Computing Degree and Enrollment Trends

Undergraduate Enrollment Grows for Sixth Straight Year

And Ph.D. Production Reaches an All-Time High

From the 2012-2013 CRA Taulbee Survey

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Executive Summary

Summary of Results

- Total undergraduate enrollment in computing majors among U.S. computer science departments in this survey rose 13.4 percent over last year, and 22 percent among departments who reported both this year and last year. This marks the sixth straight year of increasing undergraduate enrollment.

- Bachelor's degree production increased for a fourth straight year. Among U.S. computer science departments who reported both this year and last year, bachelor's degree production increased 9.4 percent over 2011-12.

- The fraction of women among bachelor's graduates in CS increased to 14.2 percent in 2012-13, compared to 11.7 percent in 2010-11.

- For the second straight year, overall Ph.D. production in computing programs reported by the Taulbee Survey reached an all-time high, with 1,991 degrees granted.

Introduction

This article and the accompanying figures and tables present the enrollment and degree production results from the 43rd annual *CRA Taulbee Survey*[1]. The survey is conducted annually by the Computing Research Association to document trends in student enrollment, degree production, employment of graduates, and faculty salaries in academic units in the United States and Canada that grant the Ph.D. in computer science (CS), computer engineering (CE) or information (I)[2]. Most of these academic units are departments, but some are colleges or schools of information or computing. In this report, we will use the term "department" to refer to the unit offering the program. The full survey report, which also includes information about faculty size, demographics and salaries, graduate student support and research expenditures, will be available in May 2014 at www.cra.org.

Information for the survey is gathered from CRA members and other PhD-granting institutions during the Fall of each year. Responses received by January 21, 2014 are included in this year's analysis. The period covered by the data varies. Degree production and enrollment (Ph.D., Master's, and Bachelor's) refer to the previous academic year (2012-2013). Data for new students in all categories refer to the current academic year (2013-2014).

We surveyed a total of 266 Ph.D.-granting departments, of which 179 responded for a response rate of 67 percent. This is lower than last year's 70 percent. The response rate for U.S. CS departments, by far the largest category, dropped from 80 percent last year to 77 percent this year. Response rates are inexact because some departments provide only partial data, and some institutions provide a single joint response for multiple departments. Thus, the number of departments shown as reporting student data may not equal the overall total number of respondents for that category of department. To account for changes in response rate, we will comment not only on aggregate totals but also on data from those departments who responded to both this year's and last year's surveys. This is a more accurate indication of the one-year changes affecting degree production and enrollments. Of the U.S. CS departments responding to this year's survey, 129 provided doctoral data in both years and 123 provided bachelor's data both years. Of the total departments responding to this year's survey, 159 provided doctoral data in both years and 146 provided bachelor's data in both years.

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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 until 1984, with retrospective annual data going back to 1970

2 Information (I) programs included here are Information Science, Information Systems, Information Technology, Informatics, and related disciplines with a strong computing component. Surveys were sent to CRA members, the CRA Deans group members, and participants in the iSchools Caucus (www.ischools.org) who met the criteria of granting Ph.D.s and being located in North America.

Table 1: Number of Respondents to the Taulbee Survey					
Year	US CS	US CE	Canadian	US I	Total
1995	110/133 (83%)	9/13 (69%)	11/16 (69%)		130/162 (80%)
1996	98/131 (75%)	8/13 (62%)	9/16 (56%)		115/160 (72%)
1997	111/133 (83%)	6/13 (46%)	13/17 (76%)		130/163 (80%)
1998	122/145 (84%)	7/19 (37%)	12/18 (67%)		141/182 (77%)
1999	132/156 (85%)	5/24 (21%)	19/23 (83%)		156/203 (77%)
2000	148/163 (91%)	6/28 (21%)	19/23 (83%)		173/214 (81%)
2001	142/164 (87%)	8/28 (29%)	23/23 (100%)		173/215 (80%)
2002	150/170 (88%)	10/28 (36%)	22/27 (82%)		182/225 (80%)
2003	148/170 (87%)	6/28 (21%)	19/27 (70%)		173/225 (77%)
2004	158/172 (92%)	10/30 (33%)	21/27 (78%)		189/229 (83%)
2005	156/174 (90%)	10/31 (32%)	22/27 (81%)		188/232 (81%)
2006	156/175 (89%)	12/33 (36%)	20/28 (71%)		188/235 (80%)
2007	155/176 (88%)	10/30 (33%)	21/28 (75%)		186/234 (79%)
2008	151/183 (83%)	12/32 (38%)	20/30 (67%)	9/19 (47%)	192/264 (73%)
2009	147/184 (80%)	13/31 (42%)	16/30 (53%)	12/20 (60%)	188/265 (71%)
2010	150/184 (82%)	12/30 (40%)	18/29 (62%)	15/22 (68%)	195/265 (74%)
2011	142/185 (77%)	13/31 (42%)	13/30 (43%)	16/21 (76%)	184/267 (69%)
2012	152/189 (80%)	11/32 (34%)	14/30 (47%)	16/26 (62%)	193/277 (70%)
2013	144/188 (77%)	10/30 (33%)	14/26 (54%)	11/22 (50%)	179/266 (67%)

Bachelor's Degree Production and Enrollments

After three straight years of double-digit percentage increases, bachelor's degree production increased by a smaller amount from 2011-12. When comparing all departments reporting this year to all departments reporting last year, there was an increase of only 1.2 percent, but this largely is due to the decreased response rate. If only those departments who reported both years are counted, the increase was 7.8 percent. In U.S. computer science departments there was a 3.7 percent increase overall but a 9.4 percent increase among those departments that reported both years.

Figure 1. Average CS majors per U.S. CS Department
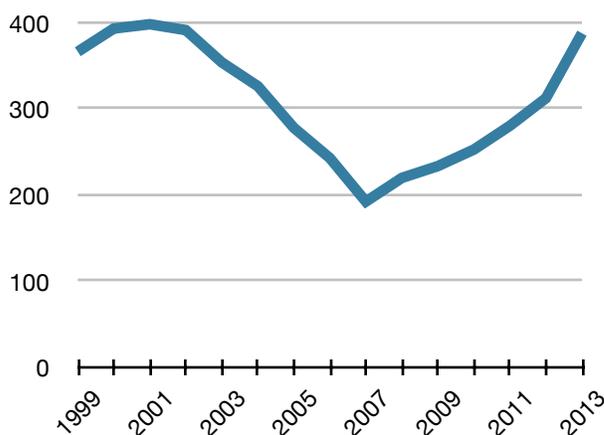
Source: Table 6: Total Bachelor's Enrollment by Department Type

The smaller growth in 2012-13 degree production might have been predicted by the fact that the Taulbee Survey reported very little change in the number of new CS majors among U.S. CS departments between fall 2009 and fall 2010. CS students in the U.S. CS departments comprise well over half of the total bachelor's students reported in the survey, and it takes about three years to graduate a typical newly declared major. Yet even with relatively flat new enrollment three years earlier, we see reasonable growth in degree production now; only in U.S. I departments is there evidence of no degree increase once response rate is taken into account. The much larger increases observed in new enrollment since 2010 bode well for future increases in undergraduate computing degree production.

The number of new undergraduate computing majors rose for the sixth straight year. Even with the reduced response rate, the total number of new undergraduate majors rose 4.9 percent when all respondents are compared, and rose 13.8 percent among those departments reporting both this year and last year. Among U.S. computer science departments, the increase was 1.8 percent overall and 13.7 percent among departments reporting both this year and last year. Total undergraduate enrollment in computing majors among U.S. CS departments increased 13.4 percent in aggregate, and 22.0 percent among departments reporting both this year and last year.

Figure 2. BS Production (All Departments)
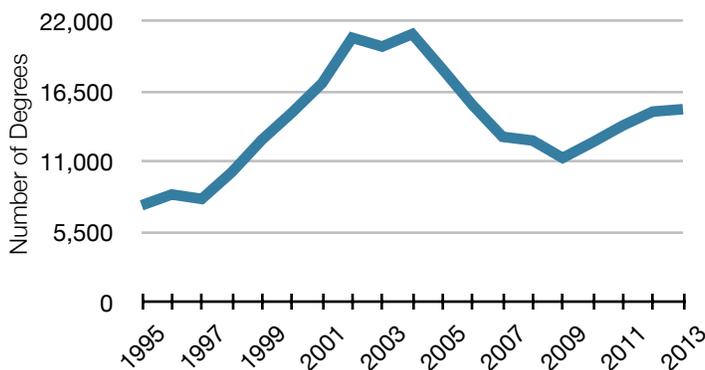
Source: Table 3: Bachelor's Degrees Awarded by Department Type

Aggregate total enrollment in CS, CE and I programs all increased. New student enrollment in computer science increased in Canadian departments and in U.S. CS private departments. New student enrollment in I programs decreased in all categories of U.S. departments. The changes in Canadian, CE and I departments are more volatile due to the small number of departments reporting in each of these areas.

When comparing the 2012-13 bachelor's degree data with that of 2010-11[3], we see that the fraction of women among bachelor's graduates increased in CS, from 11.7 percent in 2010-11 to 14.2 percent in 2012-13. There was a slight drop during this period in the fraction of women receiving CE and I degrees (from 11.8 percent to 11.6 percent in CE and 19.6 percent to 18.7 percent in I). The fraction of CS bachelor's degrees awarded to Whites declined from 66.9 percent in 2010-11 to 61.2 percent in 2012-13. Increases in the fraction of degrees awarded were present for Non-resident Aliens (7.0 percent to 8.3 percent), Asians (14.8 percent to 18.4 percent), and Hispanics (5.4 percent to 6.0 percent). Smaller increases were present among Black and Multiracial graduates. The direction of change was similar for I degrees with the exception of Asians, which declined slightly between 2010-11 and 2012-13. In CE, there was a big increase during this two-year period in the fraction of Asians receiving degrees, while the other major categories of ethnicity experienced declines. In aggregate across the three degree areas, 60.6 percent of the graduates were White, 18.8 percent Asian, 7.6 percent Non-resident Aliens, and 13.0 percent all other ethnicity categories combined.

Table 2. Degree Production and Enrollment Change From Previous Year

| | Total | | | | | | Only Departments Reporting Both Years | | | | | |
| | US CS Only | | | All Departments | | | US CS Only | | | All Departments | | |
PhDs	2012	2013	% chg	2012	2013	% chg	2012	2013	% chg	2012	2013	% chg
# Depts	149	135	-9.4%	186	168	-9.7%	129	129		159	159	
PhD Awarded	1,617	1,625	0.5%	1,929	1,991	3.2%	1,495	1,596	6.8%	1,777	1,917	7.9%
PhD Enrollment	13,208	12,100	-7.5%	15,648	14,638	-6.5%	12,121	11,977	-1.2%	14,316	14,117	-1.4%
New PhD Enroll	2,696	2,358	-12.5%	3,064	2,728	-11%	2,518	2,315	-8.1%	2,827	2,645	-6.4%
Bachelor's	2011	2012	% chg	2011	2012	% chg	2011	2012	% chg	2011	2012	% chg
# Depts	141	131	-7.1%	173	158	-8.7%	123	123		146	146	
BS Awarded	12,055	12,503	3.7%	14,901	15,087	1.2%	10,674	11,679	9.4%	13,094	14,112	7.8%
BS Enrollment	56,307	63,873	13.4%	67,850	77,653	14.4%	49,564	60,453	22%	59,867	72,487	21.1%
New BS Majors	17,041	17,348	1.8%	20,618	21,626	4.9%	14,175	16,122	13.7%	17,180	19,549	13.8%
BS Enroll/Dept	399.3	487.6	22.1%	392.2	491.5	25.3%	103.0	491.5	22%	410.0	496.5	21.1%

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[3] Normally, we would provide comparative data with 2011-12 about bachelor's degrees by gender and by ethnicity. However, this year we are unable to do so. When reviewing the bachelor's degree data reported this year and comparing it with last year's data, we observed unusual discrepancies that warranted further investigation. The investigation revealed that some departments reported their bachelor's degree data inaccurately last year. We were able to obtain corrected total 2011-12 bachelor's degrees for these departments, but did not obtain corrected 2011-12 gender and ethnicity data from them. Hence, comparisons against any bachelor's degree data by gender or ethnicity that was reported last year would be inappropriate. We caution our readers to not use the bachelor's degree data published in last year's Taulbee Survey articles. Table 2 reflects these corrections. Total enrollment and new student enrollment data, and master's and doctoral student degree data, were unaffected by these errors.

Table 3. Bachelor's Degrees Awarded by Department Type

Department Type	# Depts	CS		CE		I		Total	
US CS Public	97	7,175	66.6%	1,423	66%	998	46.3%	9,596	63.6%
US CS Private	34	2,274	21.1%	204	9.5%	429	19.9%	2,907	19.3%
Total US CS	131	9,449	87.7%	1,627	75.5%	1,427	66.2%	12,503	82.9%
US CE	7	0	0%	429	19.9%	0	0%	429	2.8%
US Info	7	160	1.5%	0	0%	702	32.6%	862	5.7%
Canadian	12	1,167	10.8%	99	4.6%	27	1.3%	1,293	8.6%
Grand Total	157	10,776		2,155		2,156		15,087	

Table 4. Bachelor's Degrees Awarded by Gender

	CS		CE		I		Total	
Male	9,116	85.8%	1,852	88.4%	1,747	81.3%	12,715	85.5%
Female	1,511	14.2%	243	11.6%	402	18.7%	2,156	14.5%
Total Known Gender	10,627		2,095		2,149		14,871	
Gender Unknown	149		60		7		216	
Grand Total	10,776		2,155		2,156		15,087	

Table 5. Bachelor's Degrees Awarded by Ethnicity

	CS		CE		I		Total	
Nonresident Alien	698	8.3%	130	7.7%	80	4.2%	908	7.6%
Amer Indian or Alaska Native	22	0.3%	5	0.3%	6	0.3%	33	0.3%
Asian	1,545	18.4%	446	26.3%	260	13.5%	2,251	18.8%
Black or African-American	322	3.8%	67	3.9%	154	8%	543	4.5%
Native Hawaiian/Pac Islander	22	0.3%	7	0.4%	4	0.2%	33	0.3%
White	5,131	61.2%	922	54.3%	1,225	63.6%	7,278	60.6%
Multiracial, not Hispanic	141	1.7%	23	1.4%	17	0.9%	181	1.5%
Hispanic, any race	499	6%	98	5.8%	181	9.4%	778	6.5%
Total Residency & Ethnicity Known	8,380		1,698		1,927		12,005	
Resident, ethnicity unknown	498		86		81		665	
Residency unknown	1,898		371		148		2,417	
Grand Total	10,776		2,155		2,156		15,087	

| Table 6. Total Bachelor's Enrollment by Department Type | | | | | | | | | | | | | | |
| Department Type | CS | | | | CE | | | | I | | | | Total | |
	Major	Pre-major	# Depts	Avg. Major per Dept.	Major	Pre-major	Total	Avg. Major per Dept.	Major	Pre-major	Total	Avg. Major per Dept.	Major	Avg. Major per Dept
US CS Public	38,564	7861	94	410.3	7,559	1633	31	243.8	4,540	479	26	174.6	50,663	539.0
US CS Private	10302	1634	32	321.9	1,135	29	10	113.5	1,862	0	5	372.4	13,210	412.8
US CS Total	48,866	9495	126	387.8	8,694	1662	41	212.0	5,674	369	28	202.6	63,873	506.9
US CE	0	0	0	0.0	1,820	499	9	202.2	0	0	0	0.0	1,820	303.3
US Information	857	80	0	0.0	0	0	0	0.0	2,553	653	9	283.7	2,699	385.6
Canadian	8352	300	13	642.5	319	0	2	159.5	0	40	0	0.0	9,261	712.4
Grand Total	58,075	9,875	139	417.8	10,833	2,161	52	208.3	8,227	1,062	37	222.4	77,653	510.9

Master's Degree Production and Enrollments

On a per-department basis, master's degree production in CS remained constant in 2012-13. However, there was increased production among U.S. private departments, while U.S. public departments had a decrease in production. Overall production of master's degrees in the information area rose in 2012-13. Both U.S. pubic and U.S. private CS departments reported substantial increases in the number of information Master's degrees produced, while information departments reported decreased production of information master's degrees.

The proportion of female graduates among both computer science and information master's degree recipients decreased in 2012-13. In CS, the decrease was from 22.6 percent to 21.2 percent, while in the information area the decrease was from 51.7 percent to 47.1 percent. In both CS and information, a higher fraction of the master's recipients were Non-resident Aliens in 2012-13 as compared with 2011-12. In CS, 65 percent of the master's degrees went to Non-resident Aliens, compared with 62.3 percent in 2011-12. In the information area, the corresponding percentages were 21.9 in 2012-13 and 19.8 in 2011-12. In both CS and I, the fraction of master's degrees going to resident Asians also rose.

Again this fall, there were large increases in the number of new master's students enrolled in both U.S. CS public and U.S. CS private departments. Considerable increases at both types of U.S. CS departments exist not only for CS master's programs but also for I programs in these departments. Information departments also reported larger numbers of new master's students in their I programs, on average. These increases should be reflected in degree production statistics in the very near future.

Roughly two-thirds of the new master's students in U.S.CS departments (whether public or private), and in CE and Canadian departments, are reported to be from outside North America. This is an increase of about seven percentage points over last year's reported numbers. In the information area, the fraction of new master's students is slightly over one-third, but that also is an increase of nearly seven percentage points over last year's figure. The entire increase in overall numbers of new CS and I master's students can be accounted for by the increased number of non-North American students.

Table 7. Master's Degrees Awarded by Department Type										
Department Type	# Depts	CS		CE		I		Total		
US CS Public	98	3,855	53.5%	260	35.0%	832	35.0%	4,947	47.9%	
US CS Private	34	2,845	39.5%	65	8.8%	439	18.5%	3,349	32.4%	
Total US CS	132	6,700	93.0%	325	43.8%	1271	53.4%	8,296	80.3%	
US CE	8	0	0.0%	304	41.0%	0	0.0%	304	2.9%	
US Info	8	34	0.5%	0	0.0%	927	39.0%	961	9.3%	
Canadian	15	471	6.5%	113	15.2%	181	7.6%	765	7.4%	
Grand Total	163	7,205		742		2,379		10,326		

Table 8. Master's Degrees Awarded by Gender

	CS		CE		I		Total	
Male	5,629	78.8%	543	75.6%	1226	52.9%	7,398	72.7%
Female	1,518	21.2%	175	24.4%	1092	47.1%	2,785	27.3%
Total Known Gender	7,147		718		2,318		10,183	
Gender Unknown	58		24		61		143	
Grand Total	7,205		742		2,379		10,326	

Table 9. Master's Degrees Awarded by Ethnicity

	CS		CE		I		Total	
Nonresident Alien	4,245	65.0%	434	66.7%	448	24.9%	5,127	57.1%
Amer Indian or Alaska Native	9	0.1%	3	0.5%	4	0.2%	16	0.2%
Asian	556	8.5%	53	8.1%	199	11.1%	808	9.0%
Black or African-American	65	1.0%	7	1.1%	106	5.9%	178	2.0%
Native Hawaiian/Pac Island	4	0.1%	0	0.0%	4	0.2%	8	0.1%
White	1521	23.3%	137	21.0%	934	51.9%	2,592	28.9%
Multiracial, not Hispanic	54	0.8%	6	0.9%	29	1.6%	89	1.0%
Hispanic, any race	78	1.2%	11	1.7%	76	4.2%	165	1.8%
Total Residency & Ethnicity Known	6,532		651		1,800		8,983	
Resident, ethnicity unknown	246		84		134		464	
Residency unknown	427		7		445		879	
Grand Total	7,205		742		2,379		10,326	

Table 10. Total Master's Enrollment by Department Type

Department Type	CS			CE			I			Total		
	Total	# Depts	Avg / Dept	Total	# Depts	Avg / Dept	Total	# Dept	Avg / Dept	Total	# Dept	Avg / Dept
US CS Public	8,162	95	85.9	668	18	37.1	1,379	14	98.5	10,209	95	107.5
US CS Private	6,010	32	187.8	129	6	21.5	2,011	7	287.3	8,150	32	254.7
Total US CS	14,172	127	111.6	797	24	33.2	3,390	21	161.4	18,359	127	144.6
US CE	0	0		1023	8	127.9	0	0		1,023	8	127.9
US Info	85	1		0	0		2,108	8	263.5	2,193	8	274.1
Canadian	1,664	13	128.0	131	2	65.5	72	1		1,867	13	143.6
Grand Total	15,921	141	112.9	1,951	34	57.4	5,570	30	185.7	23,442	156	150.3

Ph.D. Degree Production, Enrollments and Employment

For the second straight year, overall Ph.D. production in computing programs reported by the Taulbee Survey reached an all-time high, with 1,991 degrees granted. This surpasses last year's total of 1,929, representing a 3.2 percent increase. Since this year fewer departments responded to the survey, the actual increase likely is even greater. Indeed, among all departments reporting both this year and last year, the number of total doctoral degrees increased by 7.9 percent. In U.S. CS departments, overall Ph.D. production was up 6.8 percent among those departments reporting both years. Women comprised 17.2 percent of CS doctoral graduates and 18 percent of all doctoral computing graduates, both values being slightly lower than last year. The fraction of (CS and overall) doctoral degrees that went to Non-resident Aliens continues to grow, reaching over 58 percent this year, both in CS and overall.

Figure 3. Total Ph.D. Production (CS & CE, US and Canada)
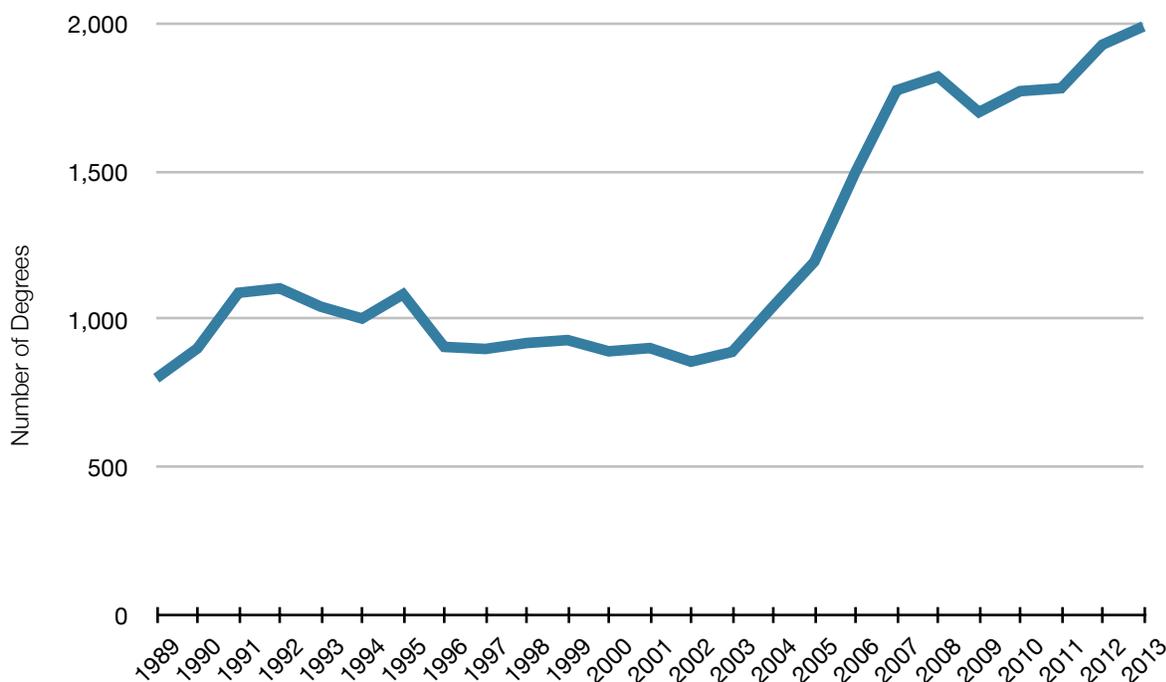
Source: Table 11: PhD Production and Pipeline by Department Type

The number of new Ph.D. students decreased compared with last year. Among all departments that reported both years, the number of new Ph.D. students declined 6.4 percent. If only U.S. CS departments that reported both years are considered, the decline was 8.1 percent. There was an increase again this year in the proportion of new doctoral students from outside North America. This year's proportion is 60.2 percent while last year's was 57.4 percent. U.S. public CS departments and I departments had increases, while Canadian departments had a decline, and U.S. CE and U.S. private CS departments had slight declines.

Artificial intelligence, networking and software engineering, in that order, were the most popular areas of specialization for doctoral graduates. Databases, and theory and algorithms were the next most popular areas. These five areas have been the most popular for the past few years.

The fraction of new 2012-13 Ph.D.s who took positions in North American industry was 55.5 percent, the same fraction as for new 2011-12 doctoral graduates. A somewhat higher fraction (30.6 percent) of graduates took North American academic jobs in 2012-13 as compared with 2011-12 (28.9 percent). The fraction taking tenure-track positions in North American doctoral-granting computing departments rose to 7.7 percent in 2012-13 from a 2011-12 level of 6.6 percent. The fraction taking positions in North American non-Ph.D.-granting computing departments dropped again, to 2.1 percent in 2012-13 from 2.5 percent in 2011-12. The fraction taking North American academic postdoctoral positions rose to 14.9 percent from last year's survey's value of 13.4 percent.

The unemployment rate for new Ph.D.s was 0.8 percent, compared to 0.4 percent in last year's survey. The proportion of Ph.D. graduates who were reported taking positions outside of North America, among those whose employment is known, declined once again. This year only 8.2 percent were reported to have taken positions outside of North America, while last year it was 9.1 percent. As was the case in last year's survey, about 1/3 of those employed outside of North America went to industry. About 27 percent of those employed outside of North America went to tenure-track positions in doctoral-granting departments and another 15 percent went to academic postdoctoral positions this year. Last year there was a smaller percentage of these persons who went to tenure-track positions and a larger percentage who went to postdoctoral positions.

Table 11. PhD Production and Pipeline by Department Type

Department Type	# Depts	PhDs Awarded		PhDs Next Year		Passed Qualifier		Passed Thesis (if dept has)		
		#	Avg/ Dept	#	Avg/ Dept	#	Avg/ Dept	#	# Dept	Avg/ Dept
US CS Public	105	1,230	11.7	1,339	12.8	1,300	12.4	955	81	11.8
US CS Private	36	395	11.0	446	12.4	401	11.1	210	24	8.8
US CS Total	141	1,625	11.5	1,785	12.7	1,701	12.1	1,165	105	11.1
US CE	9	92	10.2	120	13.3	95	10.6	202	7	28.9
US Info	10	65	6.5	71	7.1	54	5.4	56	7	8.0
Canadian	15	209	13.9	195	13.0	221	14.7	128	10	12.8
Grand Total	175	1,991	11.4	2,171	12.4	2,071	11.8	1,551	129	12.0

Table 12. PhDs Awarded by Gender

	CS		CE		I		Total	
Male	1,292	82.8%	183	88.8%	71	60.2%	1,546	82.0%
Female	269	17.2%	23	11.2%	47	39.8%	339	18.0%
Total Known Gender	1,561		206		118		1,885	
Gender Unknown	92		12		2		106	
Grand Total	1,653		218		120		1,991	

Table 13. PhDs Awarded by Ethnicity	CS		CE		I		Total	
Nonresident Alien	840	58.7%	132	66.0%	43	39.4%	1,015	58.3%
Amer Indian or Alaska Native	3	0.2%	0	0.0%	0	0.0%	3	0.2%
Asian	136	9.5%	14	7.0%	15	13.8%	165	9.5%
Black or African-American	22	1.5%	0	0.0%	2	1.8%	24	1.4%
Native Hawaiian/Pac Islander	3	0.2%	0	0.0%	0	0.0%	3	0.2%
White	406	28.4%	52	26.0%	47	43.1%	505	29.0%
Multiracial, not Hispanic	2	0.1%	0	0.0%	0	0.0%	2	0.1%
Hispanic, any race	20	1.4%	2	1.0%	2	1.8%	24	1.4%
Total Residency & Ethnicity Known	1,432		200		109		1,741	
Resident, ethnicity unknown	106		16		2		124	
Residency unknown	115		2		9		126	
Grand Total	1,653		218		120		1,991	

Table 14. Employment of New PhD Recipients By Specialty

	Artificial Intelligence	Computer-Supported Cooperative Work	Databases / Information Retrieval	Graphics/Visualization	Hardware/Architecture	Human-Computer Interaction	High-Performance Computing	Informatics: Biomedical/Other Science	Information Assurance/Security	Information Science	Information Systems	Networks	Operating Systems	Programming Languages/Compilers	Robotics/Vision	Scientific/Numerical Computing	Social Computing/Social Informatics	Software Engineering	Theory and Algorithms	Other	Total	
North American PhD Granting Depts.																						
Tenure-track	6	0	14	6	7	8	1	6	8	11	5	13	2	4	2	0	4	10	4	10	121	7.7%
Researcher	4	1	3	4	1	3	1	2	1	0	1	5	1	0	2	2	1	5	2	7	46	2.9%
Postdoc	33	2	14	16	4	8	6	23	9	2	0	15	3	7	18	3	1	9	27	35	235	14.9%
Teaching Faculty	5	0	3	1	1	2	0	0	3	2	0	6	1	3	1	2	0	8	3	7	48	3.0%
North American, Other Academic																						
Other CS/CE/I Dept.	3	2	0	4	0	4	1	1	2	2	1	2	0	1	0	2	0	5	1	2	33	2.1%
Non-CS/CE/I Dept																						
North American, Non-Academic																						
Industry	74	6	62	42	53	31	37	21	27	14	17	77	42	34	34	15	12	83	44	151	876	55.5%
Government	7	0	2	3	2	3	7	4	5	1	0	1	0	1	2	2	0	1	0	5	46	2.9%
Self-Employed	5	0	3	2	0	1	0	0	1	1	0	1	1	0	0	0	1	1	0	4	21	1.3%
Unemployed	1	0	2	0	0	1	0	0	0	1	0	2	1	0	0	1	0	1	0	2	12	0.8%
Other	0	0	0	0	0	0	0	0	0	3	0	1	0	1	0	0	0	0	0	4	9	0.6%
Total Inside North America	138	11	103	78	68	61	53	57	56	37	24	123	51	51	59	27	19	123	81	227	1,447	91.8%

Table 14. Employment of New PhD Recipients By Specialty (Continued)

	Artificial Intelligence	Computer-Supported Cooperative Work	Databases / Information Retrieval	Graphics/Visualization	Hardware/Architecture	Human-Computer Interaction	High-Performance Computing	Informatics: Biomedical / Other Science	Information Assurance/Security	Information Science	Information Systems	Networks	Operating Systems	Programming Languages/ Compilers	Robotics/Vision	Scientific/ Numerical Computing	Social Computing/ Social Informatics	Software Engineering	Theory and Algorithms	Other	Total	
Outside North America																						
Ten-Track in PhD	1	0	1	1	2	1	0	1	3	0	1	3	2	1	1	0	0	7	5	5	35	2.2%
Researcher in PhD	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	4	0.3%
Postdoc in PhD	4	0	0	0	0	1	1	1	1	0	0	0	0	3	1	0	0	0	6	0	19	1.2%
Teaching in PhD	0	0	1	2	1	0	0	1	1	1	1	2	0	0	0	0	0	0	1	1	12	0.8%
Other Academic	1	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	2	2	8	0.5%
Industry	6	0	4	2	2	1	2	0	0	0	0	7	0	0	2	0	1	4	3	8	42	2.7%
Government	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	4	0.3%
Other	0	1	0	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	1	6	0.4%
Total Outside NA	12	2	7	5	6	4	4	5	6	2	3	14	2	4	4	0	2	11	17	20	130	8.2%
Total with Employment Data, Inside North America plus Outside North America																						
	150	13	110	83	74	65	57	62	62	39	27	137	53	55	63	27	21	134	98	247	1,577	
Employment Type & Location Unknown																						
	21	4	15	16	17	16	3	12	15	6	3	15	2	3	13	2	4	6	13	228	414	
Grand Total	171	17	125	99	91	81	60	74	77	45	30	152	55	58	76	29	25	140	111	475	1,991	

Concluding Observations

Undergraduate students continue to flock to computing majors, putting increased teaching pressure on the faculty and demonstrating the recognition of computing as a valuable career choice. For the first time in four years, the fraction of doctoral graduates who took tenure-track positions at doctoral-granting departments rose, albeit by a very modest amount. Industry's ability to employ the lion's share of doctoral graduates is impressive, and most of those taking industry positions go into some kind of research position. There seems to be ample and diverse opportunity for doctoral graduates to pursue their chosen field.

Participating Schools

U.S. CS Public (105 departments): Arizona State, Auburn , Clemson, College of William & Mary, Colorado School of Mines, Colorado State, Florida International, Florida State, George Mason, Georgia Tech, Indiana, Iowa State, Kansas State, Kent State, Louisiana State, Michigan State, Michigan Technological University, Mississippi State, Missouri Science & Technology, Montana State, Naval Postgraduate School, New Mexico State, North Carolina State, North Dakota State, Ohio State, Ohio, Oklahoma State, Old Dominion, Oregon State, Pennsylvania State, Portland State, Purdue, Southern Illinois (Carbondale), Stony Brook (SUNY), Temple, Texas A&M, Texas Tech, Universities at Albany and Buffalo (SUNY), Universities of: Alabama (Birmingham and Tuscaloosa), Arizona, Arkansas, Arkansas at Little Rock, California (Berkeley, Davis, Irvine, Los Angeles, Riverside, San Diego, Santa Barbara, and Santa Cruz), Central Florida, Colorado (Boulder), Connecticut , Delaware, Florida, Georgia , Hawaii, Houston, Idaho, Illinois (Chicago and Urbana Champaign), Iowa, Kansas, Kentucky, Louisiana at Lafayette, Maryland (College Park and Baltimore County), Massachusetts (Amherst and Boston), Michigan, Minnesota, Mississippi, Missouri (Columbia), Nebraska (Omaha and Lincoln), Nevada (Las Vegas and Reno), New Hampshire, New Mexico, North Carolina (Chapel Hill and Charlotte), North Texas, Oklahoma, Oregon, Pittsburgh, Rhode Island, South Carolina, South Florida, Tennessee (Knoxville), Texas (Austin, Dallas, and El Paso), Utah, Vermont, Virginia, Washington, Wisconsin (Madison and Milwaukee), Wyoming , Virginia Tech, Washington State, Western Michigan, and Wright State

U.S. CS Private (37 departments): Boston University, Brown, Carnegie Mellon, Case Western Reserve, Columbia, Cornell, Dartmouth, DePaul, Drexel, Duke, Florida Institute of Technology, Harvard, Illinois Institute of Technology, Johns Hopkins, Lehigh, MIT, New York University, Northeastern, Pace, Polytechnic, Princeton, Rensselaer, Rice, Rochester Institute of Technology, Stanford, Stevens Institute of Technology, Toyota Technological Institute at Chicago, Tufts, Universities of: Chicago, Notre Dame, Pennsylvania, Rochester, Southern California, and Tulsa, Washington in St. Louis, Worcester Polytechnic Institute, and Yale

U.S. Computer Engineering (10 departments): Florida Institute of Technology, North Carolina State, Princeton, Purdue, Santa Clara, Universities of: Illinois (Urbana Champaign), Iowa, New Mexico , and Southern California, Virginia Tech

U.S. Information Programs (13 departments): Cornell, Drexel, Indiana, Penn State, Purdue (IT), Syracuse, University at Albany (SUNY), Universities of: California (Berkeley), Maryland (Baltimore County), Michigan, North Carolina (Chapel Hill), Pittsburgh, and Washington.

Canadian (14 departments): Concordia, Dalhousie, McGill, Memorial University of Newfoundland, Simon Fraser, Universities of: Alberta, British Columbia, Calgary, Manitoba, Ottawa , Toronto, Victoria, and Waterloo, and York University.

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