The departments ranked 13-24 are Brown University, Yale University, the University of California at Los Angeles, the University of Maryland at College Park, New York University, the University of Massachusetts at Amherst, Rice University, the University of Southern California, the

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STUDENT ENROLLMENT IN ACADEMIC YEAR 1994-95

Table 9. Gender of Enrolled Ph.D. Students

	CS				CE				CS & CE			
	Full Time		Part Time		Full Time		Part Time		Full Time		Part Time	
Male	4,930	(84%)	791	(82%)	410	(88%)	64	(91%)	5,663	(85%)	976	(82%)
Female	927	(16%)	178	(18%)	57	(12%)	6	(9%)	1,038	(15%)	209	(18%)
Total	**5,857**		**969**		**467**		**70**		**6,701**		**1,185**	

Table 10. Ethnicity of Enrolled Ph.D. Students

	CS				CE				CS & CE			
	Full Time		Part Time		Full Time		Part Time		Full Time		Part Time	
Nonresident Alien	1,999	(37%)	143	(19%)	176	(43%)	18	(27%)	2,212	(37%)	188	(21%)
African American	94	(2%)	20	(3%)	3	(1%)	2	(3%)	105	(2%)	24	(3%)
Native American	15	(0%)	2	(0%)	0	(0%)	0	(0%)	15	(0%)	2	(0%)
Asian	635	(12%)	127	(17%)	95	(23%)	12	(18%)	807	(13%)	153	(17%)
Hispanic	96	(2%)	14	(2%)	8	(2%)	2	(3%)	108	(2%)	16	(2%)
White	2,453	(46%)	427	(58%)	125	(30%)	32	(48%)	2,653	(44%)	520	(57%)
Other	93	(2%)	8	(1%)	3	(1%)	1	(1%)	102	(2%)	10	(1%)
Subtotal	**5,385**	**(100%)**	**741**	**(100%)**	**410**	**(100%)**	**67**	**(100%)**	**6,002**	**(100%)**	**913**	**(100%)**
Did Not Indicate	472		228		57		3		699		272	
Total	**5,857**		**969**		**467**		**70**		**6,701**		**1,185**	

Table 11. New Students in Fall 1995

	Bachelor's Full Time	Dept. Avg.	Master's Full Time	Dept. Avg.	Ph.D. Full Time	Dept. Avg.
US CS Ranked 1-12	1,375	114.6	215	17.9	200	16.7
US CS Ranked 13-24	480	40.0	231	19.3	181	15.1
US CS Ranked 25-36	710	59.2	163	13.6	114	9.5
US CS Other	5,428	57.1	1,155	12.2	466	4.9
Canadian CS	1,892	118.3	254	15.9	80	5.0
US CE	214	16.5	155	11.9	31	2.4
Total CS&CE	**10,099**	**63.1**	**2,173**	**13.6**	**1,072**	**6.7**

FACULTY GROWTH IN FISCAL 1995-96

Table 12. Anticipated Faculty Growth

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	Five-Year Increase	
US CS Ranked 1-12	312.4	316.4	319.9	321.9	323.9	326.1	13.7	(4%)
US CS Ranked 13-24	298.5	304.5	310.5	315.5	317.5	319.5	21.0	(7%)
US CS Ranked 25-36	243.2	253.2	259.2	264.2	269.2	274.2	31.0	(13%)
US CS Other	2,784.0	2,849.5	2,902.0	2,950.0	2,984.0	3,015.2	231.2	(8%)
Canadian CS	395.6	398.3	399.3	403.3	405.3	406.3	10.7	(3%)
US CE	182.0	183.0	183.0	184.0	184.0	184.0	2.0	(1%)
Total CS&CE	**4,215.7**	**4,304.9**	**4,373.9**	**4,438.9**	**4,483.9**	**4,525.3**	**309.6**	**(7%)**

Table 13. Gender of Professors

	Assistant		Associate		Full	
Male	499	(80%)	872	(90%)	1,086	(95%)
Female	125	(20%)	96	(10%)	58	(5%)
Total	**624**		**968**		**1,144**	

Table 14. Ethnicity of Professors

	Assistant		Associate		Full	
Nonresident Alien	31	(5%)	4	(0%)	6	(1%)
African American	8	(1%)	3	(0%)	3	(0%)
Native American	1	(0%)	2	(0%)	0	(0%)
Asian	128	(21%)	204	(23%)	124	(12%)
Hispanic	12	(2%)	9	(1%)	10	(1%)
White	403	(67%)	650	(73%)	902	(85%)
Other	17	(3%)	20	(2%)	21	(2%)
Subtotal	**600**	**(100%)**	**892**	**(100%)**	**1,066**	**(100%)**
Did Not Indicate	24		76		78	
Total	**624**		**968**		**1,144**	

Table 15. Faculty Losses

	With Ph.D.	Without Ph.D.	Total
Died	3	0	3
Retired	28	4	32
Visitors Returning to Employer	25	1	28
Teaching Elsewhere	51	1	52
Left for Nonacademic Position	35	9	44
Returned to Graduate School	0	0	0
Remained, Changed to Part Time	3	1	4
Other	11	0	11
Unknown	4	0	4
Total	**160**	**16**	**178**

Table 16. Gender of Newly Hired Faculty

	Tenured		Tenure-Track		Other	
Male	14	(82%)	79	(80%)	105	(81%)
Female	3	(18%)	20	(20%)	24	(19%)
Total	**17**		**99**		**129**	

Table 17. Ethnicity of Newly Hired Faculty

	Tenured		Tenure-Track		Other	
Nonresident Alien	1	(6%)	8	(9%)	17	(15%)
African American	0	(0%)	1	(1%)	0	(0%)
Native American	0	(0%)	1	(1%)	0	(0%)
Asian	5	(31%)	18	(20%)	16	(14%)
Hispanic	0	(0%)	2	(2%)	1	(1%)
White	10	(63%)	57	(64%)	75	(68%)
Other	0	(0%)	2	(2%)	2	(2%)
Subtotal	**16**	**(100%)**	**89**	**(100%)**	**111**	**(100%)**
Did Not Indicate	1		10		18	
Total	**17**		**99**		**129**	

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University of Michigan, the University of California at San Diego, Columbia University and the University of Pennsylvania.[3]

The departments ranked 25-36 are the University of Chicago, Purdue University, Rutgers—the State University of New Jersey, Duke University, the University of North Carolina at Chapel Hill, the University of Rochester, the State University of New York at Stony Brook, the Georgia Institute of Technology, the University of Arizona, the University of California at Irvine, the University of Virginia and Indiana University.

Acknowledgments

Phillip Louis, Frank Winstead and Juan Osuna of CRA drafted the survey, collected the data, made follow-up calls and prepared the accompanying tables.

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FACULTY SALARIES IN FISCAL 1995-96

Table 18. Nine-Month Salaries, 110 Responses of 133 US CS Departments

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	477 of 481	$33,300	$51,405	$66,000	$53,913	$42,500	$56,640	$73,800
Associate	677 of 685	$36,941	$56,968	$97,250	$62,536	$51,529	$69,114	$97,250
Full	823 of 845	$47,871	$68,540	$100,000	$84,203	$54,500	$106,599	$186,900

Table 19. Nine-Month Salaries, 11 Responses of 12 US CS Departments Ranked 1-12

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	70 of 74	$52,000	$55,066	$63,000	$57,705	$54,970	$62,843	$73,800
Associate	75 of 76	$49,050	$58,755	$64,750	$65,624	$69,700	$74,754	$86,790
Full	156 of 158	$55,600	$71,328	$81,500	$94,732	$111,078	$133,678	$166,667

Table 20. Nine-Month Salaries, 12 Responses of 12 US CS Departments Ranked 13-24

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	57 of 57	$43,000	$53,613	$61,500	$56,448	$53,813	$59,729	$69,500
Associate	86 of 86	$54,247	$61,596	$70,700	$66,507	$63,000	$75,004	$92,700
Full	142 of 143	$60,377	$70,869	$85,500	$93,843	$106,300	$129,424	$186,900

Table 21. Nine-Month Salaries, 11 Responses of 12 US CS Departments Ranked 25-36

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	49 of 49	$50,800	$53,614	$57,000	$56,136	$55,518	$59,080	$70,810
Associate	84 of 84	$55,980	$61,316	$71,400	$65,470	$62,697	$69,965	$86,800
Full	111 of 116	$60,300	$71,539	$86,400	$89,186	$83,880	$113,934	$167,000

Table 22. Nine-Month Salaries, 76 Responses of 97 US CS Departments Ranked Higher Than 36 or Unranked

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	301 of 301	$33,300	$50,204	$66,000	$52,658	$42,500	$54,887	$73,000
Associate	432 of 439	$36,941	$55,417	$97,250	$61,152	$51,529	$67,393	$97,250
Full	414 of 428	$47,871	$67,351	$100,000	$80,469	$54,500	$98,477	$157,200

Table 23. Nine-Month Salaries, 9 Responses of 13 US CE Departments

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	45 of 45	$50,000	$52,539	$57,000	$54,687	$52,000	$56,646	$60,480
Associate	57 of 58	$52,018	$58,396	$64,076	$63,603	$61,800	$69,746	$77,300
Full	67 of 68	$69,336	$72,618	$77,950	$84,653	$72,099	$105,889	$138,430

Table 24. 12-Month Salaries, 11 Responses of 16 Canadian CS Departments (Canadian Dollars)

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	58 of 58	$43,000	$52,212	$62,252	$57,086	$52,984	$61,330	$69,538
Associate	149 of 154	$52,000	$60,574	$76,086	$69,985	$58,000	$81,516	$125,233
Full	138 of 138	$63,000	$77,492	$108,488	$89,668	$84,165	$111,857	$159,539

Table 25. Nine-Month Salaries, 119 Responses of 146 US CS and CE Departments

Faculty Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
Assistant	522 of 526	$33,300	$51,484	$66,000	$53,965	$42,500	$56,640	$73,800
Associate	734 of 743	$36,941	$57,066	$97,250	$62,614	$51,529	$69,157	$97,250
Full	890 of 913	$47,871	$68,814	$100,000	$84,237	$54,500	$106,551	$186,900

Table 26. Salaries of Newly Appointed Faculty, 46 Responding CS and CE Departments

Dept. Rank	# Reporting Salary Data	Reported Salary Minimums Min.	Mean	Max.	Avg. of all Salaries	Reported Salary Maximums Min.	Mean	Max.
US: CS 1-12	5 of 5	$54,325	$55,606	$57,600	$55,606	$54,325	$55,606	$57,600
CS 13-24	4 of 4	$50,000	$52,314	$55,600	$53,209	$51,157	$54,489	$58,700
CS 25-36	4 of 4	$50,000	$54,333	$57,000	$54,400	$50,000	$54,467	$57,000
CS Other	34 of 35	$27,000	$49,093	$54,500	$49,309	$30,000	$49,538	$56,000
CE	4 of 6	$50,000	$52,875	$57,000	$52,875	$50,000	$52,875	$57,000
CS&CE	**51 of 52**	**$27,000**	**$50,755**	**$57,600**	**$50,984**	**$30,000**	**$51,257**	**$58,700**
Canadian: CS&CE	12 of 12	$27,500	$42,514	$56,202	$45,639	$43,000	$48,889	$56,202