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2014 Taulbee Survey

Relentless Growth in Undergraduate CS Enrollment; Doctoral Degree Production Remains Strong, But No New Record

By Stuart Zweben and Betsy Bizot

This article and the accompanying figures and tables present the results from the 44th annual CRA Taulbee Survey[1]. The survey, conducted annually by the Computing Research Association, documents 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.

CRA gathers survey data during the fall. Responses received by January 26, 2015 are included in the analysis. The period covered by the data varies from table to table. Degree production and enrollment (Ph.D., Master's, and Bachelor's) refer to the previous academic year (2013-14). Data for new students in all categories refer to the current academic year (2014-15). Projected student production and information on faculty salaries are also for the current academic year; salaries are those effective January 1, 2015.

We surveyed a total of 268 Ph.D.-granting departments; 181 completed the online survey form, for a response rate of 68 percent. This is similar to last year's 67 percent. The response rate from the U.S. CS departments was 76 percent this year, similar to the 77 percent rate of last year. We had an improved response rate from I departments, to 68 percent from 50 percent last year. The response rates from CE and Canadian departments continue to be rather low. Figure 1 shows the

Figure 1. Number of Respondents to the Taulbee Survey

Year	US CS Depts.	US CE Depts.	Canadian	US Information	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	151/181 (83%)	12/32 (38%)	20/30 (67%)	9/19 (47%)	192/264 (73%)
2009	147/184 (80%)	13/31 (42%)	16/30 (53.3%)	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%)
2014	143/188 (76%)	13/31 (42%)	12/26 (46%)	13/19 (68%)	181/268 (68%)

history of response rates to the survey. Response rates are inexact because some departments provide only partial data, and some institutions provide a single joint response for multiple departments. Thus, in some tables the number of departments shown as reporting will not equal the overall total number of respondents shown in Figure 1 for that category of department.

To account for the changes in response rate, we will comment not only on aggregate totals but also on averages per department reporting or data from those departments that responded to both this year's and last year's surveys. This is a more accurate indication of the one-year changes affecting the data.

Departments that responded to the survey were sent preliminary results about faculty salaries in December 2014; these results included additional distributional information not contained in this report. The CRA Board views this as a benefit of participating in the survey.

Degree, enrollment and faculty salary data for the U.S CS departments are stratified according to a) whether the institution is public or private, and b) the tenure-track faculty size of the reporting department. The faculty size strata deliberately overlap, so that data from most departments affect multiple strata. This may be especially useful to departments near the boundary of one stratum. Salary data also is stratified according to the population of the locale in which the institution is located.[3] These stratifications allow our readers to see multiple views of important data, and hopefully gain new insights from them. In addition to tabular presentations of data, we will use "box and whisker" diagrams to show medians, quartiles, and the range between the 10th and 90th percentile data points.

This year marks our first use of the new hosting platform for the survey using software by Peerfocus. The new environment affords increased security and data validation capabilities, and will soon provide the ability for CRA member respondents to select obtain certain survey information for a self-selected peer group.

We thank all respondents to this year's questionnaire. Departments that participated are listed at the end of this article.

Doctoral Degree Production, Enrollments and Employment

(Tables D1-D10; Figures D1-D6)

After two straight years of record Ph.D. production, the number of doctoral degrees produced by the reporting departments declined 2.6 percent, from 1,991 to 1,940. Among all departments reporting both this year and last year, the number of total doctoral degrees declined by 4.1 percent, and among U.S. CS departments reporting both years, the decline was 3.7 percent. An examination of the data by area of computing shows that the entire aggregate decline in degrees produced is in the computer engineering area. The number of CS doctoral degrees produced was steady (1,651 by departments reporting this year vs. 1,653 by departments reporting last year), and the number of I degrees increased (154 vs. 120). The CE and I numbers are strongly influenced by the specific departments responding in

Table D1. 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	96	1,228	12.3	1,298	13.5	1,290	14.2	1,027	80	11.8
US CS Private	34	378	11.1	487	14.3	414	12.9	214	24	8.8
US CS Total	130	1,606	12.0	1,785	13.7	1,704	13.9	1,241	104	11.1
US CE	10	90	9.0	117	11.7	215	19.5	136	7	28.9
US Info	13	98	8.2	89	6.8	103	7.9	65	10	8.0
Canadian	12	146	13.3	168	14.0	107	10.7	91	9	12.8
Grand Total	165	1,940	11.6	2,159	13.1	2,129	13.6	1,533	130	12.0

a given year, since we receive data from only a small number of these departments.

Women comprised 17.6 percent of CS doctoral graduates and 18.9 percent of all doctoral computing graduates, both values being slightly higher than those reported last year. The fraction of CS doctoral degrees that went to Non-resident Aliens was 60.1 percent, up from 58.7 percent, while the fraction that went to resident Asians dropped a corresponding amount. Among I doctoral degrees, the fraction going to Non-resident Aliens and Whites both declined (each was 34.7 percent in 2013-14), while the fraction going to resident Asians, Blacks and Hispanics increased. However, the raw number of I degrees to Blacks and Hispanics is still in the single digits. Within CE, women comprised 11.9 percent of the 2013-14 graduates, up from 11.2 percent in 2012-13, and Non-resident Aliens comprised 77.9 percent of the graduates.

The fraction of doctoral graduates who were American Indian or Alaska Native, Black or African American, Native Hawaiian/ Pacific Islander, Hispanic, or Multiracial Non-Hispanic dropped to 2.6 percent from 3.4 percent in CS, and was 3.4 percent in aggregate across CS, CE and I (vs 3.3 percent in 2012-13). Within CS, Non-resident Aliens and Resident Asians comprised a higher percentage of the female doctoral graduates than they did male graduates, while Whites comprised a lower percentage of the female graduates as compared with male graduates (Table D9).

Among currently enrolled CS doctoral students whose ethnicity is known, we see the same direction of difference among Non-resident Aliens, Asians and Whites; Non-resident Aliens and Resident Asians comprise a higher percent of the enrolled women than they do the enrolled men, and Whites comprise a lower percentage of enrolled women. This is similar to the observations last year.

Among those pursuing I degrees, 56.5 percent of the men but only 49.1 percent of the women are Non-resident Aliens or Resident Asians. This is different from last year, when there

Table D2. PhDs Awarded by Gender

	CS		CE		I		Total	
Male	1,357	82.4%	119	88.1%	94	61.0%	1,570	81.1%
Female	290	17.6%	16	11.9%	60	39.0%	366	18.9%
Total Known Gender	1,647		135		154		1,936	
Gender Unknown	4		0		0		4	
Grand Total	1,651		135		154		1,940	

Table D3. PhDs Awarded by Ethnicity

	CS		CE		I		Total	
Nonresident Alien	910	60.1%	102	77.9%	50	34.7%	1,062	59.4%
Amer Indian or Alaska Native	2	0.1%	0	0.0%	1	0.7%	3	0.2%
Asian	123	8.1%	8	6.1%	29	20.1%	160	8.9%
Black or African-American	17	1.1%	2	1.5%	8	5.6%	27	1.5%
Native Hawaiian/Pac Islander	3	0.2%	1	0.8%	0	0.0%	4	0.2%
White	441	29.1%	16	12.2%	50	34.7%	507	28.3%
Multiracial, not Hispanic	5	0.3%	0	0.0%	2	1.4%	7	0.4%
Hispanic, any Race	13	0.9%	2	1.5%	4	2.8%	19	1.1%
Total Residency & Ethnicity Known	1,514		131		144		1,789	
Resident, Ethnicity Unknown	85		1		4		90	
Residency Unknown	52		3		6		61	
Grand Total	1,651		135		154		1,940	

Table D4. 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	10	0	10	7	4	4	4	2	4	10	4	11	3	5	5	1	4	11	2	18	119	7.6%
Researcher	8	0	2	1	3	0	2	2	2	0	0	3	7	1	2	0	0	3	3	3	42	2.7%
Postdoc	17	1	7	12	9	6	4	18	5	4	4	10	2	13	11	2	2	12	17	25	181	11.6%
Teaching Faculty	4	0	2	0	1	0	0	3	3	0	3	0	0	2	1	0	5	3	4	11	42	2.7%
North American, Other Academic																						
Other CS/CE/I Dept.	4	0	3	1	2	1	2	0	1	3	1	2	0	1	0	0	0	1	0	7	29	1.9%
Non-CS/CE/I Dept	0	0	1	0	0	0	0	0	1	7	0	0	0	0	0	0	0	1	0	2	12	0.8%
North American, Non-Academic																						
Industry	85	0	78	57	47	23	27	30	32	7	24	93	41	34	43	9	13	93	36	124	896	57.5%
Government	8	0	2	2	0	1	2	0	5	3	0	2	1	0	3	2	0	3	1	11	46	3.0%
Self-Employed	2	1	1	3	1	0	1	0	0	1	0	0	1	0	1	0	0	0	0	7	19	1.2%
Unemployed	0	0	0	0	1	0	0	0	2	1	0	1	0	0	3	0	0	2	0	1	11	0.7%
Other	1	0	2	0	3	0	1	2	0	0	0	2	0	0	0	0	0	1	0	2	14	0.9%
Total Inside North America																						
	139	2	108	83	71	35	43	57	55	36	36	124	55	56	69	14	24	130	63	211	1,411	90.6%
Outside North America																						
Ten-Track in PhD	4	0	2	3	2	0	2	1	3	3	2	5	0	0	1	0	1	3	0	6	38	2.4%
Researcher in PhD	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2	0.1%
Postdoc in PhD	3	0	4	2	0	0	0	5	0	0	0	0	0	1	0	0	0	1	8	5	29	1.9%
Teaching in PhD	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	2	0.1%
Other Academic	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	2	6	0.4%
Industry	2	0	7	2	2	1	0	2	4	0	3	8	5	1	3	0	1	2	5	6	54	3.5%
Government	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	2	6	0.4%
Self-Employed	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	3	0.2%
Unemployed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0.1%
Other	1	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	5	0.3%
Total Outside NA	10	0	15	7	4	4	3	8	7	5	5	17	6	2	5	1	3	6	15	24	147	9.4%
Total with Employment Data, Inside North America plus Outside North America																						
	149	2	123	90	75	39	46	65	62	41	41	141	61	58	74	15	27	136	78	235	1,558	
Employment Type & Location Unknown																						
	29	1	17	12	18	4	9	14	21	1	9	42	6	13	5	5	3	15	20	138	382	
Grand Total	**178**	**3**	**140**	**102**	**93**	**43**	**55**	**79**	**83**	**42**	**50**	**183**	**67**	**71**	**79**	**20**	**30**	**151**	**98**	**373**	**1,940**	

Table D4a. Detail of Industry Employment

	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	Unknown	Other	Total	
Inside North America																							
Research	52	0	39	28	29	13	13	11	14	4	5	42	18	15	22	4	4	31	13	23	39	419	46.8%
Non-Research	24	0	25	23	13	6	7	15	12	2	16	46	18	13	12	3	9	46	16	18	11	335	37.4%
Postdoctorate	3	0	1	2	1	0	1	2	0	0	2	1	0	2	4	0	0	0	2	7	0	28	3.1%
Type Not Specified	6	0	13	4	4	4	6	2	6	1	1	4	5	4	5	2	0	16	5	17	9	114	12.7%
Total Inside NA	85	0	78	57	47	23	27	30	32	7	24	93	41	34	43	9	13	93	36	65	59	896	
Outside North America																							
Research	3	0	3	2	2	0	2	0	0	0	0	3	0	0	1	0	0	3	2	5	0	33	61.1%
Non-Research	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	1	11	20.4%
Postdoctorate	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	5	9.3%
Type Not Specified	1	0	1	0	0	1	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	5	9.3%
Total Outside NA	6	0	4	2	2	1	2	0	0	0	0	7	0	0	2	0	1	4	3	5	1	54	

Table D5. New PhD Students by Department Type

	CS				CE				I				Total	
Department Type	**New Admit**	**MS to PhD**	**Total**	**Avg. per Dept.**	**New Admit**	**MS to PhD**	**Total**	**Avg. per Dept.**	**New Admit**	**MS to PhD**	**Total**	**Avg. per Dept.**	**Total**	**Avg. per Dept**
US CS Public	1,448	204	1,652	17.0	84	16	100	7.7	67	7	74	7.4	1,826	18.4
US CS Private	581	17	598	17.1	4	0	4	2.0	17	0	17	5.7	619	17.7
US CS Total	2,029	221	2,250	17.0	88	16	104	6.9	84	7	91	7.0	2,445	18.2
US CE	0	0	0	0.0	85	11	96	8.7	5	0	5	5.0	101	9.2
US Information	2	0	2	2.0	0	0	0	0.0	113	9	122	9.4	124	9.5
Canadian	125	25	150	12.5	0	0	0	0.0	0	0	0	0.0	150	12.5
Grand Total	2,156	246	2,402	16.6	173	27	200	7.7	202	16	218	8.1	2,820	16.6

Table D5a. New PhD Students from Outside North America

Department Type	CS	CE	I	Total New Outside	Total New	% outside North America
US CS Public	1,103	70	29	1,202	1,826	65.8%
US CS Private	347	5	1	353	619	57.0%
Total US CS	1,450	75	30	1,555	2,445	63.6%
US CE	0	67	1	68	101	67.3%
US Info	0	0	56	56	124	45.2%
Canadian	87	0	0	87	150	58.0%
Grand Total	1,537	142	87	1,766	2,820	62.6%

Table D6. PhD Enrollment by Department Type

Department Type	# Depts	CS		CE		I		Total	
US CS Public	100	8,697	66.2%	368	66.2%	405	66.2%	9,470	66.2%
US CS Private	35	2,923	24.2%	60	24.2%	180	24.2%	3,163	24.2%
Total US CS	135	11,620	90.3%	428	90.3%	585	90.3%	12,633	90.3%
US CE	11	0	0.1%	809	0.1%	12	0.1%	821	0.1%
US Info	13	28	0.2%	0	0.2%	651	0.2%	679	0.2%
Canadian	10	793	9.3%	0	9.3%	140	9.3%	933	9.3%
Grand Total	169	12,441		1,237		1,388		15,066	

Table D7. PhD Enrollment by Gender

	CS		CE		I		Total	
Male	9,952	81.3%	1,049	84.8%	871	62.8%	11,872	79.9%
Female	2,284	18.7%	188	15.2%	517	37.2%	2,989	20.1%
Total Known Gender	12,236		1,237		1,388		14,861	
Gender Unknown	205		0		0		205	
Grand Total	12,441		1,237		1,388		15,066	

Table D8. PhD Enrollment by Ethnicity

	CS		CE		I		Total	
Nonresident Alien	7,223	63.0%	814	66.6%	520	44.1%	8,557	61.7%
Amer Indian or Alaska Native	18	0.2%	1	0.1%	1	0.1%	20	0.1%
Asian	596	5.2%	109	8.9%	113	9.6%	818	5.9%
Black or African-American	152	1.3%	14	1.1%	81	6.9%	247	1.8%
Native Hawaiian/Pac Islander	8	0.1%	6	0.5%	6	0.5%	20	0.1%
White	3,209	28.0%	225	18.4%	408	34.6%	3,842	27.7%
Multiracial, not Hispanic	64	0.6%	24	2.0%	18	1.5%	106	0.8%
Hispanic, any Race	200	1.7%	30	2.5%	32	2.7%	262	1.9%
Total Known	11,470		1,223		1,179		13,872	
Resident, Ethnicity Unknown	494		12		184		690	
Residency Unknown	477		2		25		504	
Grand Total	12,441		1,237		1,388		15,066	

were no appreciable differences in the percentages with respect to gender. Similar to last year, there is no appreciable difference in the percentage of men vs the percentage of women among Whites pursuing I degrees. Among those pursuing CE doctoral degrees, 19.5 percent of the men but only 12.0 percent of the women are White, while 79.8 percent of the women but only 74.7 percent of the men are either Non-resident Aliens or Resident Asians.

The average number of students per department who passed qualifier exams during 2013-14 in U.S. CS departments is similar to that reported last year among both public and private departments. The average number per department who passed thesis candidacy exams (most, but not all, departments have such exams) also was similar to last year among both public and private departments (Table D1).

The number of new Ph.D. students at departments reporting this year increased slightly compared with the total from last year's reporting departments. This reflects increases in CS and I departments and a small decrease in CE departments.

Among all departments that reported both years, the number of new Ph.D. students increased 3.6 percent. If only U.S. CS departments that reported both years are considered, the increase was 4.7 percent. The proportion of new doctoral students from outside North America continues to increase. This year's proportion is 62.6 percent while last year's was 60.2 percent. U.S. CS departments (both public and private) and Canadian departments had increases, while U.S. CE and U.S. I departments had declines.

Among programs that reported both years, total doctoral enrollment increased 4.4 percent. If only U.S. computer science departments are considered, the increase was 3.9 percent. Total doctoral enrollment by gender is in about the same proportion reported last year (Table D7). The fraction of doctoral students who are not either Non-resident Aliens, Asian or White remains at below 5 percent (Table D8).

Figure D5 shows a graphical view of the Ph.D. pipeline for computer science programs. The data in this graph are normalized by the number of departments reporting. The graph

Table D9. PhDs Awarded by Gender and Ethnicity, From 175 Departments

	CS					CE					I					Ethnicity Totals	
	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Total	%
Nonresident Alien	739	169	2	59	65	89	13	0	77	87	29	21	0	34	36	1,062	59.4
Amer Indian or Alaska Native	2	0	0	0	0	0	0	0	0	0	0	1	0	0	2	3	0.2
Asian	95	28	0	8	11	7	1	0	6	7	18	11	0	21	19	160	8.9
Black or African-American	15	2	0	1	1	2	0	0	2	0	6	2	0	7	3	27	1.5
Native Hawaiian/ Pac Islander	2	1	0	0	0	1	0	0	1	0	0	0	0	0	0	4	0.2
White	384	57	0	31	22	15	1	0	13	7	27	23	0	32	39	507	28.3
Multiracial, not Hispanic	4	1	0	0	0	0	0	0	0	0	2	0	0	2	0	7	0.4
Hispanic, any Race	9	4	0	1	2	2	0	0	2	0	3	1	0	4	2	19	1.1
Total Res & Ethnicity Known	1,250	262	2	0	0	116	15	0			85	59	0			1,789	
Resident, Ethnicity Unknown	67	18	0			1	0	0			3	1	0			90	
Not Reported (N/R)	40	10	2			2	1	0			6	0	0			61	
Gender Totals	1,357	290	4			119	16	0			94	60	0			1,940	
%	82.4%	17.6%				88.1%	11.9%				61.0%	39.0%					

* % of M and % of F columns are the percent of that gender who are of the specified ethnicity, of those whose ethnicity is known

offsets the qualifier data by two years from the data for new students, and offsets the graduation data by five years from the data for new students. These data have been useful in estimating the timing of changes in production rates. The graph suggests that doctoral production will remain fairly steady during the next few years, though the departments are forecasting an increase in production during 2014-15.

Figure D6 shows the employment trend of new Ph.D.s in academia and industry, those taking employment outside of North America, and those going to academia who took positions in departments other than Ph.D.-granting CS/CE departments. Table D4 shows a more detailed breakdown of the employment data for new Ph.D.s. The fraction of new Ph.D.s who took positions in North American industry rose to an historic record of 57.5 percent in 2013-14, eclipsing the previous high of 56.6 percent set in 2007-08. Among those doctoral graduates who went to North American industry and for whom the type of industry position was known, about 56 percent took research positions. This is down from the 64 percent reported last year. This year, definitive data was provided for 87 percent of the graduates who went to industry, up from the 80 percent provided last year.

Only 27.3 percent of 2013-14 graduates took North American academic jobs, an all-time low since we began tracking this in 1989-90. In 2012-13 this figure was 30.6 percent. The fraction taking tenure-track positions in North American doctoral granting computing departments held fairly steady at 7.6 percent for 2013-14 graduates. The fraction taking positions in North American non-Ph.D.-granting computing departments dropped from 2.1 percent to 1.9 percent. The fraction taking North American academic postdoctoral positions dropped from 14.9 percent to 11.6 percent.

The proportion of Ph.D. graduates who were reported taking positions outside of North America, among those whose employment is known, rose to 9.4 percent from 8.2 percent for 2012-13 graduates. About 37 percent of those employed outside of North America went to industry (slightly higher than reported last year), about 26 percent went to tenure-track academic positions (about the same as reported last year) and almost 20 percent went to academic postdoctoral positions

Table D10. PhD Enrollment by Gender and Ethnicity, From 153 Departments Providing Breakdown Data

	CS					CE					I					Ethnicity Totals	
	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Total	%
Nonresident Alien	5,553	1,332	338	63	66	691	123	0	66	67	330	174	16	48	39	8,557	61.7%
Amer Indian or Alaska Native	15	3	0	0	0	1	0	0	0	0	0	1	0	0	0	20	0.1%
Asian	427	143	26	5	7	86	23	0	8	13	61	48	4	9	11	818	5.9%
Black or African-American	93	50	9	1	3	9	5	0	1	3	40	40	1	6	9	247	1.8%
Native Hawaiian/ Pac Islander	8	0	0	0	0	6	0	0	1	0	3	3	0	0	1	20	0.1%
White	2,569	462	178	29	23	203	22	0	20	12	238	157	13	34	35	3,842	27.7%
Multiracial, not Hispanic	53	8	3	1	0	16	8	0	2	4	6	11	1	1	2	106	0.8%
Hispanic, any Race	166	30	4	2	2	28	2	0	3	1	14	18	0	2	4	262	1.9%
Total Res & Ethnicity Known	8,884	2,028	558			1,040	183				692	452	35			13,872	
Resident, Ethnicity Unknown	373	98	23			8	4				131	48	5			690	
Not Reported (N/R)	695	158	0			1	1				48	17	0			504	
Gender Totals	9,952	2,284	205			1,049	188				871	517	0			15,066	
%	81.3%	18.7%				84.8%	15.2%				62.8%	37.2%					

* % of M and % of F columns are the percent of that gender who are of the specified ethnicity, of those whose ethnicity is known

Figure D1. PhD Production

CRA Taulbee Survey 2014

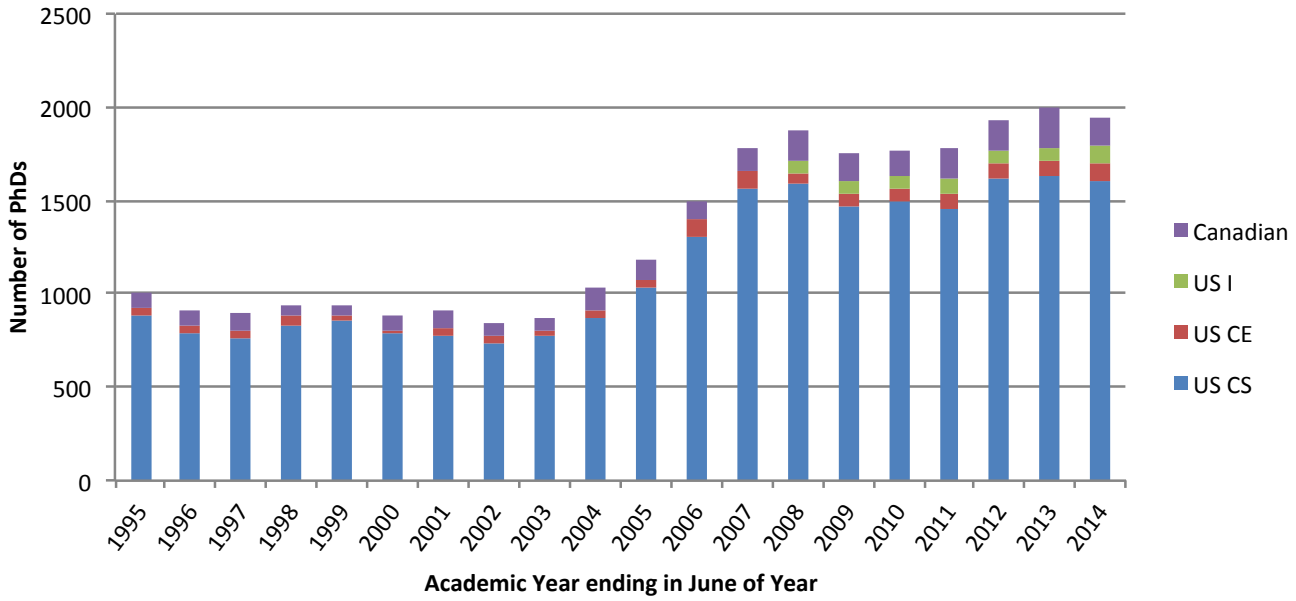


Figure D2. Nonresident Aliens as Fraction of PhD Enrollments

CRA Taulbee Survey 2014

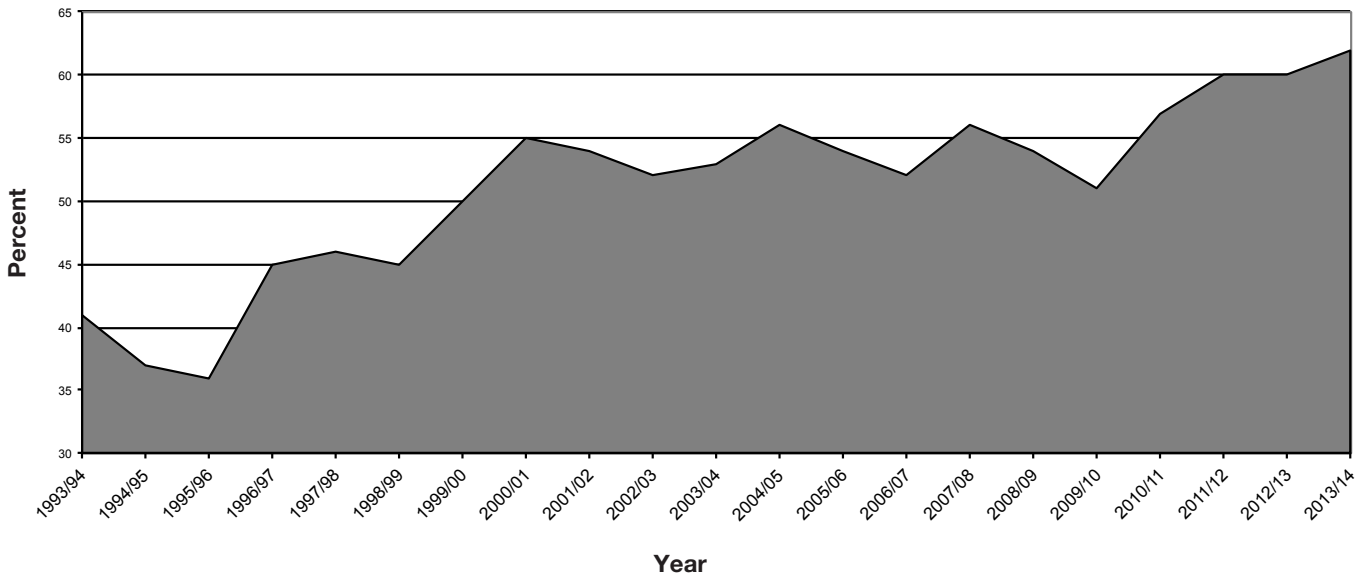


Figure D3. PhD Degrees Granted by Tenure-Track Size

CRA Taulbee Survey 2014

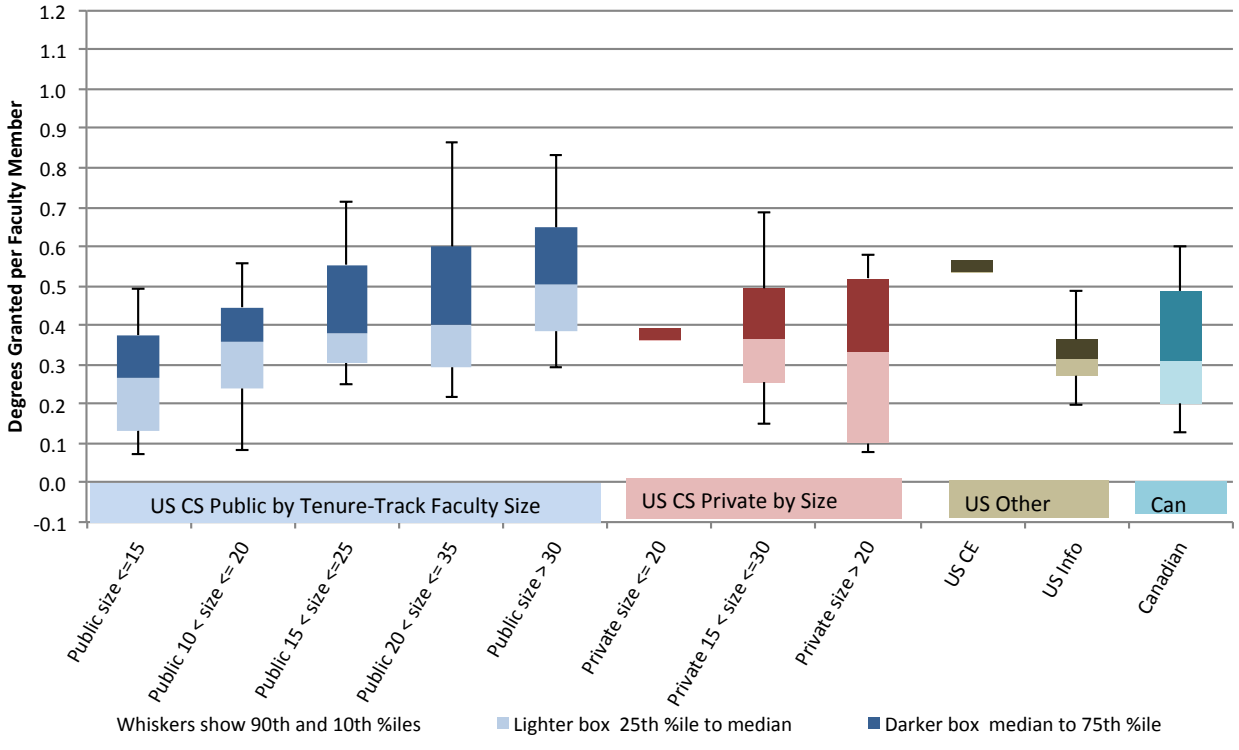
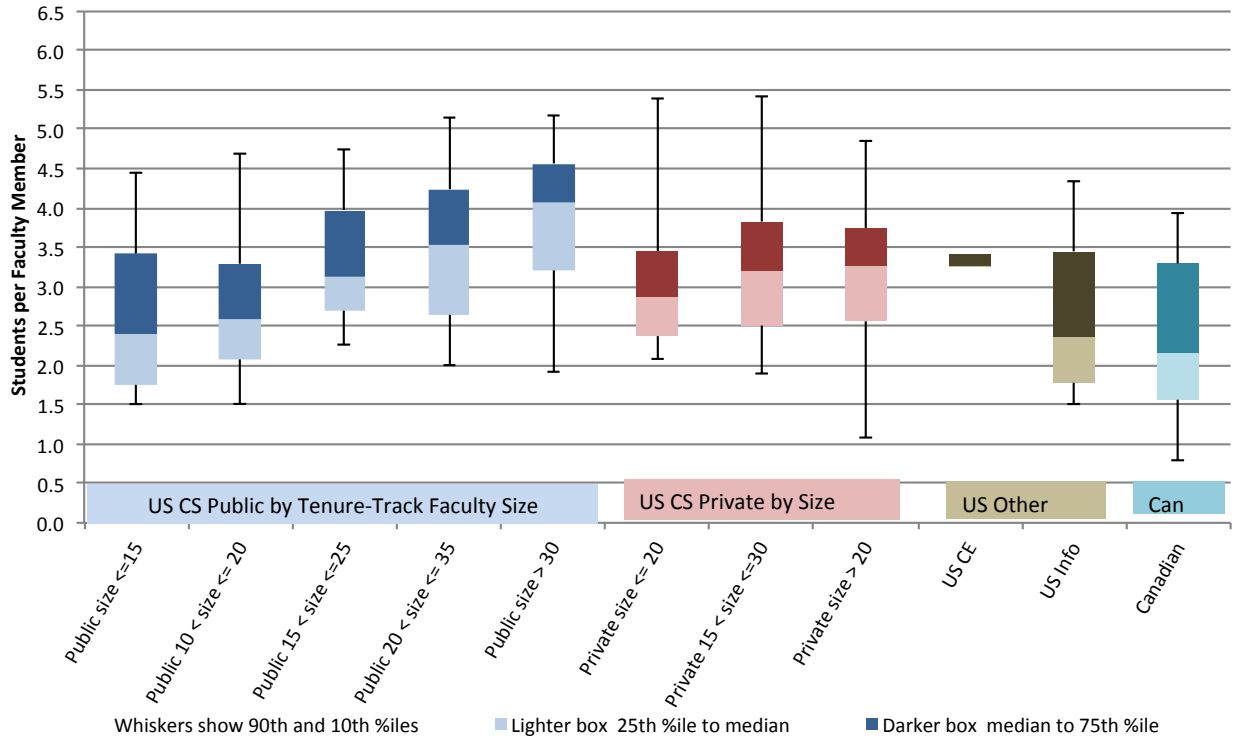


Figure D4. PhD Enrollment Normalized by Tenure-Track Size

CRA Taulbee Survey 2014



(a higher rate than reported last year). Of the doctoral graduates who went to non-North American industry positions, the positions were research by a three-to-one margin over those that were not research, the same ratio reported last year. Definitive data was provided for 91 percent of these graduates.

Employment in industry postdoctoral positions is included in the overall industry numbers. When academic and industry postdocs are combined, the result is that 15.6 percent of 2013-14 doctoral graduates took some type of postdoctoral position, down from 18.1 percent last year. Approximately 14 percent of these were industry postdocs, a slightly higher fraction than was reported last year.

The unemployment rate for new Ph.D.s again this year was below one percent. The fraction of new Ph.D.s whose employment status was unknown was 19.7 percent in 2013-14; in 2012-13 it was 20.8 percent. It is possible that the lack of information about the employment of more than one in six graduates skews the real overall percentages for certain employment categories.

Table D4 also indicates the areas of specialty of new Ph.D.s. Artificial intelligence, networking, software engineering and databases, in that order, continue to be the most popular areas of specialization for doctoral graduates.

Figure D5. CS Pipeline corrected for year of entry

CRA Taulbee Survey 2014

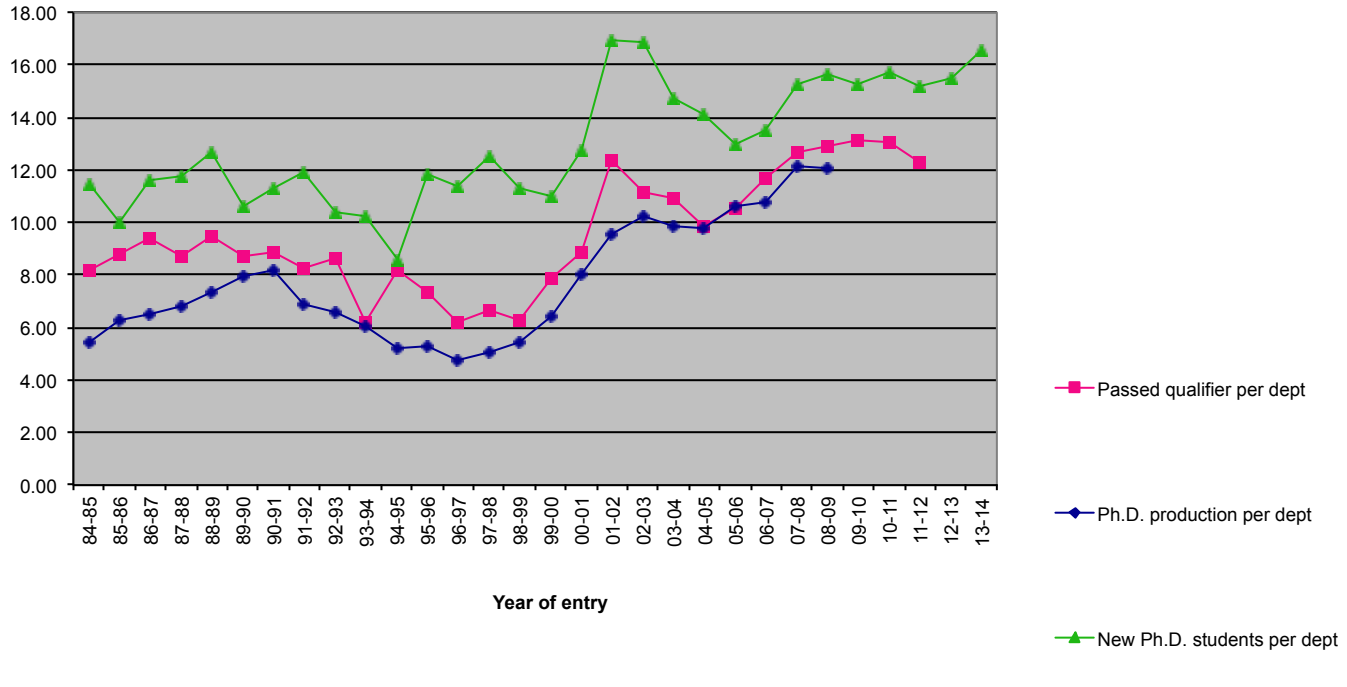
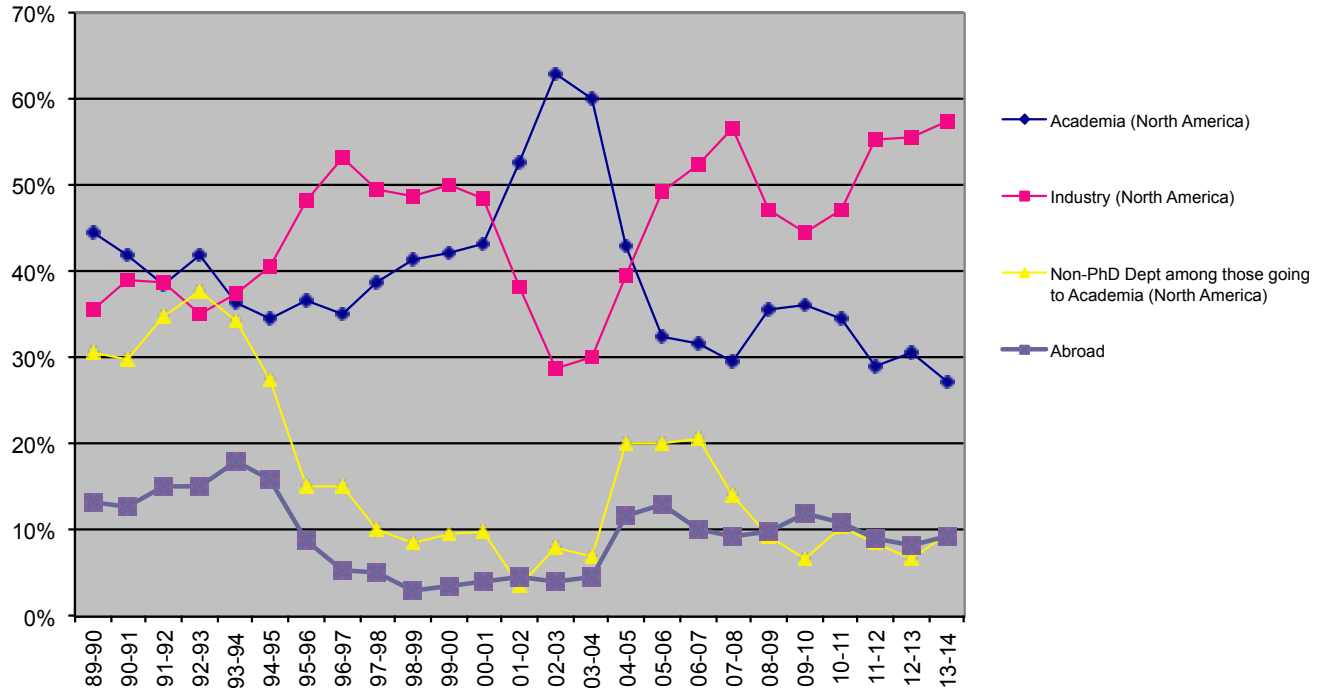


Figure D6. Employment of New Ph.D.s in U.S. and Canada

CRA Taulbee Survey 2014



Master's and Bachelor's Degree Production and Enrollments

This section reports data about enrollment and degree production for Master's and Bachelor's programs in the doctoral-granting departments. Although the absolute number of degrees and enrolled students reported herein only reflect departments that offer the doctoral degree, the trends observed in the master's and bachelor's data from these departments tend to strongly reflect trends in the larger population of programs that offer such degrees.

Master's (Tables M1-M8; Figures M1-M2)

On a per-department basis, master's degree production in CS remained fairly constant in 2013-14; this is the second year in a row that master's production held steady. However, this year there was increased production among U.S. public departments, while U.S. private departments had a decrease in production; this is the opposite of what took place last year.

Overall production of master's degrees in the information area rose in 2013-14, as it did the previous year. Both U.S. public and U.S. private CS departments reported decreases in the number of information Master's degrees produced, while I departments reported substantially increased production of information master's degrees. This, too, is the opposite of what took place last year, although the increased number of I departments responding this year likely influenced these results.

The proportion of female graduates among master's degree recipients remained fairly constant in all three computing areas (CS, CE and I). The range was from 22.0 percent in CS to 48.4 percent in I. In both CS and I, the fraction of the master's recipients that were Non-resident Aliens increased in 2013-14 as compared with 2012-13. In CS, 67.8 percent of the master's degrees went to Non-resident Aliens, compared with 65 percent in 2012-13. In the information area, the corresponding percentages were 28.1 in 2013-14 and 24.9 in 2012-13. In both CS and I, the fraction of master's degrees going to Whites and resident Asians declined.

Looking more deeply into the gender and ethnicity degree data (Table M7), we find that Non-resident Aliens comprised a much larger proportion of female CS degree recipients (74.7 percent) than male CS degree recipients (65.8 percent), while Whites

Table M1. Master's Degrees Awarded by Department Type

Department Type	# Depts	CS		CE		I		Total	
US CS Public	100	4,408	58.9%	184	28.4%	675	25.1%	5,267	48.7%
US CS Private	31	2,649	35.4%	54	8.3%	382	14.2%	3,085	28.5%
Total US CS	131	7,057	94.2%	238	36.8%	1,057	39.4%	8,352	77.2%
US CE	10	0	0.0%	342	52.9%	0	0.0%	342	3.2%
US Info	12	36	0.5%	0	0.0%	1,567	58.3%	1,603	14.8%
Canadian	12	395	5.3%	67	10.4%	62	2.3%	524	4.8%
Grand Total	165	7,488		647		2,686		10,821	

Table M2. Master's Degrees Awarded by Gender

	CS		CE		I		Total	
Male	5,813	78.0%	491	75.9%	1,386	51.6%	7,690	71.3%
Female	1,641	22.0%	156	24.1%	1,299	48.4%	3,096	28.7%
Total Known Gender	7,454		647		2,685		10,786	
Gender Unknown	34		0		1		35	
Grand Total	7,488		647		2,686		10,821	

comprised a larger percentage of male CS degree recipients (23.8 percent) than female CS degree recipients (13.8 percent). With somewhat differing percentages, the same observations held for CE master's graduates. In the I area, Non-resident Aliens comprised a larger percentage of male master's graduates than female master's graduates, and a smaller fraction of White master's graduates. The current enrollment breakdown by gender and ethnicity (Table M8) suggests that these observations will continue to be reflected in future master's recipients.

For the third straight year, there were large increases in the number of new master's students enrolled in U.S. CS public departments. These increases have begun to be reflected in degree production statistics, as noted above.

The fraction of new master's students in U.S. CS departments that is reported to be from outside North America declined from 69.6 percent in 2013-14 to 64.5 percent in 2014-15 (Table M5). The decline reverses last year's reported increase, and was strongest in private institutions, where it dropped from 70.5 percent to 58.0 percent. At U.S. information departments, the fraction of new master's students from outside North America increased by approximately seven percentage points for the second consecutive year. It is now at 43.5 percent.

Table M3. Master's Degrees Awarded by Ethnicity

	CS		CE		I		Total	
Nonresident Alien	4,742	67.8%	350	63.9%	707	28.1%	5,799	57.7%
Amer Indian or Alaska Native	7	0.1%	1	0.2%	0	0.0%	8	0.1%
Asian	500	7.1%	51	9.3%	207	8.2%	758	7.5%
Black or African-American	86	1.2%	6	1.1%	153	6.1%	245	2.4%
Native Hawaiian/Pac Island	1	0.0%	0	0.0%	2	0.1%	3	0.0%
White	1,507	21.5%	123	22.4%	1,296	51.6%	2,926	29.1%
Multiracial, not Hispanic	31	0.4%	0	0.0%	41	1.6%	72	0.7%
Hispanic, any Race	123	1.8%	17	3.1%	107	4.3%	247	2.5%
Total Residency & Ethnicity Known	6,997		548		2,513		10,058	
Resident, Ethnicity Unknown	272		25		140		437	
Residency unknown	219		74		33		326	
Grand Total	7,488		647		2,686		10,821	

Table M4. Master's Degrees Expected Next Year by Department Type

Department Type	# Depts	CS		CE		I		Total	
US CS Public	93	3,971	57.2%	138	22.6%	337	14.9%	4,446	45.3%
US CS Private	30	2,564	37.0%	79	12.9%	337	14.9%	2,980	30.4%
Total US CS	123	6,535	94.2%	217	35.5%	674	29.8%	7,426	75.7%
US CE	9	0	0.0%	308	50.4%	0	0.0%	308	3.1%
US Info	12	44	0.6%	0	0.0%	1,591	70.2%	1,635	16.7%
Canadian	12	359	5.2%	86	14.1%	0	0.0%	445	4.5%
Grand Total	156	6,938		611		2,265		9,814	

Table M5. New Master's Students by Department Type

Department Type	CS			CE			I			Total			Outside North America	
	Total	# Depts	Avg / Dept	Total	# Depts	Avg / Dept	Total	# Dept	Avg / Dept	Total	# Dept	Avg / Dept	Total	%
US CS Public	5,217	99	52.7	283	19	14.9	492	14	35.1	5,992	99	60.5	4,067	67.9%
US CS Private	2,702	31	87.2	86	5	17.2	339	4	84.8	3,127	31	100.9	1,815	58.0%
Total US CS	7,919	130	60.9	369	24	15.4	831	18	46.2	9,119	130	70.1	5,882	64.5%
US CE	0	0	0.0	551	10	55.1	0	0	0.0	551	10	55.1	428	77.7%
US Info	22	1	22.0	0	0	0.0	1,350	12	112.5	1,372	12	114.3	597	43.5%
Canadian	460	12	38.3	77	2	38.5	0	0	0.0	537	12	44.8	363	67.6%
Grand Total	8,401	143	58.7	997	36	27.7	2,181	30	72.7	11,579	164	70.6	7,270	62.8%

Table M6. 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	10,671	100	106.7	575	20	28.8	1,508	15	100.5	12,754	100	127.5
US CS Private	6,817	31	219.9	107	5	21.4	1,392	4	348.0	8,316	31	268.3
Total US CS	17,488	131	133.5	682	25	27.3	2,900	19	152.6	21,070	131	160.8
US CE	0	0	0.0	1,198	10	119.8	0	0	0.0	1,198	10	119.8
US Info	100	1	100.0	0	0	0.0	3,851	12	320.9	3,951	12	329.3
Canadian	1,221	12	101.8	259	2	129.5	149	1	149.0	1,629	12	135.8
Grand Total	18,809	144	130.6	2,139	37	57.8	6,900	32	215.6	27,848	165	168.8

Table M7. Masters Degrees Awarded by Gender and Ethnicity, From 147 Departments Providing Breakdown Data

	CS					CE					I					Ethnicity Totals	
	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Total	%
Nonresident Alien	3,500	1,124	118	66	75	245	105	0	60	76	393	252	62	33	21	5,799	57.7
Amer Indian or Alaska Native	6	1	0	0	0	1	0	0	0	0	0	0	0	0	0	8	0.1
Asian	358	124	18	7	8	38	13	0	9	9	101	90	16	9	7	758	7.5
Black or African-American	60	25	1	1	2	6	0	0	2	0	77	75	1	7	6	245	2.4
Native Hawaiian/ Pac Islander	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	3	0.0
White	1,270	207	30	24	14	107	16	0	26	12	532	732	32	45	60	2,926	29.1
Multiracial, not Hispanic	27	3	1	1	0	0	0	0	0	0	20	21	0	2	2	72	0.7
Hispanic, any Race	99	20	4	2	1	13	4	0	3	3	63	41	3	5	3	247	2.5
Total Res & Ethnicity Known	5,321	1,504	172			410	138	0			1,187	1,212	114			10,058	
Resident, Ethnicity Unknown	200	69	3			21	4	0			83	47	10			437	
Not Reported (N/R)	292	68	0			60	14	0			116	40	0			326	
Gender Totals	5,813	1,641	34			491	156	0			1,386	1,299	1			10,821	
%	78.0%	22.0%				75.9%	24.1%				51.6%	48.4%					

* % of M and % of F columns are the percent of that gender who are of the specified ethnicity, of those whose ethnicity is known

Table M8. Masters Enrollment by Gender and Ethnicity, From 139 Departments Providing Breakdown Data

	CS					CE					I					Ethnicity Totals	
	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Total	%
Nonresident Alien	7,949	3,076	261	63	77	883	425	0	66	85	1,084	811	86	33	27	14,575	57.3
Amer Indian or Alaska Native	14	4	1	0	0	2	1	0	0	0	6	2	0	0	0	30	0.1
Asian	846	298	41	7	8	115	32	0	9	6	248	210	39	8	7	1,829	7.2
Black or African-American	233	75	6	2	2	19	3	0	1	1	242	230	14	8	8	822	3.2
Native Hawaiian/ Pac Islander	13	0	0	0	0	0	1	0	0	0	4	3	0	0	0	21	0.1
White	3,282	467	128	26	12	274	32	0	21	6	1,421	1,573	74	44	52	7,251	28.5
Multiracial, not Hispanic	65	12	2	1	0	5	2	0	0	0	36	38	5	1	1	165	0.6
Hispanic, any Race	280	45	7	2	1	38	4	0	3	1	201	143	10	6	5	728	2.9
Total Res & Ethnicity Known	12,682	3,977	446			1,336	500	0			3,242	3,010	228			25,421	
Resident, Ethnicity Unknown	381	107	11			30	5	0			201	147	36			918	
Not Reported (N/R)	1,200	321	6			208	60	0			216	83	0			1,509	
Gender Totals	14,263	4,405	141			1,574	565	0			3,659	3,240	1			27,848	
%	76.4%	23.6%				73.6%	26.4%				53.0%	47.0%					

* % of M and % of F columns are the percent of that gender who are of the specified ethnicity, of those whose ethnicity is known

Figure M1. Master's Degrees Granted by Tenure-Track Size

CRA Taulbee Survey 2014

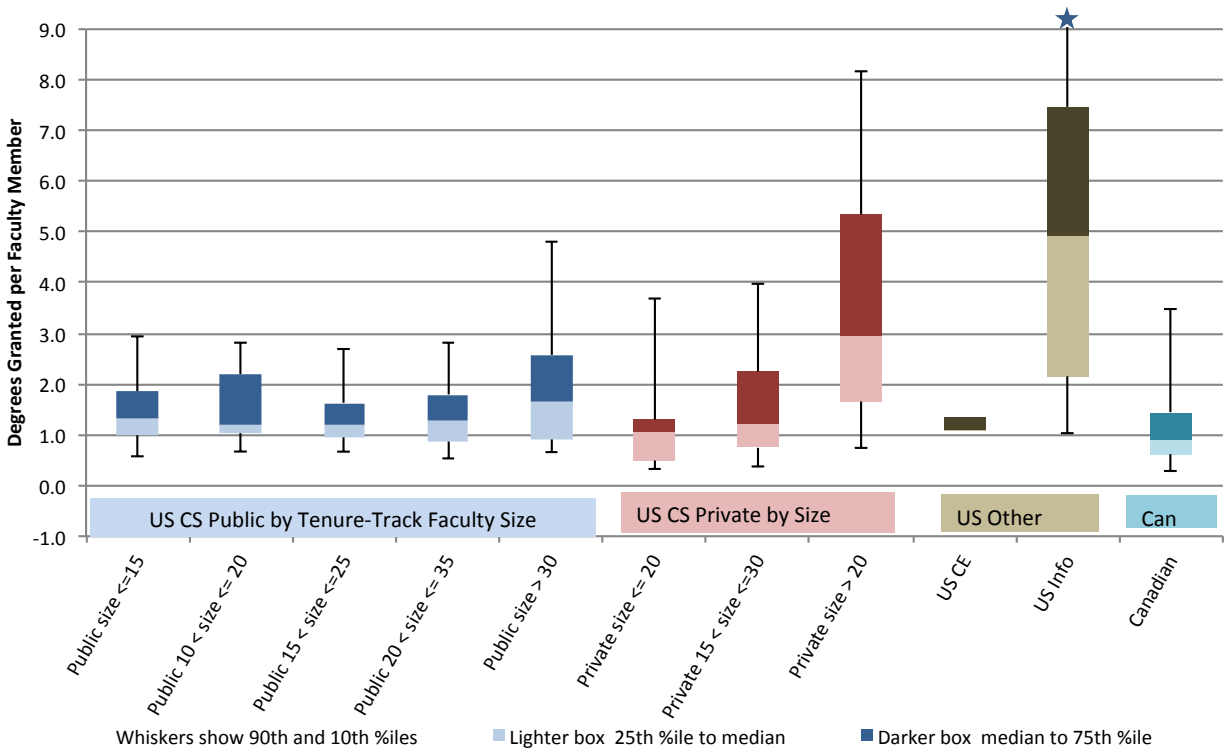
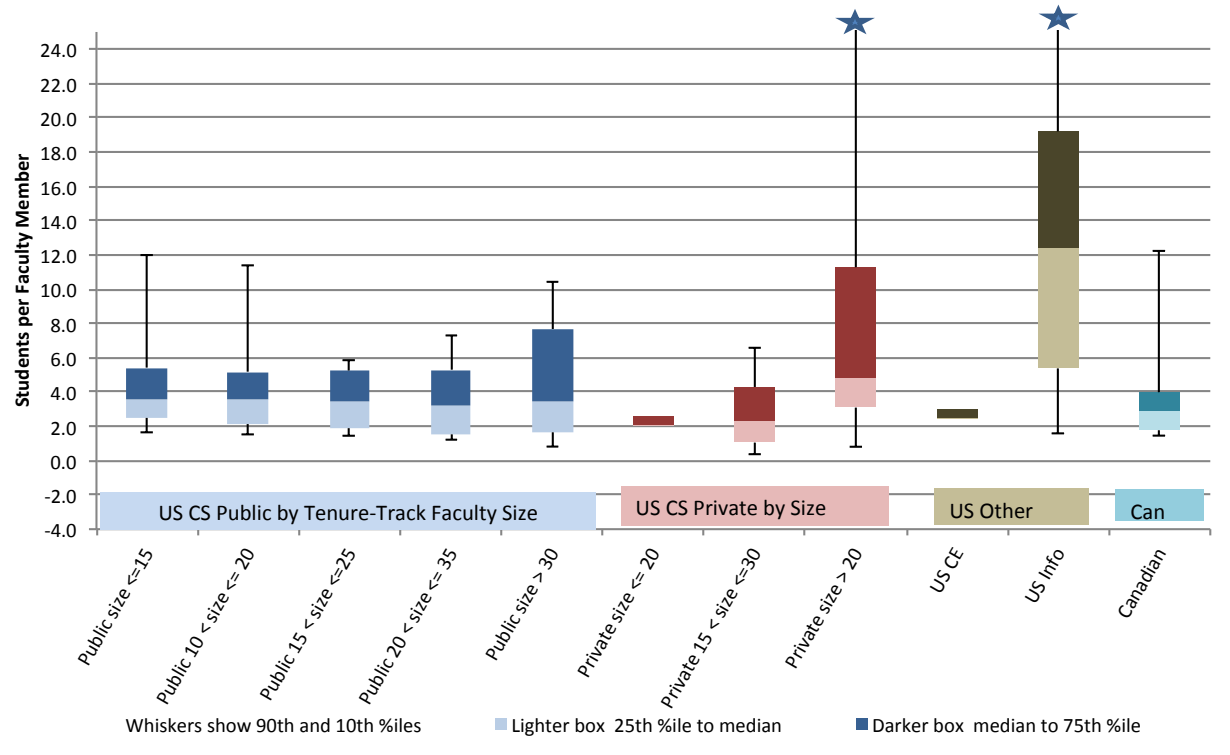


Figure M2. Master's Enrollment Normalized by Tenure-Track Size

CRA Taulbee Survey 2014



Bachelor's (Tables 1, B1-B8; Figures B1-B4)

When comparing all departments reporting this year to all departments reporting last year, there was an increase of 14.3 percent in bachelor's degree production. When considering only those departments that reported both years, the increase was 12.0 percent. Among U.S. computer science departments, the increases were 14.2 percent when comparing totals for all reporting departments and 13.6 percent for those departments that reported both years.

These double-digit percentage increases contrast with the small growth in bachelor's degree production reported in last year's survey. But they are consistent with the statement we made last year that the enrollment changes experienced during the past several years were expected to result in much higher growth in degree production.

The number of new undergraduate computing majors rose for the seventh straight year. The increase was 20.2 percent when all respondents are compared, and 18.0 percent among those departments reporting both this year and last year. Among U.S. computer science departments, the increase was 18.3 percent overall and 17.0 percent among departments reporting both this year and last year. Total undergraduate enrollment in computing majors among U.S. CS departments (i.e., the sum of the number of majors in CS, CE and I at these departments) increased 27.3 percent when all respondents are compared, and increased 18.6 percent among departments reporting both this year and last year.

Aggregate total enrollment (which combines CS departments, CE departments, I departments and Canadian departments) increased in all three computing areas (CS, CE, and I). New student enrollment also increased in all three areas. In Canadian departments, total computer science enrollment decreased though the average per department increased, while both the total enrollment and average per department decreased for Canadian I programs. In U.S. CS departments at private institutions, CE and I total enrollments declined but the average per department increased. The changes in Canadian, CE and I enrollments are more volatile due to the small number of departments reporting in each of these areas.

The fraction of women among 2013-14 bachelor's graduates in CS was 14.1 percent, similar to the 14.2 reported for 2012-13. There was a slight drop in the fraction of women receiving CE degrees (from 11.6 percent to 11.2 percent) but there was an increase for I degrees (from 18.7 percent to 20.3 percent). The fraction of CS bachelor's degrees awarded to Whites declined from 61.2 percent in 2012-13 to 57.7 percent in 2013-14, and the percentage awarded to Blacks declined from 3.8 percent to 3.2 percent. Increases in the fraction of CS degrees awarded were present for Non-resident Aliens (8.3 percent to 9.0 percent), Asians (18.4 percent to 21.1 percent), and Hispanics (6.0 percent to 6.8 percent). The direction of change was similar for I degrees with the exception of Blacks, which increased slightly between 2012-13 and 2013-14. In CE, there was an increase in the fraction of Non-resident Aliens and Hispanics

Table 1. Degree Production and Enrollment Change From Previous Year

	Total						Only Departments Responding Both Years					
	US CS Only			All Departments			US CS Only			All Departments		
PhDs	2013	2014	% chg	2013	2014	% chg	2013	2014	% chg	2013	2014	% chg
# Departments	135	136	0.7%	167	172	3.0%	118	118		143	143	
PhD Awarded	1,625	1,606	-1.2%	1,991	1,940	-2.6%	1,525	1,469	-3.7%	1,797	1,724	-4.1%
PhD Enrollment	12,067	12,633	4.7%	14,466	15,066	4.1%	11,269	11,711	3.9%	13,094	13,671	4.4%
New PhD Enroll	2,364	2,445	3.4%	2,725	2,820	3.5%	2,173	2,275	4.7%	2,453	2,540	3.6%
Bachelor's	2013	2014	% chg	2013	2014	% chg	2013	2014	% chg	2013	2014	% chg
# Departments	131	129	-1.5%	157	158	0.6%	113	113		133	133	
BS Awarded	12,503	14,283	14.2%	15,087	17,237	14.3%	11,144	12,664	13.6%	13,349	14,957	12.0%
BS Enrollment	63,098	80,324	27.3%	76,478	96,660	26.4%	59,616	70,694	18.6%	70,983	83,351	17.4%
New BS Majors	17,207	20,351	18.3%	21,291	25,595	20.2%	14,454	16,908	17.0%	18,039	21,290	18.0%
BS Enroll/Dept	481.7	622.7	29.3%	487.1	611.8	25.6%	527.6	625.6	18.6%	533.7	626.7	17.4%

receiving degrees, with the percentage of Whites showing the largest decline. In aggregate across the three degree areas, 56.7 percent of the graduates were White, 20.8 percent Asian, 8.3 percent Non-resident Aliens, and 14.2 percent all other ethnicity categories combined. However, in I programs, the other ethnicity categories accounted for over 20 percent of the graduates and account for more than 25 percent of the current enrollment.

In all three computing areas (CS, CE and I), Resident Asians comprise a larger fraction of female degree recipients than male recipients, while Whites comprise a larger fraction of male degree recipients than female recipients (Table B7). Table B8 indicates that the same comparisons hold true for total bachelor's enrollment, so these comparisons are likely to continue holding true for future degree recipients.

Table B1. Bachelor's Degrees Awarded by Department Type

Department Type	# Depts	CS		CE		I		Total	
US CS Public	99	8,613	70.4%	1,479	63.2%	1,186	44.4%	11,278	65.4%
US CS Private	30	2,527	20.7%	179	7.7%	299	11.2%	3,005	17.4%
Total US CS	129	11,140	91.1%	1,658	70.9%	1,485	55.6%	14,283	82.9%
US CE	9	0	0.0%	554	23.7%	0	0.0%	554	3.2%
US Info	10	15	0.1%	0	0.0%	1,158	43.4%	1,173	6.8%
Canadian	9	1,073	8.8%	127	5.4%	27	1.0%	1,227	7.1%
Grand Total	157	12,228		2,339		2,670		17,237	

Table B2. Bachelor's Degrees Awarded by Gender

	CS		CE		I		Total	
Male	10,345	85.9%	2,055	88.8%	2,110	79.7%	14,510	85.3%
Female	1,701	14.1%	259	11.2%	537	20.3%	2,497	14.7%
Total Known Gender	12,046		2,314		2,647		17,007	
Gender Unknown	182		25		23		230	
Grand Total	12,228		2,339		2,670		17,237	

Table B3. Bachelor's Degrees Awarded by Ethnicity

	CS		CE		I		Total	
Nonresident Alien	884	9.0%	184	9.5%	121	4.8%	1,189	8.3%
Amer Indian or Alaska Native	35	0.4%	20	1.0%	8	0.3%	63	0.4%
Asian	2,079	21.1%	499	25.6%	404	16.0%	2,982	20.8%
Black or African-American	315	3.2%	65	3.3%	206	8.2%	586	4.1%
Native Hawaiian/Pac Islander	21	0.2%	7	0.4%	8	0.3%	36	0.3%
White	5,687	57.7%	970	49.8%	1,466	58.1%	8,123	56.7%
Multiracial, not Hispanic	168	1.7%	39	2.0%	42	1.7%	249	1.7%
Hispanic, any Race	672	6.8%	163	8.4%	270	10.7%	1,105	7.7%
Total Residency & Ethnicity Known	9,861		1,947		2,525		14,333	
Resident, Ethnicity Unknown	413		70		93		576	
Residency unknown	1,954		322		52		2,328	
Grand Total	12,228		2,339		2,670		17,237	

Table B4. Bachelor's Degrees Expected Next Year by Department Type

Department Type	# Depts	CS		CE		I		Total	
US CS Public	94	9,786	64.1%	1,499	59.3%	1,118	40.8%	12,403	60.4%
US CS Private	28	3,174	20.8%	247	9.8%	234	8.5%	3,655	17.8%
Total US CS	122	12,960	84.8%	1,746	69.0%	1,352	49.4%	16,058	78.2%
US CE	8	0	0.0%	654	25.9%	0	0.0%	654	3.2%
US Info	11	75	0.5%	0	0.0%	1,363	49.8%	1,438	7.0%
Canadian	12	2,241	14.7%	129	5.1%	24	0.9%	2,394	11.7%
Grand Total	153	15,276		2,529		2,739		20,544	

Table B5. New Bachelor's Students by Department Type

	CS				CE				I				Total	
Department Type	Major	Pre-major	# Dept	Avg. Major per Dept.	Major	Pre-major	# Dept	Avg. Major per Dept.	Major	Pre-major	# Dept	Avg. Major per Dept.	Total Major	Avg. Major per Dept
US CS Public	13,933	6,879	88	158.3	1,750	710	28	62.5	946	221	22	43.0	16,629	189.0
US CS Private	3,141	1,112	23	136.6	314	6	5	62.8	267	0	4	66.8	3,722	161.8
US CS Total	17,074	7,991	111	153.8	2,064	716	33	62.5	1,213	221	26	46.7	20,351	183.3
US CE	0	0	0	0.0	802	296	9	89.1	0	0	0	0.0	802	89.1
US Information	260	0	1	260.0	0	0	0	0.0	771	157	10	77.1	1,031	103.1
Canadian	3,052	677	11	277.5	316	0	3	105.3	43	0	1	43.0	3,411	310.1
Grand Total	20,386	8,668	123	165.7	3,182	1,012	45	70.7	2,027	378	37	54.8	25,595	181.5

Table B6. Total Bachelor's Enrollment by Department Type

	CS				CE				I				Total	
Department Type	Major	Pre-major	# Dept	Avg. Major per Dept.	Major	Pre-major	# Dept	Avg. Major per Dept.	Major	Pre-major	# Dept	Avg. Major per Dept.	Total Major	Avg. Major per Dept
US CS Public	52,000	12,751	99	525.3	8,050	1,215	33	243.9	5,790	525	26	222.7	65,840	665.1
US CS Private	12,141	1,166	29	418.7	905	12	7	129.3	1,438	47	4	359.5	14,484	499.4
US CS Total	64,141	13,917	128	501.1	8,955	1,227	40	223.9	7,228	572	30	240.9	80,324	627.5
US CE	0	0	0	0.0	3,114	439	9	346.0	0	0	0	0.0	3,114	346.0
US Information	604	0	1	604.0	0	0	0	0.0	3,997	576	10	399.7	4,601	460.1
Canadian	7,702	1,075	10	770.2	794	0	2	397.0	125	0	2	62.5	8,621	862.1
Grand Total	72,447	14,992	139	521.2	12,863	1,666	51	252.2	11,350	1,148	42	270.2	96,660	615.7

Table B7. Bachelors Degrees Awarded by Gender and Ethnicity, From 125 Departments Providing Breakdown Data

	CS					CE					I					Ethnicity Totals	
	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Total	%
Nonresident Alien	657	168	59	8	13	139	26	19	8	12	87	34	0	4	7	1,189	8.3
Amer Indian or Alaska Native	31	4	0	0	0	12	7	1	1	3	8	0	0	0	0	63	0.4
Asian	1,598	421	60	20	32	413	76	10	25	34	301	103	0	15	20	2,982	20.8
Black or African-American	245	54	16	3	4	58	7	0	4	3	152	54	0	8	11	586	4.1
Native Hawaiian/ Pac Islander	15	6	0	0	1	5	2	0	0	1	7	1	0	0	0	36	0.3
White	4,923	539	225	60	41	845	83	42	51	37	1,200	265	1	60	51	8,123	56.7
Multiracial, not Hispanic	126	28	14	2	2	34	5	0	2	2	30	12	0	2	2	249	1.7
Hispanic, any Race	580	83	9	7	6	145	16	2	9	7	223	47	0	11	9	1,105	7.7
Total Res & Ethnicity Known	8,175	1,303	383			1,651	222	74			2,008	516	1			14,333	
Resident, Ethnicity Unknown	349	54	10			58	8	4			80	13	0			576	
Not Reported (N/R)	1,821	344	147			346	29	25			22	8	22			2,328	
Gender Totals	10,345	1,701	182			2,055	259	25			2,110	537	23			17,237	
%	85.9%	14.1%				88.8%	11.2%				79.7%	20.3%					

* % of M and % of F columns are the percent of that gender who are of the specified ethnicity, of those whose ethnicity is known

Table B8. Bachelors Enrollment by Gender and Ethnicity, From 121 Departments Providing Breakdown Data

	CS					CE					I					Ethnicity Totals	
	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Total	%
Nonresident Alien	4,072	942	215	9	12	1,003	173	72	10	13	337	152	1	4	7	6,967	8.6
Amer Indian or Alaska Native	207	45	2	0	1	17	8	2	0	1	30	19	0	0	1	330	0.4
Asian	8,549	2,298	595	18	28	2,281	412	196	24	32	1,217	477	0	15	21	16,025	19.8
Black or African-American	2,199	601	139	5	7	469	67	10	5	5	766	274	1	9	12	4,526	5.6
Native Hawaiian/ Pac Islander	95	15	3	0	0	137	11	1	1	1	19	12	0	0	1	293	0.4
White	27,366	3,351	1,140	57	41	4,571	443	202	47	34	4,650	1,034	2	56	46	42,759	53.0
Multiracial, not Hispanic	1,181	290	98	3	4	203	45	28	2	3	192	54	0	2	2	2,091	2.6
Hispanic, any Race	4,338	665	131	9	8	1,005	149	33	10	11	1,174	253	0	14	11	7,748	9.6
Total Res & Ethnicity Known	48,007	8,207	2,323			9,686	1,308	544			8,385	2,275	4			80,739	
Resident, Ethnicity Unknown	2,046	339	139			324	45	17			384	62	2			3,358	
Not Reported (N/R)	9,113	2,177	2,540			889	151	458			113	14	111			12,563	
Gender Totals	59,166	10,723	2,558			10,899	1,504	460			8,882	2,351	117			96,660	
%	84.7%	15.3%				87.9%	12.1%				79.1%	20.9%					

* % of M and % of F columns are the percent of that gender who are of the specified ethnicity, of those whose ethnicity is known

Figure B1. BS Production (CS & CE)

CRA Taulbee Survey 2014

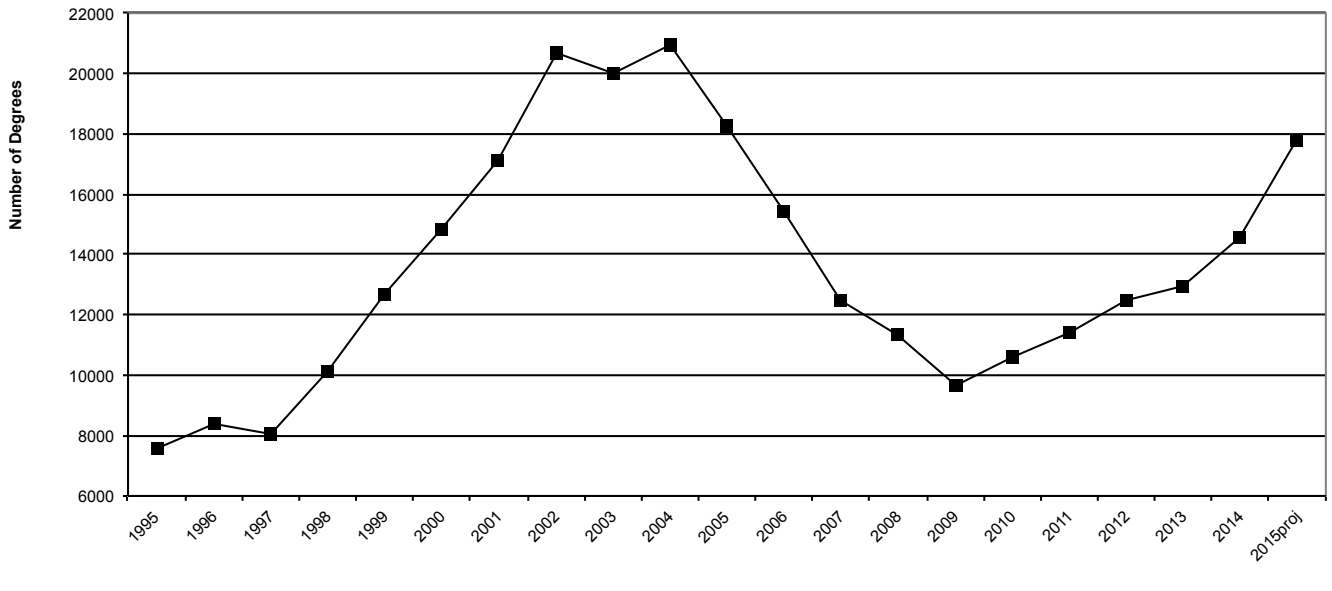


Figure B2. Newly Declared CS/CE Undergraduate Majors

CRA Taulbee Survey 2014

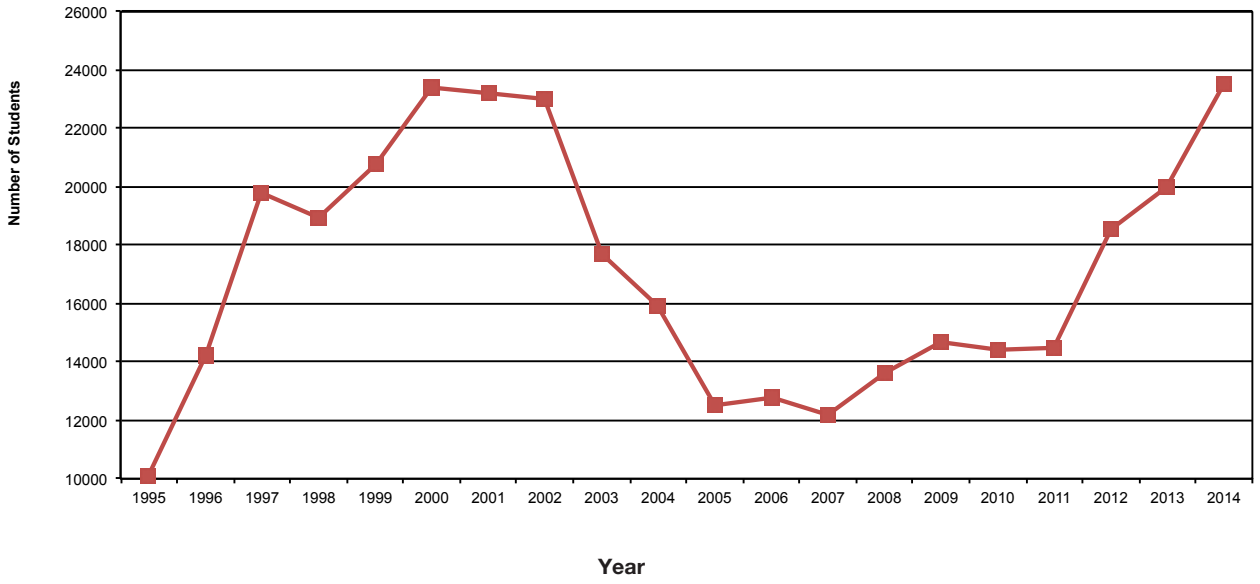


Figure B3. Bachelor's Degrees Granted by Tenure-Track Size

CRA Taulbee Survey 2014

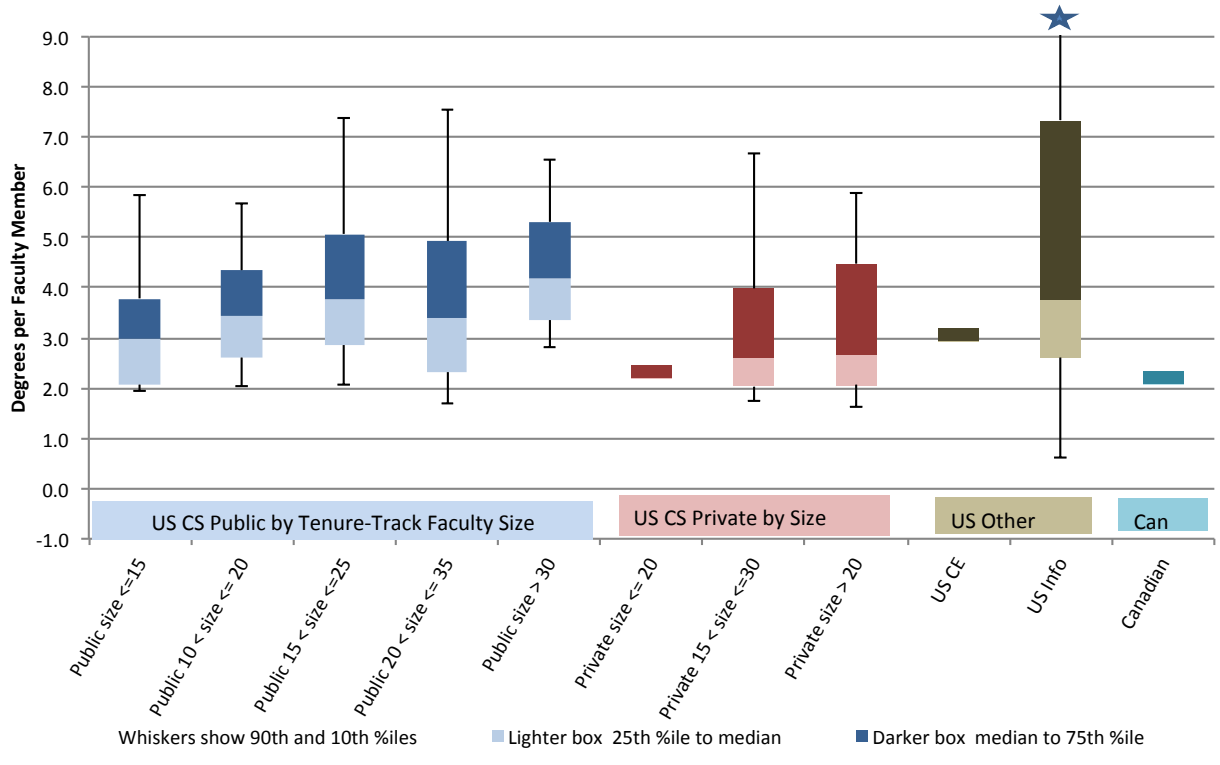
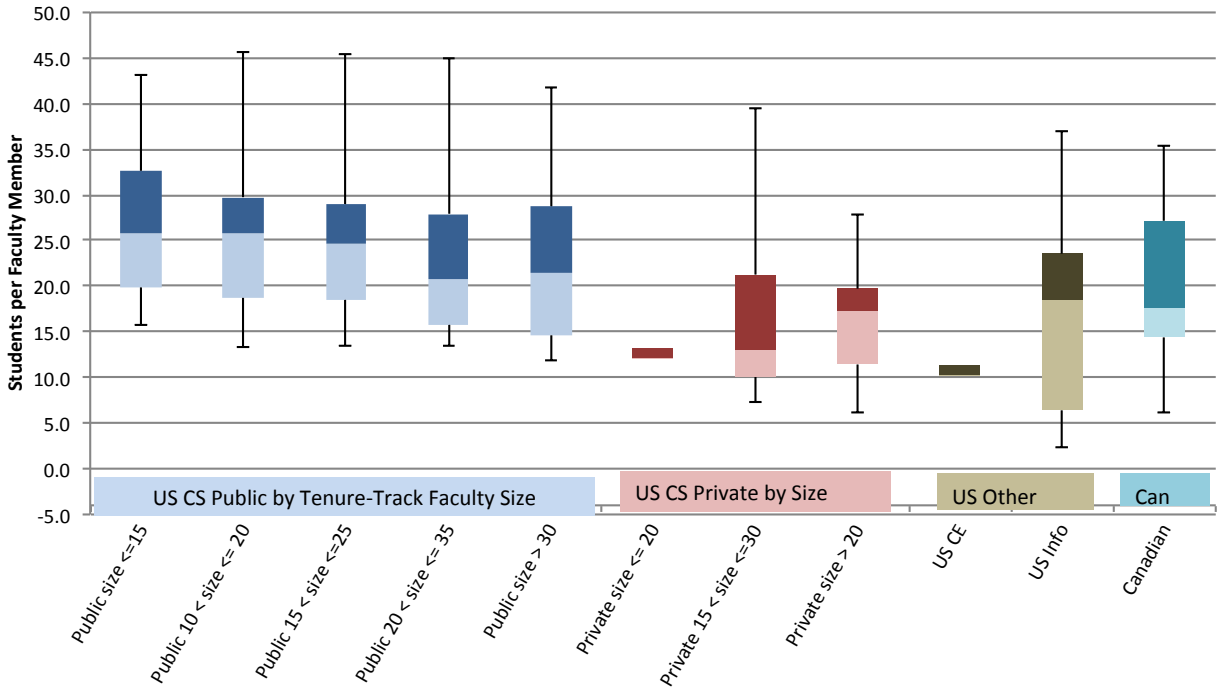


Figure B4. Bachelor's Enrollment Normalized by Tenure-Track Size

CRA Taulbee Survey 2014



Faculty Demographics (Tables F1-F9)[4]

Table F1 shows the current and anticipated sizes, in FTE, for tenure-track, teaching and research faculty, and postdocs. The total tenure-track faculty count in U.S. CS departments (3,559) is about the same as last year. However, there was an increase from last year to this year, from 26.2 to 27.4, in the average tenure-track faculty size per U.S. CS department. In these departments, there also were increases in the number of teaching and research faculty per department and the number of postdocs per department. Canadian, CE and I departments have much more volatile data due to the small number of departments reporting in each of those categories.

As we have mentioned in previous Taulbee reports, Canadian universities, on average, have several more tenure-track faculty members per department than do U.S. universities, while on average U.S. I departments and U.S. CE departments are slightly smaller than U.S. CS departments. The observations about U.S. CE and I departments may reflect the fact that we ask departments to report only computing-related faculty, so departments with Library Science or EE programs may report only part of their faculty.

Among U.S. CS departments, those at private universities tend to have more tenure-track, teaching faculty, research faculty and postdocs than do those at public universities on average. This observation also was made last year.

Table F2 summarizes faculty hiring this past year. There were more tenure-track vacancies per reporting department (2.09) in 2013-14 than in2012-13 (1.98). U.S. CS departments had a slightly greater average in 2013-14 than in 2012-13, due to increases per public department. In aggregate, only 21.2 percent of the total number of vacant tenure-track positions went unfilled; in 2012-13 there were 33.0 percent unfilled. The success rate at U.S. CS departments jumped from 64.0 percent in 2012-13 to 80.2 percent in 2013-14; increased success was enjoyed at both public and private departments. Canadian departments had lower success rates on average than did U.S. CS, U.S. CE and U.S. I departments. In aggregate, there was more hiring in 2013-14 than in 2012-13 in all categories of faculty.

The fraction of women among those hired into all categories of academic positions (tenure-track, teaching faculty, research faculty and postdoc) was 22.1 percent in 2012-13, an increase from 21.0 percent in 2012-13 (Table F3). However, in tenure-track positions, the fraction was similar to the previous year (21.8 percent vs. 22.5 percent in 2012-13). There were increases in the fraction of research faculty positions and postdoc positions going to women as compared with those reported last year, while the fraction of teaching positions going to women decreased. The fraction of new female tenure-track and overall faculty hires continues to exceed the fraction of new female Ph.D.s produced this past year (18.9 percent).

Among new tenure-track faculty, the fraction who are white rose from 47.4 percent to 49.5 percent, while the fraction who are Non-resident Alien or Asian new hires dropped from 44.0 percent to 41.8 percent. Once again, whites dominated the newly hired teaching faculty, with Asians and Non-resident Aliens accounting for most of the remainder. Among research faculty, whites comprised 42.9 percent of new hires, while Non-resident Aliens or resident Asians in aggregate comprised 47.6 percent of new hires. Among postdoc new hires, whites comprised 37.6 percent, with Non-resident Aliens and resident Asians collectively comprising 51.1 percent (Table F4).

There were more faculty losses reported this year as compared with last year (Table F5); this is the second consecutive year we observed this. Once again, the larger fraction of losses is due to movement to another (academic or non-academic) position.

This year, the fraction of women at the full professor rank was about the same as last year, while the fraction at the associate professor level rose (from 19.6 percent last year to 20.5 percent this year) and the fraction at the assistant professor level fell (from 26.2 percent to 24.6 percent) (Table F6). There also were increases in the fraction of women among research faculty and postdocs, while there was a decrease in the fraction of women among teaching faculty. Whites, Asians and Non-resident Aliens again account for about 90 percent of each category of faculty members (Table F7).

Ninety-five percent of departments provided gender by ethnicity breakdowns for their current faculty members. (Table F8 And F9). Whites comprised a greater percentage of female full professors than they do male full professors, while the reverse is true at the associate professor level. Asians comprise a greater percentage of male full professors than they do female full professors, while the reverse is true at the associate professor level.

For next year, U.S. CS departments forecast a modest 2.1 percent growth in tenure-track faculty, and a 5.6 percent growth in teaching faculty. However, they forecast an 11.8 percent growth in postdocs.

Table F1. Actual and Anticipated Faculty Size by Position and Department Type

	Actual		Projected				Expected 2-Yr Growth	
	2014-2015		2015-2016		2016-2017			
US CS Public	**Total**	**Average**	**Total**	**Average**	**Total**	**Average**	**#**	**%**
TenureTrack	2,605	26.3	2,683	28.0	2,719	28.9	114	4.4%
Teaching	463	5.1	478	5.5	519	6.1	56	12.1%
Research	283	5.1	295	5.5	298	5.5	15	5.3%
Postdoc	312	5.0	351	5.5	372	6.0	60	19.2%
Total	3,653	36.9	3,798	39.6	3,900	41.1	247	6.8%
US CS Private								
TenureTrack	954	30.8	951	31.7	984	32.8	30	3.1%
Teaching	216	7.2	239	8.0	252	8.4	36	16.7%
Research	172	9.1	287	15.1	191	10.1	19	11.0%
Postdoc	197	8.6	218	9.5	231	10.1	34	17.3%
Total	1,535	49.5	1,693	56.4	1,657	55.2	122	7.9%
All US CS								
TenureTrack	3,559	27.4	3,634	28.8	3,703	29.9	144	4.0%
Teaching	679	5.7	717	6.1	771	6.7	92	13.5%
Research	455	6.1	582	8.0	489	6.7	34	7.5%
Postdoc	509	6.0	569	6.5	603	7.1	94	18.5%
Total	5,188	39.9	5,491	43.6	5,557	44.5	369	7.1%
US CE								
TenureTrack	249	24.9	256	25.6	265	26.5	16	6.4%
Teaching	26	3.2	29	3.6	30	3.8	4	15.4%
Research	14	2.3	16	2.6	17	2.8	3	21.4%
Postdoc	58	8.4	65	9.2	69	9.9	11	19.0%
Total	345	34.5	362	36.2	379	37.9	34	9.9%
US I								
TenureTrack	292	22.4	314	24.1	329	25.3	37	12.7%
Teaching	96	8.7	106	9.6	109	9.9	13	13.5%
Research	42	6.0	44	6.2	42	7.0	0	0.0%
Postdoc	43	4.8	48	5.3	49	5.4	6	14.0%
Total	470	36.2	509	39.2	527	40.5	57	12.1%
Canadian								
TenureTrack	448	37.3	461	38.4	423	38.5	-25	-5.6%
Teaching	62	5.1	62	5.6	62	5.6	0	0.0%
Research	19	3.8	20	4.0	20	4.0	1	5.3%
Postdoc	78	8.7	88	9.8	78	9.8	0	0.0%
Total	605	50.4	630	52.5	582	52.9	-23	-3.8%
Grand Total								
TenureTrack	4,548	27.6	4,665	29.0	4,719	29.9	171	3.8%
Teaching	863	5.7	914	6.2	972	6.7	109	12.6%
Research	529	5.7	661	7.3	569	6.3	40	7.6%
Postdoc	689	6.3	769	6.9	799	7.3	110	16.0%
Total	6,608	40.0	6,992	43.4	7,045	44.3	437	6.6%

Table F2. Vacant Positions 2013-2014 by Position and Department Type		
	Tried to fill	Filled
US CS Public		
TenureTrack	212	170
Teaching	126	122
Research	56	51
Postdoc	102	87
Total	496	430
US CS Private		
TenureTrack	70	57
Teaching	35	30
Research	22	22
Postdoc	40	46
Total	167	154
All US CS		
TenureTrack	282	227
Teaching	161	152
Research	78	73
Postdoc	142	133
Total	663	584
US CE		
TenureTrack	11	7
Teaching	15	12
Research	26	26
Postdoc	15	15
Total	67	60
US I		
TenureTrack	33	28
Teaching	12	13
Research	25	25
Postdoc	21	20
Total	91	86
Canadian		
TenureTrack	27	16
Teaching	4	6
Research	6	6
Postdoc	20	20
Total	57	48
Grand Total		
TenureTrack	353	278
Teaching	192	183
Research	135	130
Postdoc	198	188
Total	878	778

Table F2a. Reasons Positions Left Unfilled		
Reason	**# Reported**	**% of Reasons**
Didn't find a good fit	32	26.4%
Offers turned down	43	35.5%
Technically vacant, not filled for admin reasons	12	9.9%
Hiring in progress	30	9.4%
Other	4	3.3%
Total Reasons Provided	121	

Table F3. Gender of Newly Hired Faculty										
	Tenure-Track		Teaching		Research		Postdoc		Total	
Male	272	78.2%	106	74.6%	58	78.4%	145	79.7%	581	77.9%
Female	76	21.8%	36	25.4%	16	21.6%	37	20.3%	165	22.1%
Unknown	0		2		0		1		3	
Total	348		144		74		183		749	

Table F4. Ethnicity of Newly Hired Faculty										
	Tenure-Track		Teaching		Research		Postdoc		Total	
Nonresident Alien	36	12.0%	11	9.3%	24	38.1%	49	27.5%	120	18.2%
American Indian/ Alaska Native	0	0.0%	0	0.0%	0	0.0%	7	3.9%	7	1.1%
Asian	89	29.8%	18	15.3%	6	9.5%	42	23.6%	155	23.6%
Black or African-American	8	2.7%	4	3.4%	1	1.6%	1	0.6%	14	2.1%
Native Hawaiian/ Pacific Islander	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
White	148	49.5%	81	68.6%	27	42.9%	67	37.6%	323	49.1%
Multiracial, not Hispanic	3	1.0%	1	0.8%	0	0.0%	1	0.6%	5	0.8%
Hispanic, any Race	6	2.0%	0	0.0%	4	6.3%	4	2.2%	14	2.1%
Resident, Race/ Ethnic Unknown	9	3.0%	3	2.5%	1	1.6%	7	3.9%	20	3.0%
Total Known Residency	299		118		63		178		658	
Residency Unknown	49		26		11		5		91	
Total	348		144		74		183		749	

Table F5. Faculty Losses	
Died	10
Retired	65
Took Academic Position Elsewhere	86
Took Nonacademic Position	44
Remained, but Changed to Part Time	15
Other	20
Unknown	6
Total	246

Table F6. Gender of Current Faculty														
	Full		Associate		Assistant		Teaching		Research		Postdoc		Total	
Male	1,930	86.7%	1,216	79.5%	628	75.4%	674	71.5%	436	80.3%	634	81.1%	5,518	80.5%
Female	296	13.3%	314	20.5%	205	24.6%	269	28.5%	107	19.7%	148	18.9%	1,339	19.5%
Unknown	2		0		0		0		0		29		31	
Total	2,228		1,530		833		943		543		811		6,888	

Table F7. Ethnicity of Current Faculty

	Full		Associate		Assistant		Teaching		Research		Postdoc		Total	
Nonresident Alien	18	0.9%	12	0.9%	88	11.2%	26	2.9%	72	14.0%	247	35.7%	463	7.3%
American Indian / Alaska Native	16	0.8%	35	2.5%	5	0.6%	5	0.6%	0	0.0%	3	0.4%	64	1.0%
Asian	499	24.2%	427	30.5%	243	30.8%	102	11.5%	77	15.0%	141	20.4%	1,489	23.5%
Black or African-American	17	0.8%	22	1.6%	25	3.2%	29	3.3%	7	1.4%	9	1.3%	109	1.7%
Native Hawaiian/ Pacific Islander	2	0.1%	3	0.2%	1	0.1%	0	0.0%	0	0.0%	0	0.0%	6	0.1%
White	1,403	67.9%	811	58.0%	386	49.0%	672	75.8%	312	60.6%	224	32.4%	3,808	60.0%
Multiracial, not Hispanic	12	0.6%	20	1.4%	7	0.9%	5	0.6%	4	0.8%	2	0.3%	50	0.8%
Hispanic, any Race	37	1.8%	39	2.8%	16	2.0%	18	2.0%	29	5.6%	14	2.0%	153	2.4%
Resident, Race/ Ethnic Unknown	62	3.0%	30	2.1%	17	2.2%	30	3.4%	14	2.7%	51	7.4%	204	3.2%
Total Known Residency	2,066		1,399		788		887		515		691		6,346	
Residency Unknown	162		131		45		56		28		120		542	
Total	2,228		1,530		833		943		543		811		6,888	

Table F8. Current Tenured and Tenure-Track Faculty by Gender and Ethnicity, From 166 Departments

	Full Professor					Associate Professor					Assistant Professor					Ethnicity Totals	
	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Total	%
Nonresident Alien	15	3	0	1	1	8	4	0	1	1	70	18	0	12	9	118	2.8
Amer Indian or Alaska Native	13	3	0	1	1	28	7	0	3	3	5	0	0	1	0	56	1.4
Asian	448	49	2	26	18	334	93	0	31	33	182	61	0	31	32	1,169	28.2
Black or African-American	14	3	0	1	1	13	9	0	1	3	15	10	0	3	5	64	1.5
Native Hawaiian/ Pac Islander	2	0	0	0	0	3	0	0	0	0	1	0	0	0	0	6	0.1
White	1,199	204	0	69	75	655	156	0	60	56	285	101	0	49	53	2,600	62.7
Multiracial, not Hispanic	11	1	0	1	0	19	1	0	2	0	7	0	0	1	0	39	0.9
Hispanic, any Race	29	8	0	2	3	28	11	0	3	4	14	2	0	2	1	92	2.2
Total Res & Ethnicity Known	1,731	271	2			1,088	281	0			579	192	0			4,144	
Resident, Ethnicity Unknown	55	7	0			22	8	0			13	4	0			109	
Not Reported (N/R)	144	18	0			106	25	0			36	9	0			338	
Gender Totals	1,930	296	2			1,216	314	0			628	205	0			4,591	
%	86.7%	13.3%				79.5%	20.5%				75.4%	24.6%					

* %M and %F columns are the percent of that gender who are of the specified ethnicity, of those whose ethnicity is known

Table F9. Current Non-Tenure-Track Faculty and Postdoctorates by Gender and Ethnicity, From 165 Departments

	Non-Tenure-Track Teaching					Non-Tenure-Track Research					Postdoctorates					Ethnicity Totals	
	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Male	Fem	N/R	% of M*	% of F*	Total	%
Nonresident Alien	19	7	0	3	3	63	9	0	16	10	205	42	0	40	34	345	17
Amer Indian or Alaska Native	3	2	0	1	1	0	0	0	0	0	3	0	0	1	0	8	0
Asian	64	38	0	11	15	57	20	0	14	21	111	29	1	22	23	320	16
Black or African-American	19	10	0	3	4	4	3	0	1	3	4	5	0	1	4	45	2
Native Hawaiian/ Pac Islander	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
White	488	184	0	80	75	253	59	0	62	63	184	40	0	36	32	1,208	61
Multiracial, not Hispanic	3	2	0	1	1	4	0	0	1	0	1	1	0	0	1	11	1
Hispanic, any Race	14	4	0	2	2	26	3	0	6	3	5	8	1	1	6	61	3
Total Res & Ethnicity Known	610	247	0			407	94	0			513	125	2			1,998	
Resident, Ethnicity Unknown	22	8	0			10	4	0			27	7	17			95	
Not Reported (N/R)	42	14	0			19	9	0			94	16	10			204	
Gender Totals	674	269	0			436	107	0			634	148	29			2,297	
%	71.5%	28.5%				80.3%	19.7%				81.1%	18.9%					

* %M and %F columns are the percent of that gender who are of the specified ethnicity, of those whose ethnicity is known

Research Expenditures (Table R1; Figures R1-R2)

Table R1 shows the department's total expenditure (including indirect costs or "overhead" as stated on project budgets) from external sources of support. Figures R1 and R2 show the per capita expenditure, where capitation is computed two ways. The first (Figure R1) is relative to the number of tenure-track faculty members. The second (Figure R2) is relative to researchers and postdocs as well as tenure-track faculty. Canadian levels are shown in Canadian dollars.

Overall median research expenditures for 2013-14 at U.S. CS public departments rose 5.5 percent in comparison with 2012-13. At U.S. CS departments in private institutions, median expenditures rose 2.7 percent. However, the median research expenditure at U.S. CS departments in private institutions is more than 25 percent higher than that at public institutions. Median expenditures also rose at U.S. CE departments, but fell at U.S. I departments and Canadian departments in comparison with 2012-13. The CE, I and Canadian departments are based on much smaller samples, which makes these comparisons subject to more volatility.

The U.S. CS data for public institutions indicate that the larger the department, the more external funding is received by the department (both in total and per capita). Research expenditures at private institutions were less affected by the size of the department, though per capita they also tended to rise with department size. Both of these observations are consistent with what we reported in previous years.

Table R1. Total Expenditure from External Sources for Computing Research

Department Type	# Depts	Percentile of Department Averages				
		10th	25th	50th	75th	90th
US CS Public	97	$536,264	$1,334,831	$3,951,097	$7,631,364	$14,714,568
US CS Private	30	$1,289,034	$2,232,799	$5,002,006	$8,220,360	$25,000,000
US CE	8		$2,792,305	$5,207,907	$14,272,561	
US Information	13	$1,137,486	$1,711,729	$3,262,156	$5,222,987	$11,815,066
Canadian	10	$1,089,275	$1,851,374	$3,488,194	$4,872,762	$5,562,742

Figure R1. Research Expenditures Normalized by Tenure-Track Size

CRA Taulbee Survey 2014

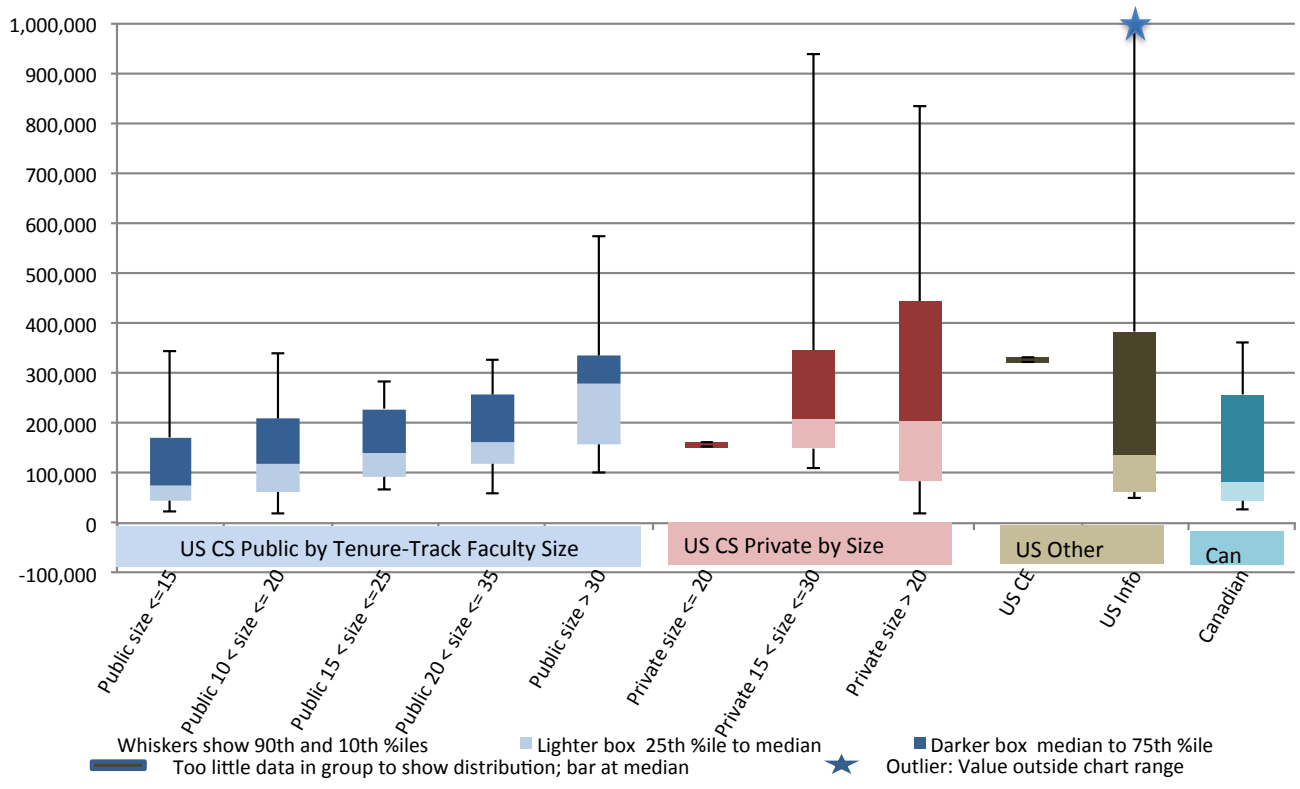
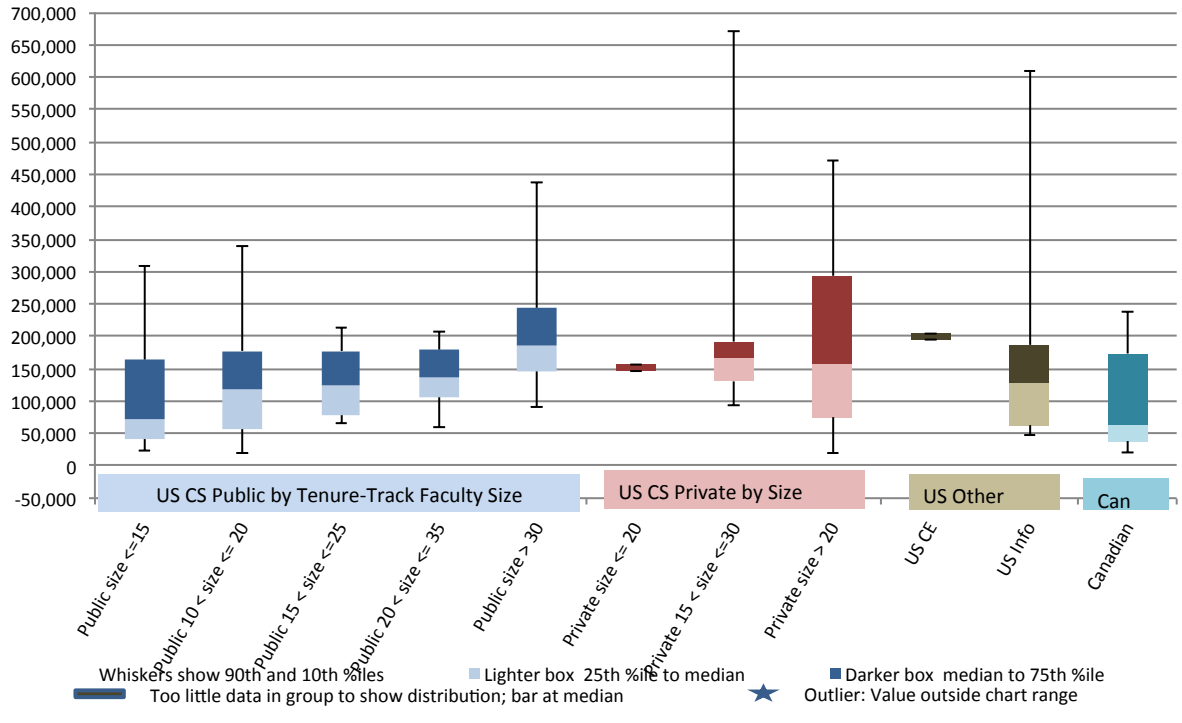


Figure R2. Research Expenditures Normalized by Tenure-Track + Research Faculty + Postdoctorates

CRA Taulbee Survey 2014



Graduate Student Support (Tables G1-G2; Figures G1-G3)

Table G1 shows the number of graduate students supported as full-time students as of fall 2014, further categorized as teaching assistants (TAs), research assistants (RAs), and full-support fellows. The table also shows the split between those on institutional vs. external funds. The total number of TAs on institutional funds in U.S. CS departments increased 14.6 percent this year. Public universities reported a 21.3 percent increase, while private universities reported a 14.2 percent decrease (though there were somewhat fewer private universities reporting this year). In last year's report, private universities reported over a 25 percent increase. It is possible that there were some inconsistencies between years in departmental reporting.

There was an overall decrease of 36 percent in the number of RAs that were supported on institutional funds at U.S. CS departments. Significant decline existed at both public and private universities. The number of RAs on external funding increased by 18.6 percent in U.S. CS departments at public universities, but decreased by 11.5 percent in departments at private universities. In this case, we see both public and private institutions experiencing just the reverse of what was experienced in last year's report. However, there were fewer private universities reporting this year, which likely is the most significant reason why the raw numbers declined.

The number of full-support fellows on external funds declined in U.S. CS departments at public universities, but rose slightly at private universities. However, the number of full-support fellows supported on institutional funds rose over 40 percent in both public and private universities.

There are many substantial differences between this year and last year in the data from U.S. CE and I departments, and from Canadian departments. The fairly small number of departments in each of these categories makes such large changes more probable.

Table G2 shows the distribution of stipends for TAs, RAs, and full-support fellows. U.S. CS data are further broken down in this table by public and private institution. Figures G1-G3 further break down the U.S. CS data by size of department and by geographic location of the university.

The median TA salaries at U.S. CS departments rose 5.6 percent at public universities and 4.1 percent at private universities. Median salaries of RAs rose, respectively, 6.0 and 6.9 percent at public and private universities. For full support fellows, median salaries rose 2.8 percent at U.S. public universities and 19.7 percent at U.S. private universities.

Larger departments at U.S. public universities tend to offer higher stipends to both TAs and RAs than do smaller departments, and private universities tend to offer higher stipends to all categories of grad students than do public universities. As was the case last year, departments located in larger population centers also tend to pay higher stipends to TAs and RAs; the data for full-support fellows exhibits no clear trend relative to locale at public universities.

Table G1. Graduate Students Supported as Full-Time Students by Department Type

		On Institutional Funds						On External Funds						Total
Department Type	# Dept	Teaching Assistants		Research Assistants		Full-Support Fellows		Teaching Assistants		Research Assistants		Full-Support Fellows		
US CS Public	98	2,969.7	36.7%	476.1	5.9%	402.9	5.0%	13.0	0.2%	3,963.4	48.9%	273.1	3.4%	8,098.2
US CS Private	30	490.0	19.3%	366.3	14.4%	263.0	10.3%	3.0	0.1%	1,223.8	48.1%	198.0	7.8%	2,544.0
US CS Total	128	3,459.7	32.5%	842.4	7.9%	665.9	6.3%	16.0	0.2%	5,187.1	48.7%	471.1	4.4%	10,642.2
US CE	8	347.0	31.7%	46.0	4.2%	29.0	2.6%	0.0	0.0%	670.1	61.1%	4.0	0.4%	1,096.1
US I	10	170.5	34.1%	41.7	8.3%	40.0	8.0%	1.0	0.2%	233.7	46.7%	13.0	2.6%	499.9
Canadian	10	218.0	27.6%	192.0	24.3%	91.0	11.5%	36.0	4.6%	211.0	26.7%	41.0	5.2%	789.0
Grand Total	156	4,195.2	32.2%	1,122.1	8.6%	825.9	6.3%	53.0	0.4%	6,301.9	48.4%	529.1	4.1%	13,027.2

Table G2. Fall 2014 Academic-Year Graduate Stipends by Department Type and Support Type

Teaching Assistantships

		Percentiles of Department Averages				
Department Type	# Depts	10th	25th	50th	75th	90th
US CS Public	97	$13,448	$15,000	$17,470	$18,765	$21,422
US CS Private	23	$15,000	$18,700	$22,365	$23,842	$28,068
US CE	8		$18,484	$19,190	$21,222	
US Information	11	$17,000	$17,978	$18,971	$21,257	$24,104
Canadian	8		$10,250	$12,570	$14,489	

Research Assistantships

		Percentiles of Department Averages				
Department Type	# Depts	10th	25th	50th	75th	90th
US CS Public	96	$13,572	$15,638	$18,000	$20,000	$22,829
US CS Private	29	$18,000	$20,447	$22,950	$26,000	$28,842
US CE	8		$18,062	$19,350	$21,133	
US Information	11	$17,955	$19,508	$20,588	$21,539	$24,104
Canadian	8		$10,550	$13,021	$14,125	

Full-Support Fellows

		Percentiles of Department Averages				
Department Type	# Depts	10th	25th	50th	75th	90th
US CS Public	60	$15,540	$17,100	$21,126	$25,000	$30,200
US CS Private	22	$21,622	$22,525	$28,702	$30,000	$30,742
US CE	6			$24,825		
US Information	8		$20,533	$22,475	$25,425	
Canadian	3					

Figure G1. Teaching Assistantship Stipends

CRA Taulbee Survey 2014

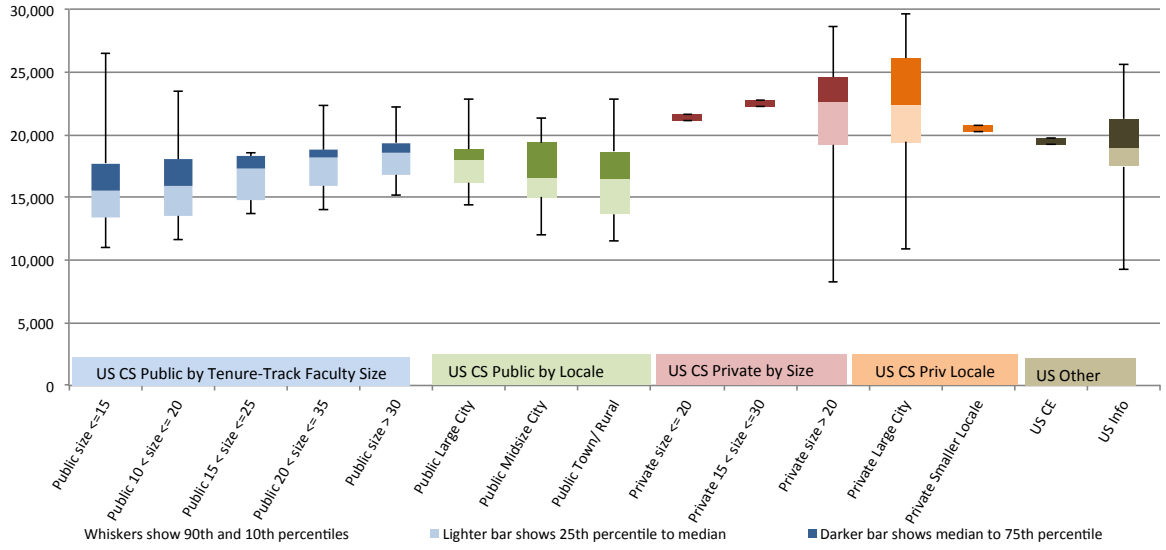


Figure G2. Research Assistantship Stipends

CRA Taulbee Survey 2014

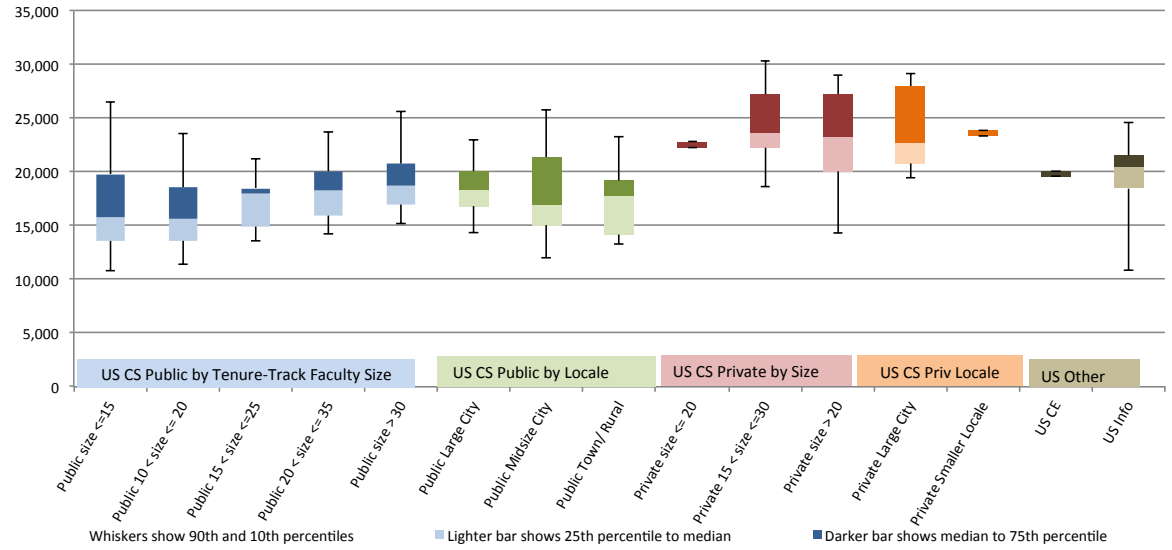
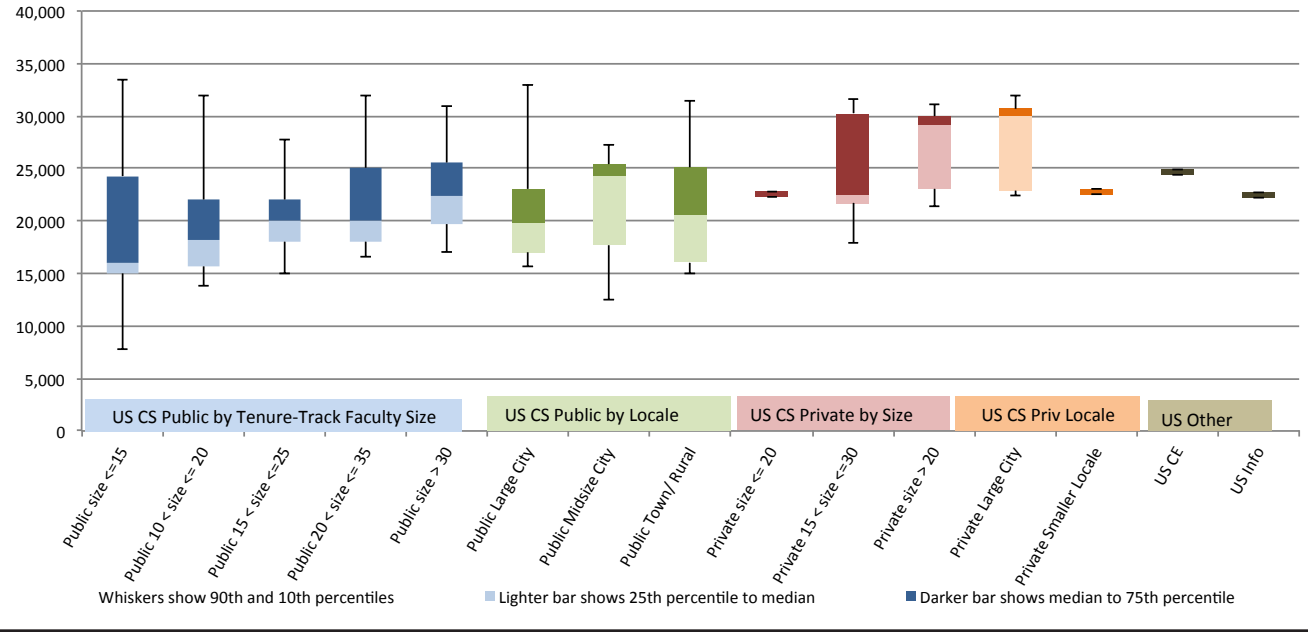


Figure G3. Full Support Fellows Stipends

CRA Taulbee Survey 2014



Faculty Salaries (Tables S1-S21; Figures S1-S9)

Each department was asked to report individual (but anonymous) faculty salaries if possible; otherwise, the department was requested to provide the mean salary for each rank (full, associate, and assistant professors and non-tenure-track teaching faculty, research faculty, and post-doctorates) and the number of persons at each rank. The salaries are those in effect on January 1, 2015. For U.S. departments, nine-month salaries are reported in U.S. dollars. For Canadian departments, twelve-month salaries are reported in Canadian dollars. Respondents were asked to include salary supplements such as salary monies from endowed positions.

U.S. CS data are reported in Tables S1-S16 and in the box and whiskers diagrams. Data for CE, I, Canadian and new Ph.D.s are reported in Tables S17-S20. The tables and diagrams contain distributional data (first decile, quartiles, and ninth decile) computed from the department averages only. Thus, for example, a table row labeled "50" or the median line in a diagram is the median of the averages for the departments that reported within the stratum (the number of such departments reporting is shown in the "depts" row). It therefore is not a true median of all of the salaries.

We also report salary data for senior faculty based on time in rank, for meaningful comparison of individual or departmental faculty salaries with national averages. We report associate professor salaries for time in rank of 7 years or less, and of more than 7 years. For full professors, we report time in rank of 7 years or less, 8 to 15 years, and more than 15 years.

Those departments reporting salary data were provided a summary report in December 2014. Those departments that provided individual salaries were additionally provided more comprehensive distributional information based on these individual salaries. This year, about 75 percent of those reporting salary data provided salaries at the individual level.

The remainder of this section updates the basic report provided in December to all departments that provided salary data. It reflects salary data received since the deadline for that report.

Similar to past years, the data show that salaries at private universities tend to be higher than those at public universities in all faculty strata (Tables S2 and S3). At public universities, salaries tend to be higher for larger departments (Tables S4-S8). At private universities, full professor salaries are somewhat higher in smaller locales, while associate professor salaries are somewhat lower in smaller locales. Public university salaries appear to be generally lower in smaller locales for non-tenure-track faculty and for tenure-track associate and assistant professors.

To provide a more meaningful comparison of this year's salaries with those from last year's Taulbee report, we use only those departments that reported both years. Because some departments that reported both years provided only aggregate salaries for their full and associate professors during one year and in the other year reported them by years in rank, we only include the salaries for all full professors and for all associate professors in the year-to-year comparison. Table S21 shows the change in median of the average salaries in departments that reported both years (the number of departments being compared is indicated in each column). The table indicates that the median of the average salaries has increased by 2-3 percent from 2013-14 to 2014-15 in most categories of faculty.

When interpreting these changes, it is important to remember the effect that promotions have on the departmental data from one year to the next, since individual faculty members move from one rank to another. Thus, a department with a small number of faculty members in a particular rank can have its average salary in that rank change appreciably (in either direction) by a single promotion to or from that rank. Departures via resignation or retirement also impact these figures, particularly in the non-tenure-track categories. Because of the small number of Canadian and Computer Engineering departments reporting, the values in those columns are considerably more volatile.

For new Ph.D.s in tenure-track positions at U.S. computer science, computer engineering, and I-school departments (Table S20) the median of the averages increased by 2.5 percent vs. last year. Canadian departments did not report any salaries this year for new Ph.D.s in tenure-track, teaching, or non-tenure-track research positions.

Table S1. Nine-month Salaries, 129 Responses of 186 US CS Departments, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	101	106	109	124	94	110	121	120	89	46	51
Indiv	542	543	562	1741	413	615	1087	664	535	277	368
10	$122,365	$120,900	$117,826	$123,512	$95,162	$98,341	$99,635	$87,639	$56,037	$58,914	$41,546
25	$137,398	$134,195	$124,608	$135,415	$100,745	$105,289	$103,351	$91,691	$65,231	$70,393	$45,313
50	$156,787	$150,693	$142,017	$149,036	$105,957	$111,100	$109,633	$96,055	$71,839	$87,848	$52,877
75	$176,102	$169,862	$155,000	$164,589	$117,996	$118,705	$118,419	$103,110	$81,038	$104,909	$59,402
90	$195,950	$191,795	$168,591	$186,329	$124,500	$130,494	$129,444	$107,969	$95,074	$134,096	$65,423

Table S2. Nine-month Salaries, 97 Responses of 134 US CS Public (All Public), Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	77	81	82	94	76	84	93	91	70	34	37
Indiv	378	402	394	1266	316	476	845	483	383	172	219
10	$120,129	$118,309	$113,505	$122,852	$95,994	$97,671	$99,157	$87,410	$56,029	$62,116	$41,818
25	$137,398	$130,075	$120,127	$135,065	$100,606	$102,959	$102,381	$91,138	$65,058	$70,014	$45,625
50	$153,025	$145,833	$139,476	$145,267	$105,747	$109,407	$108,929	$95,199	$69,585	$85,302	$52,364
75	$168,517	$161,243	$151,772	$157,220	$115,273	$115,755	$114,416	$99,709	$77,157	$97,129	$56,200
90	$179,454	$177,000	$163,214	$166,647	$122,959	$125,155	$124,904	$104,200	$91,922	$111,794	$60,229

Table S3. Nine-month Salaries, 32 Responses of 52 US CS Private (All Private), Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	24	25	27	30	18	26	28	29	19	12	14
Indiv	164	141	168	475	97	139	242	181	152	105	149
10	$123,966	$138,565	$121,997	$125,987	$91,999	$106,120	$104,168	$92,729	$61,668	$56,180	$41,770
25	$140,908	$147,616	$131,116	$149,030	$101,507	$111,390	$107,823	$97,211	$73,666	$75,806	$45,019
50	$178,987	$182,742	$153,572	$170,963	$113,917	$118,686	$117,563	$105,060	$81,038	$100,491	$58,255
75	$201,227	$192,188	$165,708	$192,072	$125,825	$129,120	$128,203	$109,200	$90,919	$129,492	$65,067
90	$215,118	$213,976	$194,645	$200,344	$133,482	$141,412	$139,587	$115,020	$100,551	$141,861	$67,563

Table S4. Nine-month Salaries, 25 Responses of US CS Public With <=15 Tenure-Track Faculty, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	14	14	17	23	17	17	22	20	16	2	3
Indiv	42	30	38	116	49	57	115	55	56		
10	$110,023	$107,572	$107,260	$112,375	$98,315	$95,628	$96,230	$85,987	$54,759		
25	$124,445	$118,484	$117,856	$123,215	$100,243	$97,020	$99,344	$87,263	$57,611		
50	$139,866	$125,378	$126,963	$135,522	$103,351	$102,987	$103,793	$90,762	$67,631		
75	$146,681	$144,438	$135,848	$145,647	$108,929	$112,168	$111,825	$96,443	$74,635		
90	$152,684	$160,422	$151,486	$147,895	$122,276	$116,298	$118,764	$99,180	$82,827		

Table S5. Nine-month Salaries, 30 Responses of US CS Public With 10 < Tenure-Track Faculty <=20, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	20	23	24	29	24	26	29	27	22	5	6
Indiv	64	67	59	205	71	97	179	77	80	15	11
10	$123,525	$114,891	$110,757	$121,787	$94,533	$95,560	$95,075	$86,252	$53,631		
25	$134,472	$117,650	$116,536	$124,861	$98,863	$97,140	$99,141	$88,845	$56,437		
50	$143,398	$128,250	$123,482	$135,848	$101,522	$103,083	$103,351	$91,710	$67,036	$75,000	$49,980
75	$150,361	$147,936	$138,345	$145,007	$105,783	$109,162	$106,926	$96,380	$74,214		
90	$157,247	$163,577	$152,225	$153,304	$115,840	$114,434	$117,365	$101,081	$85,367		

Table S6. Nine-month Salaries, 28 Responses of US CS Public With 15 < Tenure-Track Faculty <=25, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	22	25	25	27	23	26	27	27	22	10	11
Indiv	73	101	89	280	65	118	196	91	88	31	33
10	$118,565	$116,624	$110,639	$119,228	$94,485	$97,546	$97,609	$86,444	$55,905	$71,266	$40,000
25	$134,816	$128,250	$117,701	$129,720	$97,189	$101,475	$101,615	$90,013	$62,404	$77,525	$44,725
50	$146,589	$134,500	$124,608	$143,584	$101,316	$106,991	$104,219	$93,842	$66,829	$92,220	$48,000
75	$163,252	$149,885	$143,289	$151,306	$106,584	$110,206	$108,924	$99,489	$72,953	$104,909	$55,503
90	$168,606	$161,241	$155,648	$160,052	$117,329	$114,698	$117,113	$103,612	$78,080	$118,374	$62,112

Table S7. Nine-month Salaries, 32 Responses of US CS Public With 20 < Tenure-Track Faculty <=35, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	30	30	29	32	27	31	32	32	24	13	14
Indiv	118	144	115	402	116	143	275	152	123	34	70
10	$120,364	$125,895	$118,786	$131,773	$98,513	$98,947	$101,503	$87,768	$59,357	$56,142	$44,615
25	$132,077	$134,707	$124,608	$138,194	$100,964	$106,052	$102,832	$91,861	$65,315	$70,000	$46,219
50	$157,630	$144,832	$141,223	$146,143	$107,632	$109,400	$109,317	$95,471	$66,954	$88,100	$51,705
75	$168,215	$158,157	$152,475	$158,597	$117,246	$115,366	$112,699	$100,119	$76,872	$97,539	$56,444
90	$175,052	$162,979	$168,736	$169,875	$122,753	$124,191	$122,591	$104,188	$81,108	$105,019	$60,704

Table S8. Nine-month Salaries, 33 Responses of US CS Public With Tenure-Track Faculty >30, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	30	31	31	32	25	30	32	32	22	15	18
Indiv	223	218	238	737	137	246	403	251	185	119	133
10	$141,479	$135,329	$128,002	$142,409	$97,735	$105,665	$105,324	$93,007	$58,947	$62,681	$41,864
25	$154,887	$143,686	$136,491	$148,461	$103,520	$109,993	$109,280	$95,005	$67,441	$68,662	$45,970
50	$163,249	$157,270	$146,519	$155,063	$109,096	$114,659	$112,877	$97,448	$74,773	$83,009	$52,839
75	$174,540	$175,721	$156,512	$165,268	$116,309	$123,280	$119,042	$100,691	$85,011	$94,193	$55,188
90	$189,841	$188,500	$166,116	$176,992	$123,377	$130,494	$129,216	$105,730	$92,438	$104,628	$59,288

Table S9. Nine-month Salaries, 12 Responses of US CS Private With <=20 Tenure-Track Faculty, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	6	7	9	11	5	8	9	10	5	1	3
Indiv	27	24	34	87	11	26	42	33	14		
10				$123,787				$98,409			
25		$176,200	$125,774	$137,601		$111,705	$105,345	$100,156			
50	$148,604	$206,033	$140,322	$154,258	$102,774	$120,825	$118,050	$106,220	$78,600		
75		$214,272	$156,696	$185,801		$126,545	$126,781	$110,338			
90				$203,969				$115,916			

Table S10. Nine-month Salaries, 13 Responses of US CS Private With 15 < Tenure-Track Faculty <=30, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	8	11	11	13	6	8	10	12	5	4	6
Indiv	34	50	46	139	19	29	59	55	20	10	39
10		$144,506	$126,892	$149,024			$105,106	$95,111			
25	$176,488	$157,077	$134,040	$154,258		$110,352	$106,174	$96,936			
50	$183,560	$182,400	$152,200	$172,870	$109,347	$115,477	$112,344	$104,609	$85,360	$90,280	$46,667
75	$198,569	$200,097	$162,648	$191,723		$124,317	$123,664	$109,579			
90		$206,441	$187,250	$198,495			$127,093	$113,408			

Table S11. Nine-month Salaries, 20 Responses of US CS Private With Tenure-Track Faculty >20, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	19	19	19	20	14	19	20	20	15	12	12
Indiv	138	121	148	407	90	122	213	162	162	111	144
10	$136,328	$136,310	$125,625	$132,899	$98,982	$108,293	$106,911	$92,927	$63,645	$56,180	$41,323
25	$171,723	$146,161	$133,660	$153,750	$103,981	$112,380	$108,673	$95,430	$73,666	$75,806	$43,353
50	$187,113	$180,321	$155,000	$171,961	$113,917	$117,075	$116,726	$104,281	$87,112	$107,912	$54,834
75	$205,923	$191,475	$165,708	$192,696	$123,040	$134,049	$129,368	$108,048	$94,685	$129,492	$61,538
90	$217,282	$192,582	$193,511	$197,892	$132,694	$143,180	$143,527	$115,010	$105,625	$141,861	$66,049

Table S12. Nine-month Salaries, 36 Responses of US CS Public In Large City or Suburbs, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	29	29	32	36	28	31	36	36	29	17	15
Indiv	161	147	149	523	142	181	358	212	184	103	91
10	$129,890	$124,592	$118,217	$132,773	$99,225	$103,803	$102,307	$91,217	$60,726	$57,472	$44,747
25	$142,333	$134,130	$124,994	$136,524	$103,270	$107,995	$104,890	$93,018	$66,197	$72,725	$48,000
50	$150,707	$143,021	$133,789	$145,921	$108,819	$110,724	$109,751	$96,388	$70,618	$93,382	$53,314
75	$167,845	$157,270	$143,845	$154,356	$119,002	$117,286	$114,714	$101,018	$78,031	$103,260	$55,698
90	$182,792	$174,953	$163,069	$165,236	$123,352	$125,568	$121,940	$104,385	$88,598	$117,779	$57,104

Table S13. Nine-month Salaries, 23 Responses of US CS Public In Midsize City or Suburbs, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	20	19	20	23	20	22	23	22	14	6	8
Indiv	109	111	125	358	63	125	197	118	77	26	54
10	$115,970	$121,977	$112,785	$118,404	$95,543	$97,005	$100,084	$87,790	$58,162		
25	$140,411	$140,630	$120,020	$137,148	$98,630	$102,694	$102,178	$92,342	$65,926		$41,125
50	$154,782	$150,902	$143,181	$150,590	$104,333	$109,177	$109,300	$96,330	$70,315	$88,720	$57,142
75	$171,145	$163,437	$154,171	$162,121	$106,994	$114,979	$113,846	$100,346	$79,433		$59,909
90	$187,532	$176,928	$156,125	$166,765	$117,650	$131,565	$140,474	$111,427	$100,490		

Table S14. Nine-month Salaries, 36 Responses of US CS Public in Small City, Town, or Rural, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	28	33	30	35	28	31	34	33	27	11	14
Indiv	108	144	120	385	111	170	290	153	122	43	74
10	$113,487	$115,798	$112,739	$121,096	$94,299	$96,142	$95,473	$86,087	$55,788	$66,075	$43,154
25	$129,704	$126,001	$119,077	$131,291	$100,093	$100,795	$101,437	$87,843	$58,351	$68,143	$46,327
50	$150,154	$139,792	$144,662	$141,487	$102,705	$106,100	$106,771	$94,039	$68,100	$70,057	$51,705
75	$168,254	$161,243	$152,238	$156,706	$116,894	$114,101	$116,040	$95,990	$76,960	$73,349	$53,776
90	$175,356	$176,594	$166,250	$172,369	$123,515	$124,165	$122,472	$99,732	$87,990	$97,539	$58,762

Table S15. Nine-month Salaries, 22 Responses of US CS Private in Large City or Suburbs, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	17	17	20	22	14	19	20	21	17	10	11
Indiv	110	97	144	353	81	112	198	156	164	106	117
10	$130,802	$135,358	$120,533	$124,266	$96,348	$104,160	$101,407	$93,125	$63,923	$76,459	$43,333
25	$142,382	$144,506	$128,588	$135,248	$103,981	$109,165	$108,673	$96,109	$78,409	$85,930	$46,680
50	$177,938	$180,321	$142,490	$159,821	$114,566	$119,321	$119,991	$104,405	$85,360	$107,912	$56,667
75	$193,519	$191,917	$163,601	$190,016	$125,825	$133,276	$131,063	$108,750	$93,341	$124,977	$65,059
90	$205,509	$211,465	$198,639	$202,285	$132,341	$140,638	$138,662	$115,000	$103,088	$139,854	$68,182

Table S16. Nine-month Salaries, 10 Responses of US CS Private in Other than Large City, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	8	9	8	9	5	8	9	9	3	3	4
Indiv	55	48	38	141	20	36	57	39			34
10											
25	$164,644	$172,756	$153,948	$171,053		$114,976	$107,025	$104,100			
50	$182,540	$183,500	$155,974	$189,094	$101,085	$117,563	$117,075	$105,060			$55,122
75	$213,435	$194,160	$164,270	$192,188		$124,244	$126,453	$110,717			
90											

Table S17. Nine-month Salaries, 9 Responses of 31 US Computer Engineering Departments, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	6	7	6	8	6	7	8	7	4	2	1
Indiv	19	21	27	78	18	48	72	15	16		
10											
25		$115,892		$120,760		$98,815	$99,529	$88,001			
50	$153,221	$129,451	$116,378	$142,388	$109,187	$99,450	$107,667	$93,769	$79,840		
75		$151,443		$167,679		$103,320	$113,540	$96,653			
90											

Table S18. Nine-month Salaries, 14 Responses of 21 US Information Departments, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	9	11	11	13	9	13	13	13	9	7	3
Indiv	22	40	58	121	47	92	143	92	78	40	
10		$117,647	$137,823	$128,655		$101,927	$104,670	$84,146			
25	$126,172	$129,034	$139,982	$133,318	$107,684	$104,262	$107,671	$91,636	$76,188	$67,976	
50	$147,255	$132,776	$143,835	$147,800	$110,468	$110,687	$111,055	$95,500	$80,123	$76,045	
75	$165,646	$157,496	$162,303	$160,581	$115,359	$114,143	$113,052	$99,804	$91,223	$91,610	
90		$165,500	$171,538	$161,848		$115,912	$117,847	$103,478			

Table S19. Twelve-month Salaries, 8 Responses of 30 Canadian Departments, Percentiles from Department Averages

	Full Professor				Associate			Assistant	Non-Tenure Track		
	In rank 16+ yrs	In rank 8-15 yrs	In rank 0-7 years	All years in rank	In rank 8+ years	In rank 0-7 years	All years in rank		Teach	Research	Postdoc
Depts	7	7	6	8	7	6	8	7	8	3	5
Indiv	42	51	45	157	63	42	113	32	55		56
10											
25	$176,783	$160,379		$165,303	$138,497		$132,824	$104,201	$82,394		
50	$192,124	$187,842	$165,301	$177,650	$141,415	$142,619	$140,556	$117,132	$104,555		$47,600
75	$208,661	$192,810		$184,204	$157,431		$149,959	$121,139	$113,808		
90											

Table S20. Nine-month Salaries for New PhDs

	US (CS, CE, and Info Combined)				Canadian			
	Tenure-Track	Non-ten Teaching	Non-ten Research	Postdoc	Tenure-Track	Non-ten Teaching	Non-ten Research	Postdoc
Depts	64	22	5	25	0	0	0	1
Indiv	128	33	9	79	0	0	0	2
10	$85,472	$45,900		$37,834				
25	$91,586	$56,950		$42,619				
50	$95,476	$72,500	$51,488	$52,288				
75	$101,584	$91,951		$60,875				
90	$107,146	$112,520		$62,130				

Table S21. Change in Salary Median for Departments that Reported in Both 2013 and 2014

	U.S. CS	U.S. CE	U.S. I	Canadian
Departments	122	6	11	7
Full Profs.	2.3%	1.0%	3.1%	2.3%
Assoc. Profs.	2.0%	2.2%	2.7%	2.1%
Asst. Profs.	3.0%	1.2%	2.7%	3.0%
Non-ten-track teaching faculty	1.1%	6.3%	19.9%	3.1%
Research faculty	-0.4%		6.9%	-0.2%
Post doctorates	-2.8%		8.2%	-2.6%

Figure S1. US CS Department Average Salary, Full Professor in Rank 16+ Years

CRA Taulbee Survey 2014

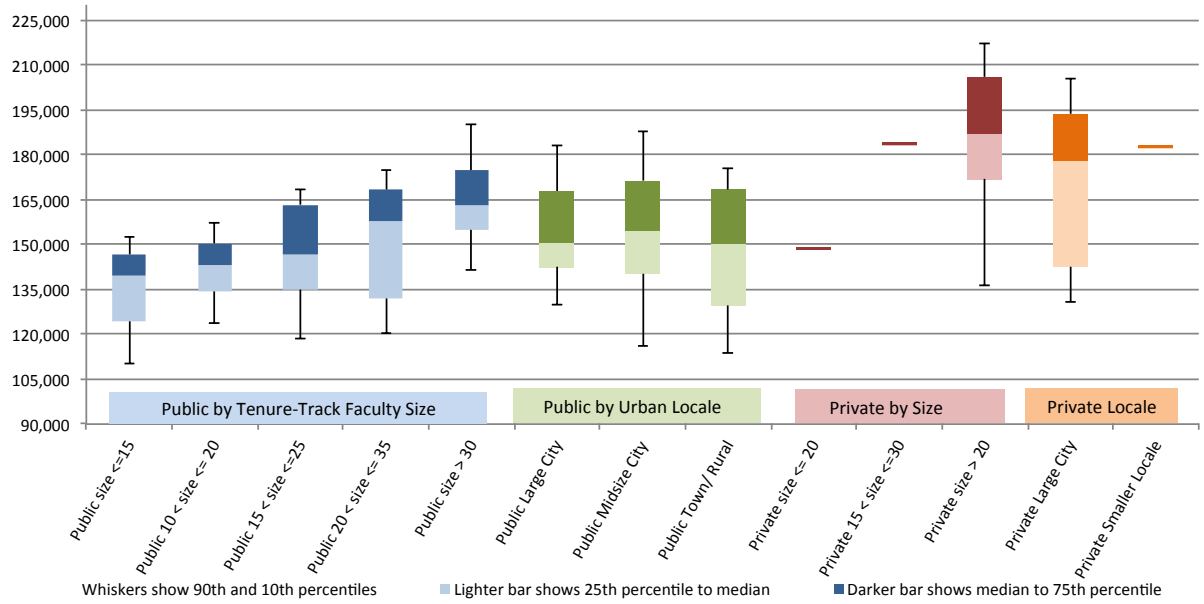


Figure S2. US CS Department Average Salary, Full Professor in Rank 8-15 Years

CRA Taulbee Survey 2014

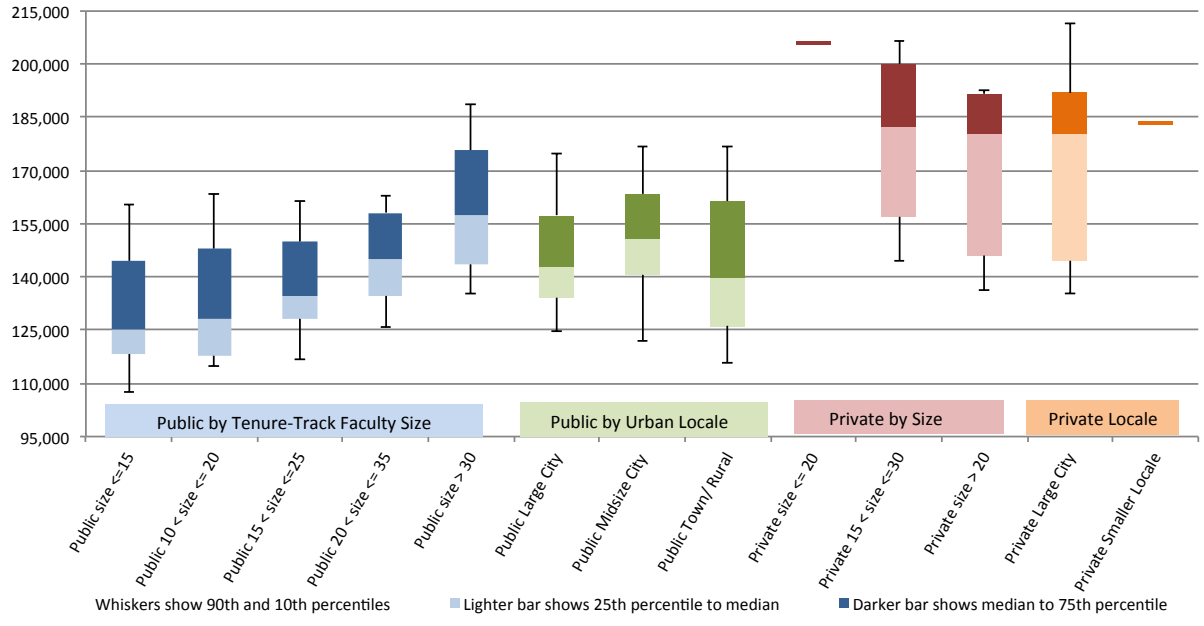


Figure S3. US CS Department Average Salary, Full Professor in Rank 0-7 Years

CRA Taulbee Survey 2014

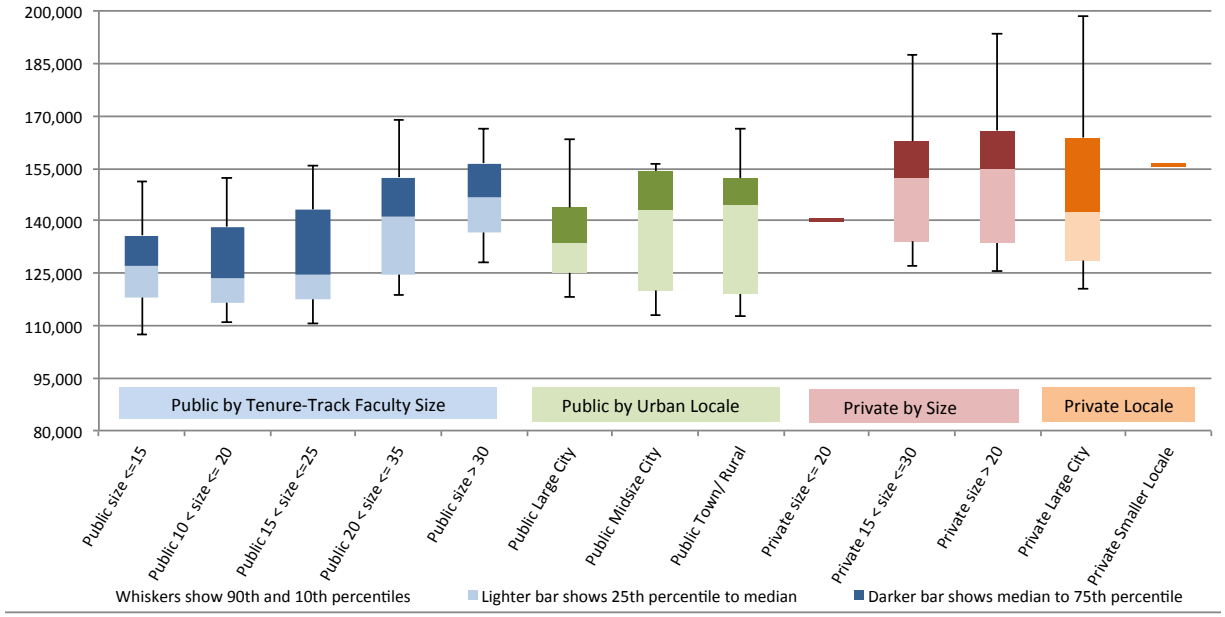


Figure S4. US CS Department Average Salary, Associate Professor in Rank 8+ Years

CRA Taulbee Survey 2014

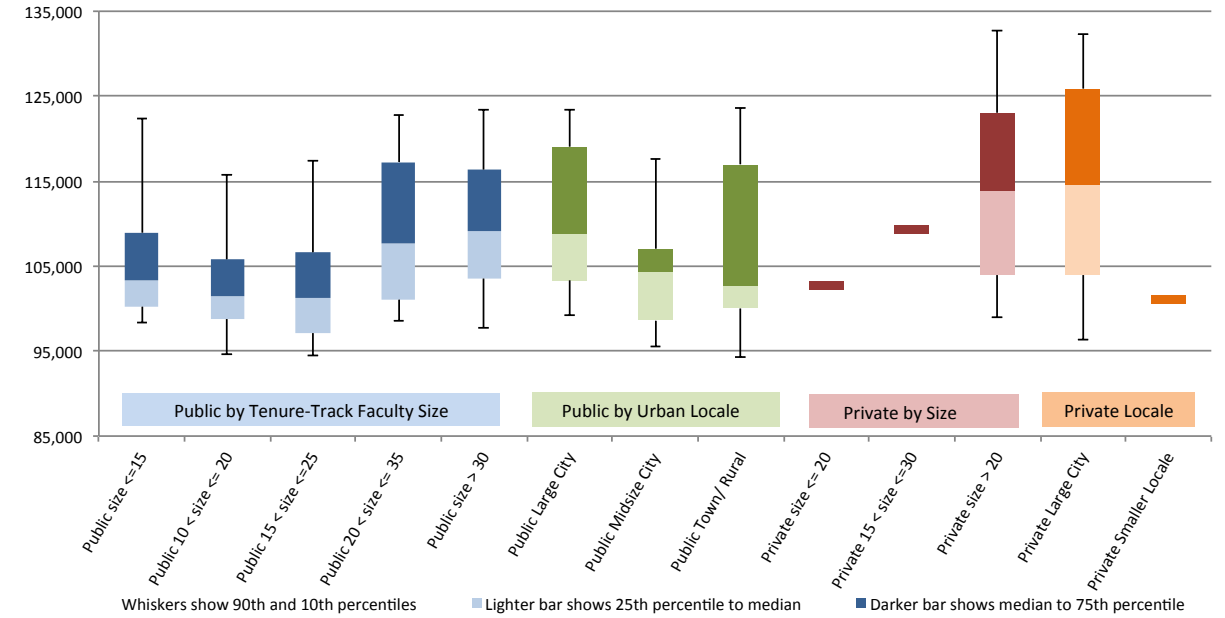


Figure S5. US CS Department Average Salary, Associate Professor in Rank 0-7 Years

CRA Taulbee Survey 2014

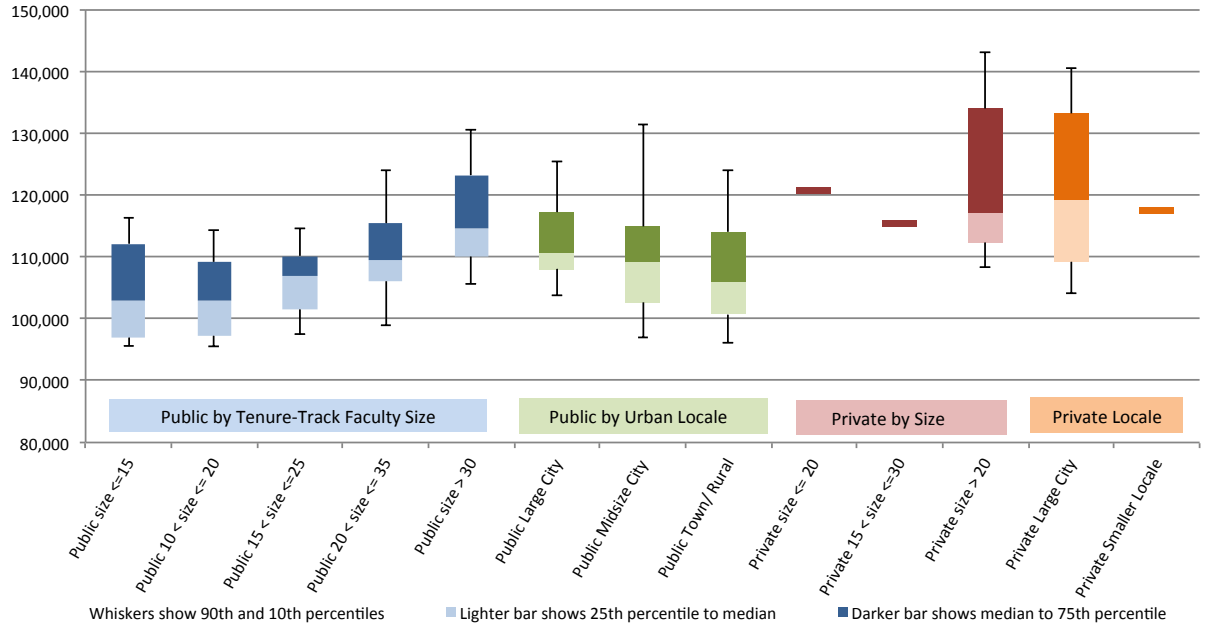


Figure S6. US CS Department Average Salary, Assistant Professor

CRA Taulbee Survey 2014

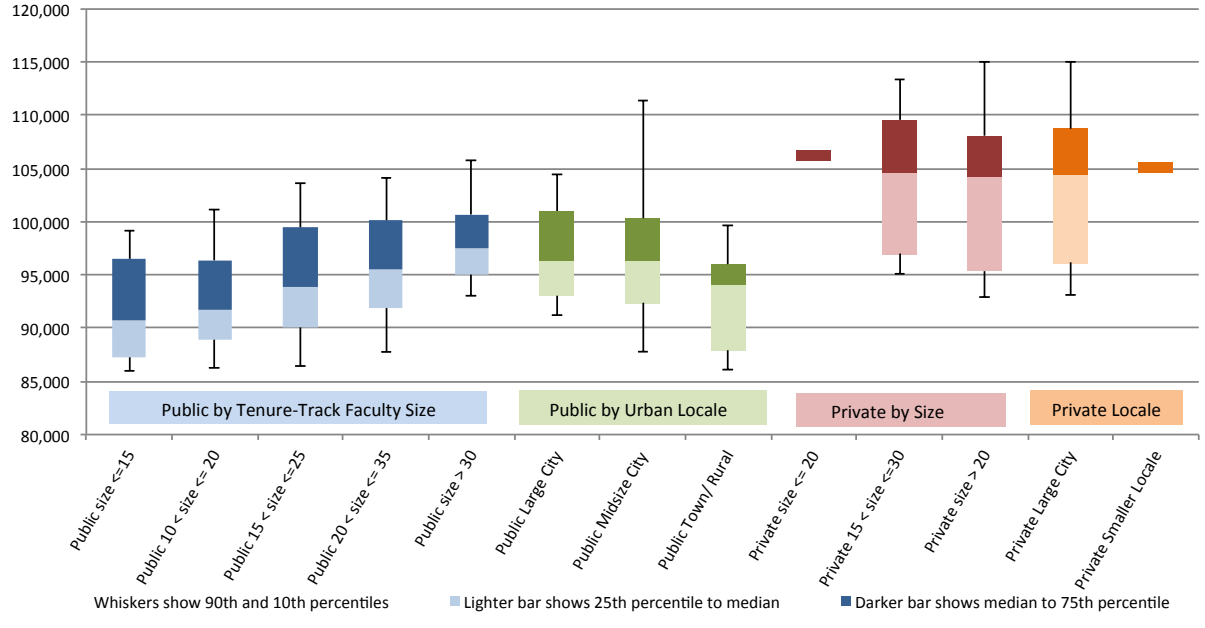


Figure S7. US CS Department Average Salary, Non-Tenure Track Teaching Faculty

CRA Taulbee Survey 2014

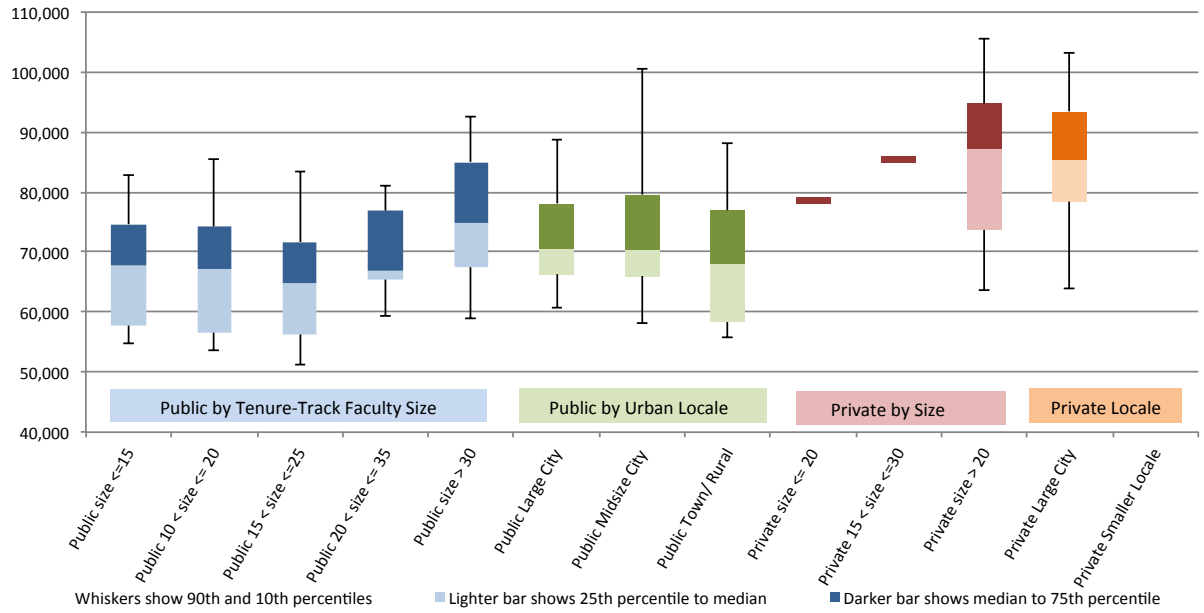


Figure S8. US CS Department Average Salary, Non-Tenure Track Research Faculty

CRA Taulbee Survey 2014

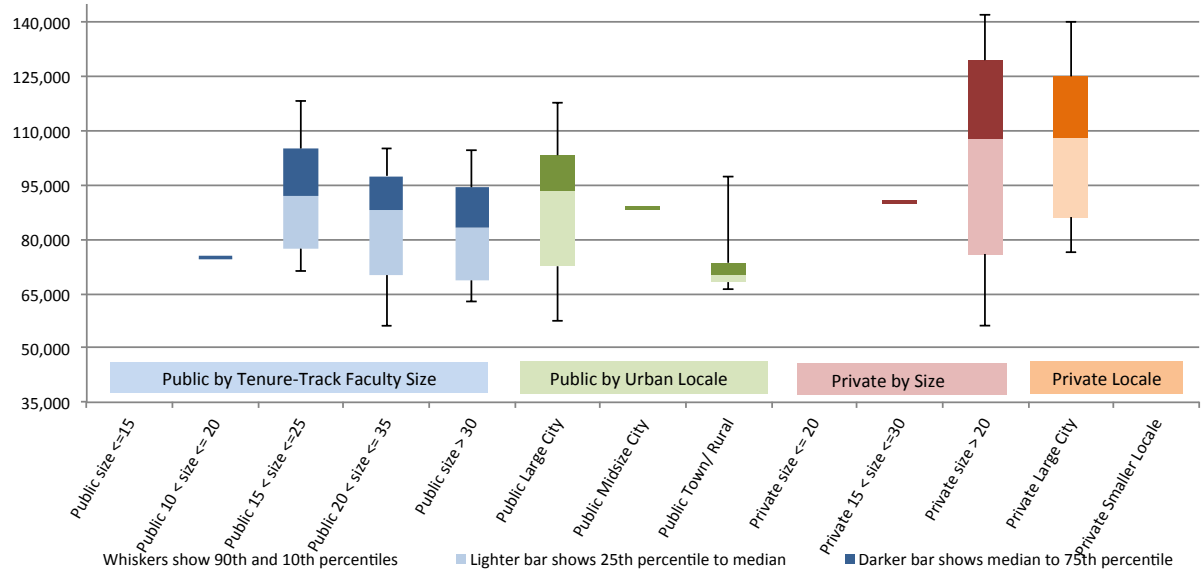
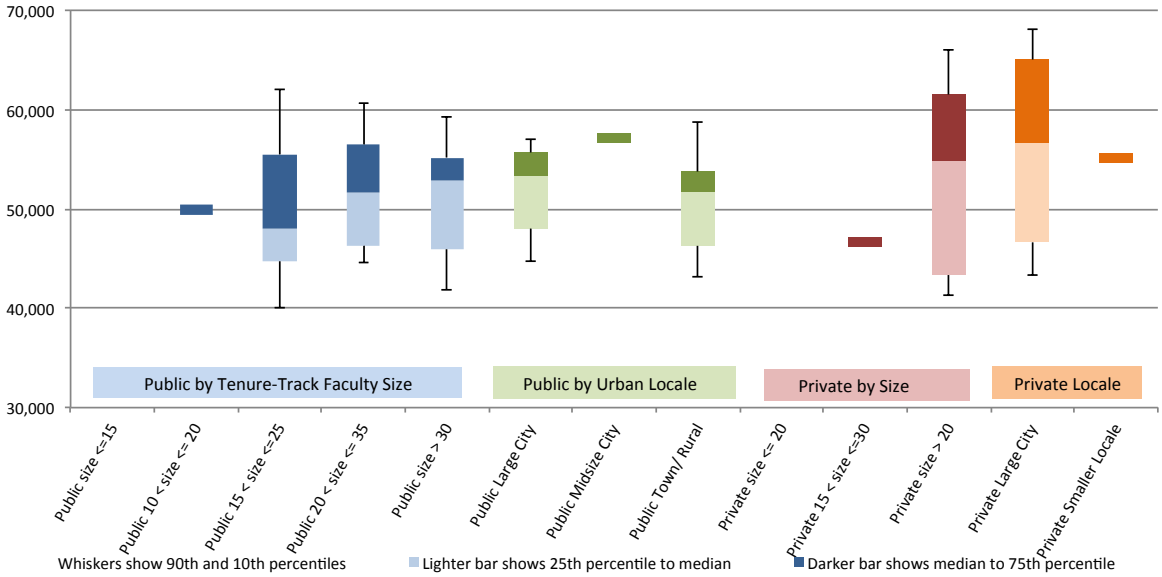


Figure S9. US CS Department Average Salary, Postdoctorates

CRA Taulbee Survey 2014



Concluding Observations

There is seemingly relentless teaching pressure on academic computing departments from the undergraduate demand. Yet, for the fourth time in five years, the fraction of doctoral graduates who took tenure-track positions at doctoral-granting departments declined. Industry continues to employ majority of doctoral graduates, with most of those going to industry taking research positions where the nature of their industry position is known. The struggles that academic departments face in coping with the increased demand remind us of the high growth eras in the 80s and 90s.

Participating Departments

US CS Public (103): Arizona State, Auburn, Clemson, College of William & Mary, Colorado School of Mines, Colorado State, Florida International, Florida State, George Mason, Georgia Tech, Georgia State, 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 Jersey Institute of Technology, New Mexico State, North Carolina State, North Dakota State, Ohio State, Ohio, Oklahoma State, Old Dominion, Oregon State, Pennsylvania State, Portland State, Purdue, Rutgers, Stony Brook (SUNY), Temple, Texas A&M, University at Albany, 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 (Reno), New Hampshire, North Carolina (Chapel Hill and Charlotte), North Dakota, 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), Wyoming, Virginia Tech, Washington State, Western Michigan, and Wright State.

US CS Private (34): Boston University, Brown, Carnegie Mellon, Case Western Reserve, Columbia, Cornell, DePaul, Drexel, Duke, Florida Institute of Technology, Harvard, Illinois Institute of Technology, Johns Hopkins, Lehigh, MIT, New York University, Northeastern, Pace, Princeton, Rensselaer, Rice, Rochester Institute of Technology, Stanford, Stevens Institute of Technology, Toyota Technological Institute at Chicago, Tufts, Universities of: Chicago, Pennsylvania, Rochester, Southern California, and Tulsa, Washington in St. Louis, Worcester Polytechnic Institute, and Yale.

US CE (10): Florida Institute of Technology, Iowa State, North Carolina State, Princeton, Purdue, Santa Clara, Universities of: California (Santa Cruz), Illinois (Urbana Champaign), New Mexico, and Southern California, and Virginia Tech.

US Information (15): Cornell, Drexel, Florida State, Indiana, Penn State, Syracuse, University at Albany (SUNY), Universities of: California (Berkeley and Santa Cruz), Illinois (Urbana Champaign), Maryland (Baltimore County), Michigan, North Carolina (Chapel Hill), Pittsburgh, and Washington.

Canadian (11): Concordia, McGill, Simon Fraser, Universities of: British Columbia, Calgary, Manitoba, New Brunswick, Toronto, Victoria, Waterloo, and Western Ontario.

[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. Other I-programs who meet these criteria and would like to participate in the survey in future years are invited to contact survey@cra.org for inclusion.

[3]Classification of the population of an institution's locale is in accordance with the Carnegie Classification database. Large cities are those with population >= 250,000. Mid-size cities have population between 100,000 and 250,000. Town/rural populations are less than 100,000.

[4]All faculty tables: The survey makes no distinction between faculty specializing in CS vs. CE programs. Every effort is made to minimize the inclusion of faculty in electrical engineering who are not computer engineers.

Expanding the Pipeline:

Booming Enrollments – What is the Impact?

By Lecia Barker (University of Texas at Austin), Tracy Camp (Colorado School of Mines), Ellen Walker (Hiram College), and Stu Zweben (Ohio State University)

Introduction

We are in the throes of another undergraduate enrollment surge. The number of new CS/CE majors in bachelor's programs at Taulbee departments this year has reached the peak levels seen at the end of the dot-com era. While this is better news than the opposite (declining enrollments), it is critical that the field take into account how policies and efforts to manage the enrollment surge will affect groups that are under-represented in computing. The Taulbee Survey shows a three-year increase of approximately 61 percent in undergraduate enrollment at U.S. CS departments between 2010-11 and 2013-14. We also note that the booming enrollments are not limited to doctoral granting universities. For the past two years, ACM has sponsored a survey similar to the Taulbee Survey, but which collects data from Non-doctoral granting Departments in Computing (NDC). The most recent study included data from 164 institutions representing 302 programs at the bachelor's level. Between 2012-13 and 2013-14, these institutions saw more than a 16% increase in CS degree production and over 7% increase in total CS enrollment.

How are Universities Accommodating the Undergraduate Boom?

At the 2015 ACM SIGCSE conference in March, the authors held a discussion with about 150 computer science educators to understand how universities are dealing with increasing enrollments. Three general approaches were presented (which are not mutually exclusive), including managing staffing, class sizes and formats, and administrative policies.

- **Staffing approaches:** increasing teaching assistant staff, both graduate and undergraduate; using undergraduate peer advisors; partnering with other departments to teach interdisciplinary majors; creating lines for tenure-track faculty and/or teaching faculty; hiring adjuncts (e.g., adjunct faculty at NDC institutions increased by 175% from 2012-13 to 2013-14); hiring Ph.D. students (from neighboring institutions for NDC institutions); imposing teaching overloads on faculty; and other approaches, such as keeping some faculty in reserve to teach courses as needed (if not needed, they can teach their favorite elective instead).
- **Class size and format:** increasing class sizes, changing course structure (e.g., from individual sections to large lecture with recitations), and using online or blended courses.
- **Policies and predictions:** changing course sequences; reducing pre-requisites to influence course-taking patterns; reducing number of electives to cover core courses; conducting surveys and/or tightening pre-requisites to improve course-taking predictions; eliminating non-major service courses; increasing student fees to support hiring needs; and imposing policies to cap enrollment.

Each of these approaches has implications for managing departments; e.g., teaching assistants require training and management and charging student fees requires approval beyond the department. In addition, some of the approaches may not be feasible. For example, although we are producing new Ph.D.s at record or near record numbers, about 60% are going to industry. Meanwhile, graduate enrollments have been stable the last few years, which suggests that there is limited capacity to handle growing undergraduate enrollments via the hiring of new doctoral graduates. Furthermore, some approaches may have especially negative consequences for diversity.

How Might the Enrollment Boom Affect Diversity Efforts?

The U.S. computing community has put enormous effort into diversifying the field. Diversity is a social justice issue given the huge industry demand and high salaries associated with the demand, but also critical for innovation and problem solving (as shown by numerous studies). Programs like the National Science Foundation's Broadening Participation in

Computing and code.org have made significant inroads into formal and informal education. The students interested in computing are now more diverse than ever, yet the way the enrollment boom is managed could divert promising undergraduates into other majors.

Enrollment caps can help departments reduce the number of students who take courses or declare a major. Some course enrollment caps are simply based on a first-come, first-served approach or in randomization, so that students have a more or less equal chance to be admitted into classes or the major. Yet many departments go beyond FCFS, to give priority to students who are willing to declare the major. Students who take computer science in high school are more likely to declare the computer science major, are more likely to be a white or Asian male, and are more likely to be from a school large enough to have computer science classes. In contrast, underrepresented students and those from high schools without computer science courses are increasingly intrigued by computing and want to try it out for the first time as undergraduates. *Enrollment policies influenced by pre-college course-taking limits access by women, under-represented minorities, and rural (under-resourced) areas.*

Charging differential tuition or fees is another way that departments can accommodate increased teaching staff and lab expenses. However, research shows that *differential costs are likely to more negatively impact students who are first in family to go to college or come from less affluent backgrounds.*

Even when students can be accommodated, the need to scale course size may also negatively impact retention of under-represented groups in computing. Large lecture courses are less personal, with less faculty-student and student-peer interaction, two significant predictors of retention in computer science. Students can also have less information on which to judge their progress relative to their peers. In addition, *when courses are large, it can be harder to establish ties with the peer networks that support learning and the development of identity as a person who belongs in the field.* Women and under-represented minorities in computing also stand out as different and become isolated. Research shows that women leave computer science not because of their grades (which are typically higher than the men who stay), but because they are isolated, don't understand their standing relative to peers, and feel the social climate is uncomfortable.

Will the Undergraduate Enrollment Boom Lead to a Graduate Enrollment Boom?

Some of the growth in interest in computer science appears to be tied to the availability of immediate, lucrative employment with a bachelor's degree. For these students, the pipeline from undergraduate degree programs to graduate degree programs is likely to remain static. And, as mentioned, Taulbee data shows that graduate enrollments have been stable the last few years, with an increasing fraction of new graduate students from outside North America. Many attendees at our SIGCSE session, however, agreed that the current boom feels different than the dot.com boom. Specifically, SIGCSE panel attendees indicated that students taking computing classes during the dot.com boom seemed to mainly be interested in money, but now appear to be interested in computing. This interest is illustrated by the large increase in REU site applications seen by many universities, which indicates a graduate enrollment boom might be forthcoming.

Conclusions

Our field has faced booming enrollments twice in the past: in the mid-1980s and in the late 1990s. This one feels different to many of us. At the 2014 CRA Conference at Snowbird, we saw data from some universities that showed higher than ever demand for more advanced computing courses by students who were not computing majors. Since the previous surge, there has been a maturing of the computing disciplines of software engineering and information technology, and new areas such as security are on the rise. During the past decade, there has been an increase in the number of interdisciplinary programs that involve computing and demand for courses well beyond the introductory level. Students from all fields are much more aware of the power that computational abilities give to them within their chosen major. This is great news for the computing community. After the last boom, however, there was a considerable decline in gender diversity for both majority (e.g., white) and minority (e.g., Hispanic) populations. We need to be especially careful with our enrollment policies and practices right now, so that the computing community can benefit from the diversity that exists in the enrollment boom we currently face.

ACM Appoints New Representative to CRA Board

Mary Hall replaces Mary Fernández as one of the ACM Representatives on the CRA Board.

Mary Hall is a Professor in the School of Computing at the University of Utah, where she has been since 2008. She conducts research in programming language and compiler technology for parallel and high-performance computing architectures. Her current research focuses on automatic performance tuning of scientific and data analytics applications, which involves close collaboration with architects, computational scientists and domain scientists. She has previously served ACM through membership in awards and conference steering committees, leadership roles in conference organization, and most significantly, as member of the ACM History Committee for the past decade, and chair from 2009-2013. She has also served IEEE as a member of the Computer Society Award Committee, chair of the ACM/IEEE Kennedy Award Committee, and member of the Cray and Fernbach Award Committees. She has participated in several CRA-W mentoring workshops as both attendee and speaker, and this year's CRA Leadership in Science Policy Institute. She has co-authored numerous reports for government agencies, particularly NSF, DOE and DARPA, to establish the research agenda in compilers and high-performance computing. Professor Hall is an ACM Distinguished Scientist. She received an M.S. and Ph.D. in Computer Science from Rice University, in 1989 and 1991, respectively, and graduated Magna Cum Laude in 1985 with a B.A. in Computer Science and Mathematical Sciences also from Rice University. Prior to joining Utah, Professor Hall was jointly a research associate professor and project leader at University of Southern California, and previously held research positions at Caltech, Stanford and Rice.

Engaging Undergraduates in Research: Upcoming Workshops at ICRA and FCRC

CRA-E
Computing Research Association
Education

The Education Committee of the Computing Research Association (CRA-E) is sponsoring workshops for faculty members interested in mentoring undergraduate research. The next two workshops are at ICRA (Seattle, Saturday May 30, 12-1:30 PM, lunch provided) and FCRC (Portland, Monday, June 15, 6-7:30 PM, appetizers provided). The workshops are free.

The objectives of these workshops are to provide faculty with resources and best practices for engaging undergraduates in their research, identifying funding sources for undergraduate research, and encouraging undergraduates to consider careers in research. To ensure a healthy pipeline of students motivated to continue on to graduate school, it is critically important that talented undergraduates obtain meaningful research experiences. *Having faculty who are well-prepared to supervise undergraduate research can make a difference.*

The workshops are funded by the National Science Foundation. Please see the CRA-E's workshop page for more information and instructions for registering.

May 2015 CERP Infographic

By: Jane Stout, CERP Director

Ph.D. students' choice of specialty area differs among women and men

Top 10 Specialty Areas	
Women	**Men**
1 Artificial Intelligence	1 Artificial Intelligence
2 Human-Computer Interaction	2 Databases / Information Retrieval
3 Databases / Information Retrieval	3 Software Engineering
4 Software Engineering	4 Programming Languages / Compilers
5 Graphics/Visualization	5 Theory and Algorithms
6 Robotics / Vision	6 Networks
7 Theory and Algorithms	7 Human-Computer Interaction
8 Informatics: Biomedical or Other Science	8 Robotics / Vision
9 Networks	9 Security/Information Assurance
10 Social Computing / Social Informatics	10 High-Performance Computing

In 2014, CERP asked 1,035 Ph.D. students (378 women; 657 men) to report their specialty area for their graduate research. Students were able to select more than one specialty area. Although there was considerable overlap in women and men's specialty areas, there were also notable differences. In particular, women were more likely to specialize in human-oriented research areas such as Human-Computer Interaction, Biomedical Informatics and Social Computing/Informatics. This pattern is consistent with social science research indicating that, on average, women tend to be more interested in professions with clear social applications compared to men. CERP's data suggest that one way to increase women's participation in computing research is to promote women's understanding of the social applicability of computing research early on. To accomplish this, academics and industry members could give research talks to K-12 and college students with emphasis on the real world implications of their research.

CERP
Computing Research Association
Evaluation

This infographic is brought to you by the CRA's Center for Evaluating the Research Pipeline (CERP). CERP provides social science research and comparative evaluation for the computing community. To learn more about CERP, visit our website at http://cra.org/cerp/.

CCC Announces New Council Members

The Computing Research Association (CRA), in consultation with the National Science Foundation (NSF), has appointed five new members to the Computing Community Consortium (CCC) Council:

- Cynthia Dwork, Microsoft Research
- Kevin Fu, University of Michigan
- Daniel P. Lopresti, Lehigh University
- Shwetak Patel, University of Washington
- Katherine Yelick, University of California at Berkeley

Beginning July 1, the new members will each serve three-year terms. The CCC Council is comprised of 20 members who have expertise in diverse areas of computing. They are instrumental in leading CCC's visioning programs, which help create and enable visions for future computing research. Members serve staggered three-year terms that rotate every July.

The CCC, CRA and NSF thank those Council members whose terms end on June 30 for their exceptional dedication and service to the CCC and to the broader computing research community:

- Susan Davidson, University of Pennsylvania
- Susan Graham, University of California at Berkeley, founding member of CCC
- Joseph Evans, The University of Kansas
- Ran Libeskind-Hadas, Harvey Mudd College, founding member of CCC
- Shashi Shekhar, University of Minnesota
- Robert Sproull, Oracle Corporation

The CCC encourages participation from all members of the computing research community. Each fall, the CCC issues a call for proposals for visioning activities. Each spring, the CCC issues a call for nominations for Council members effective the following July. For more information, please visit the CCC website or contact Dr. Ann W. Drobnis, CCC Director, at adrobnis@cra.org.

Full Bios of New CCC Council Members

Cynthia Dwork

Cynthia Dwork is known for her research placing privacy-preserving data analysis on a mathematically rigorous foundation, including the co-invention of differential privacy, a strong privacy guarantee frequently permitting highly accurate data analysis. She was elected as a Fellow of the American Academy of Arts and Sciences (AAAS) in 2008, as a member of the National Academy of Engineering in 2008, and as a member of the National Academy of Sciences in 2014. She received the Dijkstra Prize in 2007 for her work on consensus problems together with Nancy Lynch and Larry Stockmeyer. Dwork received her B.S.E. from Princeton University in 1979, graduating Cum Laude, and receiving the Charles Ira Young Award for Excellence in Independent Research. Dwork received her Ph.D. from Cornell University in 1983. For additional information visit: http://research.microsoft.com/en-us/people/dwork/.

Kevin Fu

Kevin Fu is Associate Professor of Electrical Engineering and Computer Science at the University of Michigan where he directs the Archimedes Center for Medical Device Security and the Security and Privacy Research Group. His research investigates how to achieve trustworthy computing on embedded devices with application to health care, commerce, and communication. His participation in the provocative 2008 research paper analyzing the security of a pacemaker/defibrillator led to a watershed moment in cybersecurity for medical device manufacturing and regulatory science. Prof. Fu received his Ph.D. in EECS from MIT where his doctoral research pertained to secure storage and web authentication. Fu received a Sloan Research Fellowship, NSF CAREER award, Fed100 Award, and best paper awards from various academic silos of computing. The research is featured in critical articles by the NYT, WSJ,

and NPR. Kevin was named MIT Technology Review TR35 Innovator of the Year for work on medical device security. Kevin has testified in Congress on health matters and has written commissioned work for the Institute of Medicine of the National Academies. He served as a visiting scientist at the Food & Drug Administration, the Beth Israel Deaconess Medical Center of Harvard Medical School, Microsoft Research, and MIT CSAIL. Previous employers include Bellcore, Cisco Systems, HP Labs, and Holland Community Hospital. He is a member of the ACM Committee on Computers and Public Policy and the NIST Information Security and Privacy Advisory Board. He is a principal investigator of Trustworthy Health & Wellness. Prior to joining Michigan, he served on the faculty at UMass Amherst. Kevin also holds a certificate of achievement in artisanal bread making from the French Culinary Institute. For more information visit: https://web.eecs.umich.edu/~kevinfu/.

Daniel P. Lopresti

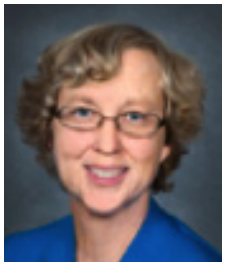
Daniel Lopresti received his bachelor's degree from Dartmouth in 1982 and his Ph.D. in computer science from Princeton in 1987. After completing his doctorate, he joined the Department of Computer Science at Brown and taught courses ranging from VLSI design to computational aspects of molecular biology and conducted research in parallel computing and VLSI CAD. He went on to help found the Matsushita Information Technology Laboratory in Princeton, and later also served on the research staff at Bell Labs where his work turned to document analysis, handwriting recognition, and biometric security.

In 2003, Dr. Lopresti joined the Department of Computer Science and Engineering at Lehigh where his research examines fundamental algorithmic and systems-related questions in pattern recognition, bioinformatics, and security. Dr. Lopresti is director of the Lehigh Pattern Recognition Research (PatRec) Lab. On July 1, 2009, he became Chair of the Department of Computer Science and Engineering. Effective July 1, 2014, he assumed the role of Interim Dean of the P. C. Rossin College of Engineering and Applied Science at Lehigh. For additional information visit: http://www.cse.lehigh.edu/~lopresti/.

Shwetak Patel

Shwetak N. Patel is the Washington Research Foundation Entrepreneurship Endowed Professor in Computer Science and Engineering and Electrical Engineering at the University of Washington, where he directs his research group, the Ubicomp Lab. His research interests are in the areas of Human-Computer Interaction, Ubiquitous Computing, Sensor-enabled Embedded Systems, and User Interface Software and Technology. He is particularly interested in developing new sensing technologies with a particular emphasis on energy monitoring and health applications for the home.

Dr. Patel was a founder of Zensi, Inc., a residential energy monitoring company, which was acquired by Belkin, Inc in 2010. He is also a co-founder of SNUPI Technologies, a low-power wireless sensor company. He received his Ph.D. in Computer Science from the Georgia Institute of Technology in 2008 and B.S. in Computer Science in 2003. Dr. Patel is a recipient of a MacArthur Fellowship (2011), Microsoft Research Faculty Fellowship (2011), Sloan Fellowship (2012), TR-35 Award (2009), World Economic Forum Young Global Scientist Award (2013), and an NSF Career Award (2013). He was also named top innovator of the year by Seattle Business Magazine and Newsmaker of the year by Seattle Business Journal in 2011. His past work was also honored by the New York Times as a top technology of the year in 2005. For more information visit: http://abstract.cs.washington.edu/~shwetak/.



Katherine Yelick

Katherine Yelick is a Professor of Electrical Engineering and Computer Sciences at the University of California at Berkeley and is also the Associate Laboratory Director for Computing Sciences at Lawrence Berkeley National Laboratory. She is the co-author of two books and more than 100 refereed technical papers on parallel languages, compilers, algorithms, libraries, architecture, and storage. She co-invented the UPC and Titanium languages and demonstrated their applicability across architectures through the use of novel runtime and compilation methods. She also

co-developed techniques for self-tuning numerical libraries, including the first self-tuned library for sparse matrix kernels which automatically adapts the code to properties of the matrix structure and machine. Her work includes performance analysis and modeling as well as optimization techniques for memory hierarchies, multicore processors, communication libraries, and processor accelerators. She has worked with interdisciplinary teams on application scaling, and her own applications work includes parallelization of a model for blood flow in the heart. She earned her Ph.D. in Electrical Engineering and Computer Science from MIT and has been a professor of Electrical Engineering and Computer Sciences at UC Berkeley since 1991 with a joint research appointment at Berkeley Lab since 1996. She has received multiple research and teaching awards and is a member of the California Council on Science and Technology and a member of the National Academies committee on Sustaining Growth in Computing Performance. For more information visit: http://www.cs.berkeley.edu/~yelick/.

Great Innovative Ideas!

The Computing Community Consortium (CCC) is delighted to announce a new feature on our website!

CCC
Computing Community Consortium
Catalyst

Great Innovative Ideas are a way to showcase the exciting new research and ideas generated by the computing community. Once a month we will post an article highlighting new research going on in the field and ideas generated by our colleagues. This feature will replace the Highlight of the Week. All previously posted highlights of the week are archived here.

A few of the ideas showcased in Great Innovative Ideas will be from the CCC Blue Sky Ideas Conference Track, including our first Great Innovative Idea from Marian Petre (Open University) and Daniela Damian (University of Victoria, Canada) on Development Methodology.

NSF's CISE Pushing beyond Today's Internet

By Erwin Gianchandani & Gera Jochum, Directorate for Computer and Information Science and Engineering, National Science Foundation

In late March, NSF's Directorate for Computer and Information Science and Engineering (CISE) sponsored a meeting, "Beyond Today's Internet: Experiencing a Smarter Future," which brought together researchers, educators, entrepreneurs, and civic leaders who are envisioning the future of the Internet through the Global Environment for Network Innovations, or GENI, Project and US Ignite Initiative. The joint session began with remarks by NSF Director Dr. France Córdova and White House Office of Science and Technology Policy Deputy Director for Technology and Innovation Tom Kalil, followed by demonstrations of what this future might entail, as detailed in a blog by Steve Lohr of the New York Times. NSF published a new special report with links to a press release, discovery stories, and videos that demonstrate the efforts of these communities, and CISE published a new perspective, which is reprinted below:

Beyond today's Internet: Experiencing a smart and connected future

A perspective from Erwin Gianchandani, Deputy Division Director for Computer and Network Systems

Nearly 30 years ago, NSF initiated NSFNET, a general-purpose research network that sought to link scientists and engineers to the nation's supercomputing facilities. Through additional public funding and private industry partnerships, NSFNET led to breakthrough discoveries in network architectures, protocols, and applications – that in turn ultimately developed into a major part of the backbone of today's Internet.

Along with the Internet came essential and fundamental advances in networking and information technology that have transformed our world – from sensor networks to real-time data analytics to mobile and ubiquitous computing. Today, we all carry smartphones and tablets. We communicate with one another via emails transmitted over the Internet. And "Google" – which traces its origins back to NSF funding of a Stanford digital library project in the 1990s – is a *verb* and has grown into a multi-billion-dollar corporation.

Taken together, our fundamental research advances over the last several decades have accelerated the pace of discovery in nearly all fields – and they have enabled us to achieve national priorities and advance economic competitiveness.

But we haven't stopped innovating the Internet despite these advances. NSF's Directorate for Computer and Information Science and Engineering (CISE) has led long-term, significant investments in the Global Environment for Network Innovations, or GENI Project, and the US Ignite initiative. By investing in future networking architectures, protocols, and applications, and by helping to nurture and grow communities of researchers, experimenters, and developers, NSF continues to advance the capabilities and user experiences afforded by the Internet for generations to come.

A Global Environment for Network Innovations

Since its inception in 2007, NSF's investments in GENI have allowed us to build an at-scale virtual laboratory for networking experimentation. Today, GENI spans over 60 university campuses throughout the U.S. as well as collaborators in over 30 countries around the world.

GENI has resulted in two key networking innovations:

1. First, it enables individual researchers to obtain access to their own secure "slice" of the network to conduct experiments.
2. And second, it allows for control of the network to be separate from the data flowing through it, enabling researchers and developers to customize experiments and applications, and to try radically new approaches for real-time, secure, enhanced, and personalized user experiences.

To date, more than 3,500 researchers around the globe have used GENI to conduct networking and other scientific experiments in ways that are simply not possible on today's

production Internet. And over 100,000 unique customizations have been created.

The innovations enabled by GENI – slicing and deep programmability – have also led to a new paradigm called Software-Defined Networking (SDN). Through partnerships with leading networking companies, SDN has become a multi-billion-dollar sector in just a matter of years – and it is anticipated to top $35 billion in market value by the year 2018.

Advancing Next-Generation Public-Sector Application Prototypes

To leverage our investments in GENI and take advantage of this programmable virtual laboratory, NSF, in collaboration with other federal, state, and local governments and industry partners, launched the US Ignite initiative in 2012.

US Ignite is connecting "islands" of broadband across the nation and demonstrating the potential of game-changing new applications that take advantage of ultra-high speed connections. These "apps" are offering new ways to provide never-before-imagined services that are in turn beginning to transform public safety, healthcare, education and learning, energy, transportation, manufacturing, and more.

Showcasing the potential of these next-generation applications, especially in addressing societal challenges, has proven that access to ultra-high-speed network connections is critically important for our future. It has also begun to demonstrate how a novel approach – a "user-inspired" model for advancing gigabit networks – is having an impact. For too long, there has been a fundamental deadlock: there has been insufficient investment in gigabit applications that can take advantage of advanced networking infrastructure because such infrastructure is rare and dispersed; and conversely, there has been a lack of broad availability of advanced broadband infrastructure for open experimentation and innovation because there are few advanced applications and services to justify it. We are breaking this deadlock by inspiring users themselves – through imagining, prototyping, and developing public-sector gigabit applications, and leveraging and extending a network testbed across U.S. campuses, cities, and regions.

In fact, since US Ignite's launch three years ago, we have seen nearly 40 cities and regions across the nation deploy gigabit connections to homes and businesses – and over 100 concepts or prototypes of applications that use these advanced networks have emerged. One app has resulted in operational improvements in emergency response following disasters. Another has catalyzed a small business with a commercial product called FitNet that analyzes high-quality video of individuals' exercise routines to provide personalized and real-time feedback to improve their health.

Toward a Smart and Connected Future

The result is that secure, programmable networks and next-generation apps are making their way into schools, libraries, hospitals and homes in communities across the nation. Through the hard work of researchers, educators, entrepreneurs, and civic leaders alike, these technologies are giving rise to transformational approaches for conducting science and engineering broadly – and they are fostering game-changing innovation throughout the entire Internet ecosystem.

NSF continues to facilitate the involvement of citizens and community organizations in building and experimenting with multiple advanced networking applications addressing national priorities. We are especially interested in fostering efforts that support mechanisms and processes to rapidly share and scale up innovations by transferring applications shown to be useful in once city/region to other cities/regions.

Ultimately, a key goal is to support mechanisms that will enable cities and regions to develop a smart and connected national ecosystem supporting applications of advanced networking.

Computing Education Research Becomes a Research Area in CISE's CAREER Proposals: What every department should know about CS Education research

Susanne Hambrusch, Purdue University
Mark Guzdial, Georgia Institute of Technology

The 2014 NSF CAREER competition in the Computer and Information Sciences and Engineering (CISE) directorate for the first time actively sought proposals in computing education research. The area of interest was closely aligned with the computing education research goals stated in its CE21 solicitation (NSF 12-609) which solicited proposals developing a research base for computing education: *"Projects may conduct basic research on the teaching and learning of computational competencies in face-to-face or online settings; they may design, develop, test, validate, and refine materials, measurement tools, and methods for teaching in specific contexts; and/or they may implement promising small-scale interventions in order to study their efficacy with particular groups."* In March 2015 CISE announced two education research CAREER awardees, Kristy Boyer and R. Benjamin Shapiro. In the coming CAREER cycle, CISE is again inviting computing education research proposals. The topics of interest are highlighted in the STEM+C solicitation (NSF 15-537). Of special interest for CAREER proposals is the track focused on Computing Education Knowledge and Capacity Building.

This article briefly describes the proposed research in the two new CAREER awards. These two awards represent a new area of exploration for CISE. Computing education research offers new opportunities for computer science departments and schools, and we also describe some of them.

Kristy Elizabeth Boyer is an Assistant Professor of Computer Science at North Carolina State University. Her research focuses on how to support learning with natural language dialogue and intelligent systems. Her interest in computer science education research focuses on collaborative learning and on how machine learning can help us understand social, cognitive, and affective phenomena in human interactions. She received a Ph.D. in Computer Science from North Carolina State University in 2010. She holds an undergraduate degree in Mathematics and Computer Science from Valdosta State University and an M.S. in Applied Statistics from the Georgia Institute of Technology. Kristy was the recipient of a 2007 NSF Graduate Research Fellowship award.

Kristy Boyer's CAREER project is titled "CS-CLIMATE: Collaborative Learning for Identity, Motivation, and Technology Engagement." A rich body of evidence suggests that collaborative learning holds many benefits for computer science students, yet there is growing recognition that neither collaborative learning itself, nor the innovative curricula in which it may be situated, are "magic bullets" capable of single-handedly broadening the participation of students belonging to underrepresented groups. In contrast to being a one-size-fits-all solution, collaborative learning is highly dependent upon characteristics of the collaborators and on fine-grained interactions.

The proposed research will explore the fine-grained facets of collaborative dialogue known to be particularly effective for diverse computer science learners and build theoretically informed models that capture collaborative dialogue and problem solving phenomena associated with learning, identity development, motivation, and engagement. The project will leverage a learning environment built by the PI to support remote collaboration with textual natural language dialogue, synchronized code editing, and integrated repository control. It will implement and evaluate evidence-based pedagogical support for fostering effective collaborative dialogue by extracting a set of evidence-based pedagogical strategies for fostering effective collaborative dialogue tailored to student characteristics. Pedagogical support is expected to significantly improve learning, sense of identity, motivation,

and continued engagement for students overall, and for women and African American students in particular. The research will draw upon collaborative learning data from computer science students at North Carolina State University, Meredith College, and Florida A&M University.

Benjamin Shapiro is the McDonnell Family Assistant Professor of Engineering Education and an Assistant Professor in the departments of Computer Science and Education at Tufts University. He received his Ph.D. in Learning Sciences from Northwestern University in 2009 and was a postdoctoral fellow at the University of Wisconsin-Madison. He holds an undergraduate degree in Independent Studies in Symbolic Systems (Computer Science & Cognitive Science) from the University of California, San Diego. His research focuses on the design of playful and constructionist learning environments. He studies how engineering computational systems can help learners to further their personal interests. To do so, he creates new technologies for learning and investigates how people, including students and teachers, use them to learn together.

Ben Shapiro's CAREER project is titled "Constructing Modern and Inclusive Trajectories for Computer Science Learning." His research will explore how youth building distributed cyber-physical systems offers possibilities of broadening participation and producing new theoretical and practical insights into the development of computational thinking.

Using data from middle and high school students solving problems by building networks of devices and mobile applications that communicate with each other, the project will develop new empirically-supported theories of the development of student thinking about distributed computing, as well as new tools to enable that development. Underrepresented minority youth will be partners in the co-design of the tools and supporting curriculum and the effects of their participation on interest, self-efficacy, and projective identity within computer science will be evaluated. A learning environment will be constructed to support youths' transitions from using beginner-specific programming environments (e.g., Scratch) into techniques and tools that are commonly found in university-level computer science education and in industry and open-source community practice. The research will describe and assess the development of student thinking in these transitions.

Benjamin Shapiro and Kristy Boyer at the Computing Education for the 21st Century NSF PI Meeting.

Why computing education research is important to computer science. Undergraduate enrollments are at a record high level. University administrators are unsure whether this is another high in the CS enrollment cycle to be followed by a steep drop or whether this is the new status quo. A time of burgeoning enrollments may not seem like an obvious time to focus on research in computing education, but the reality is that computer science students are changing and computing education practices are needed. Increased class sizes make many faculty re-evaluate how to teach and how to assess learning at scale. While MOOCS courses had significant promise three years ago, completion rates have been disappointing. But MOOCS demonstrated a new approach and model for a scalable teaching method that could make novel use of continuously collected data on learning.

Faculty are teaching freshmen with increasingly diverse computing backgrounds, both in-person and in-MOOCs. We see an increasing number of non-majors are taking computing courses. We do not always know how to engage, motivate, and retain a diverse student body. We know surprisingly little about how students understand foundational concepts in computer science. We know even less about effective methods for teaching parallel and distributed computing concepts. The field of computing education research draws on other disciplinary-based education research (DBER) areas, like science, mathematics, and engineering education. The

history of DBER fields tell us computer science education is different, with unique challenges.

The percentage of students from underrepresented groups in computing has changed little in the last decade. While many departments have outreach and recruiting events that manage to attract more students from underrepresented groups, the retention of those students is often a challenge. To engage more diverse students, departmental outreach activities increasingly engage the entire K-12 range. However, little is known about validated practices for the earlier ages.

The computing community has recently seen a number of new activities at the high school level. A new AP course called CS Principles has been developed in an NSF-funded effort between computer scientists, higher education and high school educators, and the College Board. The CS Principles course is currently piloted in hundreds of schools across the country. The course will "introduce students to creative aspects of programming, using abstractions and algorithms, working with large data sets, understandings of the Internet and issues of cybersecurity, and impacts of computing that affect different populations." The course was designed to be engaging and inspiring for all students. With only 19% of high school students currently taking a single CS course, the CS Principles course aims to attract a more diverse student to computing. The first AP Computer Science Principles Exam is taking place in May 2017.

Computer science has the unique position of teaching the medium that we can also use to teach. Can computing revolutionize how we teach and how students learn computer science? We can create specialized development environments tuned to the learning needs of our students. As we teach with MOOCs and other new media, we are challenged to explore the advantages of these platforms. Are there effective and scalable methods available to instructors for automated assessment of learning? Do we have validated data and evidence driven analysis tools for student learning? Many of these questions are at the heart of computing education research.

The research proposed by the two exceptional CS education researchers in their CAREER awards highlights a number of characteristics of computing education research. First, the field of computing education research is interdisciplinary. While grounded in computer science, the research area draws expertise and knowledge from learning sciences, education research, behavior and social scientists, psychology and sociology. We expect successful researchers to have a strong background in computer science as well as a clear understanding of the techniques and tools of education and learning science research. Many promising computing education research projects explore the application of the methods used in computer science research on itself. Common are methods in the areas of machine learning, big data/analytics, delivery of software as a service, human computer interaction. Computing education research has a number of similarities with HCI research. HCI research relies on the computing discipline to develop new methods and techniques and it also uses methods from the social sciences for assessment and validation.

Computing education research topics include understanding how students with different backgrounds learn computing, understanding how to effectively teach computing to audiences with different interests and backgrounds, and how to make use of personalized learning approaches and validated learning progressions. Research focuses on inventing, developing, assessing and validating ways to teach computing at all levels, from elementary school to a scientist. Computing education research aims to transform how learning happens in the traditional classroom as well as on-line. Based on new understandings on how learning happens, new systems and tools supporting teaching at scale are developed and assessed. Computing education research also includes effective teacher preparation and training, both as pre-service and in-service.

Numerous funding opportunities for computing education research exist. At NSF, the CISE and the EHR directorates both offer solicitations that can support work in computing education research. The most recent STEM + Computing Partnerships (STEM+C) solicitation is such an example. Other opportunities include Science of Learning (NSF 15-532), Cultivating Cultures for Ethical STEM (CCE STEM, NSF 15-528), and Cyberlearning and Future Learning Technologies (NSF 14-526). The Department of Education is also a source for computing education research funding. Funding opportunities from foundations include the MacArthur Foundation, Gates Foundation, and Sloan Foundation. Companies with a critical

workforce computing needs including Microsoft Research, Google, Intel, IBM have various programs and opportunities for support.

In the long run, computing education research will strengthen our field and it has the potential to broaden participation of underrepresented groups. Understanding how students think about computing and how we can improve their learning will have impacts in how we design the interface between humans and computers. Teachers will have access to validated and established pedagogical instruments and assessment tools. The training of K-12 computer science teachers will follow established guidelines, principles, and methods. Departments with faculty interested in computing education research or interested in hiring in this area, will realize that a number of models for successful appointments and collaborations exist. Faculty often have joint appointments, especially in CS departments that are not in a College/School of Computing environment. Departments with computing education research as focus will train graduate students in the field of computing education research and will develop curricula. We expect graduates to get hired by CS/I/CE departments with active computing education research, Education departments, teaching focused institutions, providers of on-line and MOOCS courses, high schools, and organizations like Code.org, the Computer Science Teachers Association (CSTA), the National Center for Women in Information Technology (NCWIT), or Project Lead the Way (PLTW). This is an exciting time to get involved in computing education research, a research area shaped by the advances in our field which will help shape the future of our field.

Announcements

The CRA 2013-14 Annual Report is Now Available!

Find out about the impacts of CRA's activities in our mission areas of leadership, policy and talent development.

Click here to download our Annual Report.

Achievements

Current CRA Board Member Laura Haas was elected a Fellow of the American Academy of Arts and Sciences.

Current CRA Board Member Margaret R. Martonosi was selected to receive the Marie R. Pistilli Women in EDA Achievement Award.

Former CRA Board Members Bob Kahn and Moshe Vardi were recently elected to the National Academy of Sciences in recognition of their distinguished and continuing achievements in original research.

Former CRA Board Member Jeanette Wing is the 2015 ACM Service Award Recipient.

Dear Colleague Letter: ACI & Career

Dear Colleague:

The Directorate for Computer and Information Science and Engineering (CISE) Division of Advanced Cyberinfrastructure (ACI) invites proposals from junior faculty within the community of scientists, engineers, and educators involved with cyberinfrastructure research to apply to the Faculty Early Career Development (CAREER) Program (http://www.nsf.gov/career). ACI's research interests include use-inspired and/or applied multidisciplinary research. Additional context for ACI's interests in this solicitation can be found in "Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21)" at http://www.nsf.gov/cif21. These proposals are due this year on July 21, 2015 and next year on July 20, 2016.

CAREER is a Foundation-wide activity that offers the National Science Foundation's (NSF) most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations. Such activities should build a firm foundation for a lifetime of leadership in integrating education and research. NSF encourages submission of CAREER proposals from junior faculty members at all CAREER-eligible organizations and especially encourages women, members of underrepresented minority groups, and persons with disabilities to apply.

Within this context, ACI encourages proposals that are either of:

1. primary interest to ACI, or
2. primary interest to another division of NSF, and of secondary interest to ACI.

In both cases, to be of interest to ACI, proposals should promote research, education, and the integration of research and education in projects that:

1. Contribute to exploration, experimentation, development, and/or deployment of comprehensive, integrated, sustainable, and secure cyberinfrastructure at the campus, regional, national, and/or international scale,
2. Have an effective cyberinfrastructure impact with clearly defined benefits across multiple research disciplines, and
3. Build on or complement the existing or upcoming ACI investments, as well as major cyberinfrastructure investments from other NSF divisions.

CAREER proposals that seek ACI support should clearly address these issues within the body of the proposal, and should designate ACI as the primary or secondary program during proposal submission.

Many general questions are answered in the program's FAQ document, which is available from the CAREER program page (http://www.nsf.gov/career). The FAQ question #34 relates to ACI (http://www.nsf.gov/pubs/2015/nsf15057/nsf15057.jsp#b34).

ACI-specific questions regarding the solicitation should be addressed to Sushil Prasad, sprasad@nsf.gov.

Sincerely,
James Kurose,
Assistant Director, CISE

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Column Editor

Expanding the Pipeline
Patty Lopez, Intel

Professional Opportunities

AT&T Labs

Researchers and Research Engineers

AT&T Labs, one of the world's premier R&D Labs, is looking for passionate, talented and inventive scientists and engineers to join our team full-time. Of particular interest are candidates with backgrounds in the areas of cloud computing, virtualization, software defined networking (SDN), Network Function Virtualization (NFV), Network Virtualization (NV), mobile computing, service quality management, optimization, machine and online learning, big data and large-scale distributed computing, stream data management, data quality, visualization, and large-volume stream analytics systems. Specific expertise of interest includes, but is not limited to, the following:

- Big Data and Data Science Research: Massive data analytics; machine learning and statistical computing; data visualization; database management; data quality and streaming data systems
- Cloud Technologies & Services Research: Compute, storage, network virtualization; Distributed storage, databases; Cloud Quality of Service (QoS) methods; Resource scheduling, placement, optimization; hypervisors; security
- Intelligent Services and Platform Research: intelligent systems, machine learning and autonomous technologies for driving enterprise, IoT and mobility services
- Networking and Service Quality Management (SQM) Research: SQM for cloud-based services and beyond; Cross-layer analytics and design in a mobile, virtualized and SDN-controlled world
- Optimization for Network and Virtualized Services: Optimization, reliability, network analytics, statistics, and analytics prototyping for SDN-controlled virtualized networks

Our Culture

AT&T Labs draws on a rich heritage of innovation, including eight Nobel Prizes, and a strong culture that encourages openness, teamwork, and collaboration across AT&T, academia and within the industry.

How to Apply

Interested in a career with AT&T Labs?

To apply, visit http://soc.att.com/1jrmLH9 for positions in each of these areas.

Boise State University

Department of Computer Science

Tenure-Track Faculty Position (Assistant/ Associate/Full Professor)

The Department of Computer Science at Boise State University invites applications for an open-rank, tenured/tenure-track position at the assistant, associate or full professor level. Applicants should have a commitment to excellence in teaching, a desire to make significant contributions in research, and experience in collaborating with faculty and local industry to develop and sustain funded research programs. Seeking an applicant with systems background, including but not limited to, operating systems, programming languages, compilers, computer architecture or high performance computing. Preference given to candidates with experience collaborating in the following areas: big data, information retrieval, security, machine learning or visualization. A Ph.D. in Computer Science or a closely related field is required by the date of hire.

The University and the State of Idaho have made significant investments in the department to satisfy the high demand for computer science graduates, driven by the vibrant software and high-tech industry of the Boise metropolitan area. The department has undergone a major expansion in the last two years with four new faculty and three new lecturers, additional office staff, sixteen new graduate and teaching assistant lines, a spacious tutoring center for computer science and substantially increased budget. A PhD program is currently under development.

For application and other information, please visit: http://coen.boisestate.edu/cs/jobs

Boise State University is strongly committed to achieving excellence through cultural diversity. The University actively encourages applications and nominations of women, persons of color, and members of other underrepresented groups. EEO/AA Institution, Veterans preference may be applicable.

Clemson University

School of Computing

12-month Senior Lecturer Position

The School of Computing at Clemson University invites applicants for a 12-month Senior Lecturer position, in the role of undergraduate coordinator. The coordinator will oversee advising, orientation, student records, and scholarships, serve as the lead on assessment and accreditation activities, and serve as the point of contact for career placement and outreach. The coordinator will also teach one course per semester, typically an undergraduate course, but with the opportunity to teach a graduate-level course in the candidate's area of specialty.

Clemson University is an Affirmative Action/ Equal Opportunity employer and does not discriminate against any individual or group of individuals on the basis of age, color, disability, gender, national origin, race, religion, sexual orientation, veteran status or genetic information.

For more information and to apply, please visit: http://www.clemson.edu/ces/computing/cs-lecturer-position.html

Professional Opportunities

Desert Research Institute (DRI)

Division of Earth and Ecosystem Sciences, Applied Innovation Center (AIC)

Computational Lead for Advanced Analytics, Associate/Senior Research Scientist

DRI is seeking a Computational Lead that has the primary responsibility of providing the day-to-day computationally development of the AIC and providing the technical leadership in areas related to integrating the analytics/visualization components of projects, providing oversight, computational creativity and supervision of relevant activities, and supporting R&D activities for the AIC and, as requested, throughout DRI. The AIC aims to develop commercially relevant solutions to real-world problems through the integration of data analysis, cyber-physical systems, high performance computing, and advanced visualization, prototyping, and tool development.

Qualifications: US citizenship; Master's in Science, Engineering, Information Technology or a related field; minimum of 10-15 years of proven, progressive experience in successfully developing and effectively managing large multi-collaborator projects developing and deploying advanced analytics; at least 7 years of experience working with High Performance Systems (HPC) and visualization systems; minimum of 10 years in a science or engineering leadership role with a corresponding experience hiring and effectively managing a scientific and engineering staff.

Visit http://jobs.dri.edu/postings/69 for a complete description and application details. DRI is an AA/EEO/disability/protected veteran employer.

D-Wave Systems

Machine Learning Researcher

D-Wave Systems is looking for experienced machine learning researchers to develop algorithms to exploit our unique adiabatic quantum computer.

To for more information and to apply visit http://www.dwavesys.com/careers/machine-learning-researcher

The Henry M. Jackson Foundation

Junior and Senior Scientists

The Henry M. Jackson Foundation (HJF) is looking for junior and senior scientists to join the U.S. Army Medical Research and Materiel Command's Biotechnology High Performance Computing Software Applications Institute (BHSAI) [www.BHSAI.org]. HJF provides scientific, technical, and programmatic support services to the BHSAI.

This opening is for dynamic scientists interested in working in an interdisciplinary environment focused on the development and the application of computational solutions to biomedical problems, involving signal processing of time series physiological data, data mining, data-driven and physiological-based models, and artificial intelligence. The candidate should have a Ph.D. in a related discipline and a strong publication record. The candidate is expected to simultaneously work on multiple projects, involving a diverse and interdisciplinary team of scientists across multiple laboratories.

Foreign nationals are welcome to apply. U.S. citizenship or permanent resident status is not required. This position is located in Frederick, Maryland.

Please apply on-line at careers.hjf.org click "Advanced Search" and enter job number ***208839*** in the Job Opening ID box.

HJF is an equal opportunity and affirmative action employer. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability, or protected veteran status.

Istanbul Sehir University

Computer Engineering

Assistant Professor

Istanbul Sehir University (SEHIR), Turkey, invites all applications for a full-time position in Computer Science Department. The position is available at the Assistant Professor rank beginning in September 2015.

The areas of particular interest are: Software Engineering, Information and Data Management, Scalable Data Science, High Performance Distributed Computing, Cloud Computing, Information Retrieval, and Health Informatics.

All candidates are expected to have a Ph.D. degree in COMPUTER SCIENCE from a major research university, prior to, or at the time of, appointment. The successful candidate is expected to have excellent command of English, fulfil the departmental requirements with regard to teaching (2 courses per semester), research, and service to our institution.

SEHIR is a private institution governed by the Foundation for Sciences and Arts. The foundation was established in 1986 in the city of Istanbul, Turkey. Building on a quarter-century of experience in education, SEHIR aims to be an elite research university in the whole region. The medium of instruction is English. The main campus area will be located on the shores of the Marmara Sea, overlooking Princess Islands. To be constructed at the heart of Istanbul, it will be one of the most beautiful campuses in the region.

Professional Opportunities

SEHIR is an equal opportunity employer. Salary is competitive and commensurate with experience and qualifications. Several fringe benefits (housing and travel allowance, private health insurance, sabbatical leave, etc.) will apply.

Please submit an application file that includes information about **your research and teaching interests, your curriculum vitae, two samples of written work and names of referees** via e-mail to: Ahmet Bulut (mdbf_info@sehir.edu.tr).

Short-listed candidates will be individually informed of their selection for formal interviews and job talks.

Lawrence Technological University

Computer Science Faculty Position

The Mathematics & Computer Science Department invites applications for a full time tenure-track Assistant Professor in Computer Science to start in the Fall 2015 semester. The ideal candidate will have a Ph.D. in computer science, will have experience in software engineering, and be a gifted teacher and active scholar/ researcher. Strong consideration in other research areas will be considered. Scholarship can focus on pedagogical, applied, or theoretical research, publication and participation in peer reviewed professional conferences. Teaching responsibilities can range from developmental Computer Science through introductory undergraduate and graduate level courses. Our primary mission is developing exceptional undergraduates through faculty engagement in collaborative student research, faculty use of active teaching techniques in the classroom, and faculty oversight of interdisciplinary student project teams. Review of applications begins immediately and will continue until the position is filled.

Applicants should send a cover letter, curriculum vitae, undergraduate and graduate transcripts (unofficial copies initially acceptable), statement of teaching philosophy, description of research, and three letters of recommendation to: cssearch@ltu.edu (Email submission only)

Computer Science Search Committee,
Department of Mathematics and Computer Science
Lawrence Technological University,
21000 West Ten Mile Road,
Southfield, MI 48075-1058.

For more information:
Email mcschair@ltu.edu
Web site: http://www.ltu.edu/arts_sciences/mathematics_computer_science/index.asp

Lawrence Tech is an independent university enrolling approx. 5000 students and surrounded by many of the Midwest's premier high-tech corporations. LTU's technological focus coupled with strong programs in engineering, architecture, business, and the sciences provides unique opportunities for collaboration across colleges and disciplines.

EOE, strongly encouraging applications from females and minorities.

NEC Laboratories America, Inc.

Researcher - Data Management

The Data Management Department of **NEC Laboratories America, Inc.** in Cupertino, CA is focused on building large-scale data management platforms to solve real problems and expand NEC's business offerings. Our research has directly contributed to NEC products/solutions and also has resulted in publications at top-tier conferences, including a record 5 accepted research papers in SIGMOD 2014.

Our focus in the big data analytics space is in providing holistic support to data scientists as they perform the seemingly endless task (http://tinyurl.com/puk25m2) of data preparation and modeling in the process of finding value in data. To this end, our group is developing a suite of big data solutions that frees up data scientists from data engineering concerns so that they can simply focus on the analysis. We have two areas for targeted hiring:

1. Development of large-scale big data analytical systems with focus on query optimization, physical design tuning and management of analytics on multiple stores such as Hadoop, Spark, DW, and Graph Databases etc.
2. Design of data management systems to support extremely large-scale machine learning tasks with focus on providing support for model building, testing and validation.

Suitable candidates must have a Ph.D. degree (or equivalent) in Computer Science (or related fields) with strong research results and excellent hands-on system development skills. Good knowledge of database internals and existing big data technologies is a must. Familiarity with machine learning algorithms and data science is very desirable. Contributions to open source software will be considered a plus.

For more information about NEC labs, access http://www.nec-labs.com/, and submit your CV and research statement through our career center at https://www.appone.com/MainInfoReq.asp?R_ID=1033864.

EOE-M/F/Vets/Disabled

NEC Laboratories America

Researcher - Mobile Communications and Networking

The Mobile Communications and Networking research department at **NEC Laboratories America** in Princeton, NJ, has Researcher positions available. In addition to current areas of research, the department is evolving

Professional Opportunities

in new directions with specific focus on developing end-to-end wireless networking solutions. Details about projects can be found at http://www.nec-labs.com/research-departments/mobile-communications/mobile-communications-home

The current search is for candidates with the following experience:

1. Experience in novel technology development at the MAC and TCP/IP layers of the protocol stack and developing prototypes using software radios and other research oriented wireless platforms. Familiarity with basic PHY concepts is a plus.
2. Networking systems experience at the application and services layer. Background in technologies including but not limited to traffic optimization, software-defined networking and cloud services is desirable with an emphasis on application of such technologies to developing end-to-end wireless networking solutions.

Candidates must have, or soon expect to receive, a PhD degree in EE or CS and have strong research experience and publication record. Candidates must be able to carry out original research, develop innovative technologies, work towards technology transfer to relevant business units within the company, and also maintain a track record of high-quality peer-reviewed publications.

Interviews for select candidates will be scheduled during the first three weeks of April with decisions expected to be made by the end of April.

For more information about NEC labs, access http://www.nec-labs.com/, and submit your CV and research statement through our career center at https://www.appone.com/MainInfoReq.asp?R_ID=1022879.

EOE-M/F/Vets/Disabled

MichiganTech

Michigan Technological University
Department of Computer Science
Lecturer Position

Applications are invited for a Lecturer position beginning August 2015 with a teaching focus of second and third-year systems courses. Appointed for two-year renewable terms, an applicant must have a master's or doctoral degree in Computer Science, Computer Engineering, or equivalent. The expected teaching load is three courses per semester. Review of applications will begin on May 15, 2015 and will continue until the position is filled. Women and under-represented minorities are particularly encouraged to apply.

Applications should be submitted online at www.jobs.mtu.edu/postings/2981. To learn more about the opportunity, please visit www.mtu.edu/cs/department/employment/faculty-staff/.

Michigan Tech is an ADVANCE Institution, one of a limited number of universities in receipt of NSF funds in support of our commitment to increase diversity and the participation and advancement of women in STEM. Michigan Tech acknowledges the importance of supporting dual career partners in attracting and retaining a quality workforce. See Dual Career Program for additional information.

Michigan Tech is an EOE which includes protected veterans and individuals with disabilities

Professional Opportunities

New Mexico Institute of Mining and Technology

Instructor Positions

New Mexico Institute of Mining and Technology seeks applicants for 2 non-tenure-track Instructor positions to teach introductory courses in the Computer Science department.

Please visit: http://www.nmt.edu/images/stories/hr/InstructorITCS144-049.pdf

For questions or clarifications. please email secretary@cs.nmt.edu.

Oak Ridge National Laboratory

Computer Science and Mathematics Division

Postdoctoral Research Associate in Computational Biology and Bioinformatics

The research areas will include metagenomics, metaproteomics and metabolomics. These omics data will be used for microbial ecology, phylogenomics, metabolic network analysis, and Earth system climate modeling. The qualified candidate will be responsible for algorithm development, data analysis, and publication. The position will provide the opportunity to perform cutting-edge research using high-performance computing. More information on the group's activities may be found http://www.omicsbio.org/

Qualifications:

- A Ph.D. in computer science, computational biology, or a related field.
- Qualified candidates should have programming experience using C++, Python, and R for development of computer algorithms.
- Prior research experience in analysis of proteomics mass spectrometry data or next-generation sequencing data are highly desired.
- Relevant optional skills include parallel computing, GPU/Intel Xeon Phi programming, and cloud computing.

For further consideration please email a CV to Kate Carter, ORNL Recruiter, at carterka@ornl.gov.

Ohio University

School of Electrical Engineering and Computer Science

Lecturer (Lecturer/Associate Lecturer/Senior Lecturer)

The School of Electrical Engineering and Computer Science in the Russ College of Engineering and Technology at Ohio University is currently inviting applications for the full-time, benefits eligible position of Lecturer (Lecturer/Associate Lecturer/Senior Lecturer) in Computer Science to begin on August 15, 2015.

Primary job responsibilities involve teaching undergraduate-level courses in Computer Science and committee or other service work.

Job responsibilities may include teaching more advanced courses in Computer Science or student advising, depending on the current needs of the School.

Minimum qualifications for this position are an attained Master's or Ph.D. degree in Computer Science by time of appointment or similarly named program from a regionally accredited university.

Preferred qualifications for this position are a dedication to and demonstrated excellence in undergraduate education in Computer Science.

This position is faculty non-tenure track under Group II category.

Further details concerning the rights and responsibilities of Group II faculty at Ohio University can be found in the Faculty Handbook: http://www.ohio.edu/facultysenate/handbook/

To apply, please complete the online application (http://www.ohiouniversityjobs.com/postings/13254) and attach the required documents. Incomplete applications or applications submitted by other means (e.g. email) will not be reviewed.

For full consideration, please apply by June 1, 2015.

Princeton University

Computer Science Department

Part-Time or Full-Time Lecturer

The Department of Computer Science seeks applications from outstanding teachers to assist the faculty in teaching our introductory course sequence or some of our upper-level courses.

Depending on the qualifications and interests of the applicant, and needs of the department, job responsibilities will include such activities as teaching recitation sections and supervising graduate-student teaching assistants; grading problem sets and programming assignments; supervising students in the grading of problem sets and programming assignments; developing and maintaining online curricular material, classroom demonstrations, and laboratory exercises; and supervising undergraduate research projects. An advanced degree in computer science, or related field, is required (PhD preferred).

The position is renewable for 1-year terms, up to six years, depending upon departmental need and satisfactory performance. To apply, please submit a cover letter, CV, and contact information for three references to (https://www.cs.princeton.edu/general/jobs/lecturer) This position is subject to the University's background check policy.

Princeton University is an Equal Opportunity/Affirmative Action Employer Equal Opportunity/Affirmative Action Employer and all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability status, protected veteran status, or any other characteristic protected by law.

Professional Opportunities

Saint Louis University

Department Mathematics and Computer Science

One-Year Visiting Position (Assistant/Associate)

Saint Louis University, a Catholic, Jesuit institution dedicated to education, research and healthcare, is seeking applicants for a one-year leave-replacement position in Computer Science at the rank of Assistant or Associate Professor within the Department of Mathematics and Computer Science. Ph.D. in Computer Science or related field required.

Duties, beginning in August 2015, include teaching three undergraduate courses each semester and possible supervision of undergraduate student projects.

Formal applications with cover letter and CV must be made online at http://jobs.slu.edu. Additional supporting materials must be submitted at http://mathcs.slu.edu/oneyear, including: CV, research statement, teaching statement, and names of at least three references (including at least one who can address teaching experience).

Saint Louis University is an Affirmative Action, Equal Opportunity Employer (AA/EEOE) and encourages nominations of and applications from women and minorities.

Smith College

Statistical and Data Sciences

Visiting Assistant Professor of Data Science

4-year, full-time position. PhD in computer science, statistics, or related required.

Details at http://apply.interfolio.com/29381.

Review begins immediately.

EO/AA/Vet/Disability Employer.

Trinity University, San Antonio, Texas

Department of Computer Science

Postdoctoral Research Associate

Start Date: Summer or Fall 2015

Duration: 1 to 2 years

Contact: Albert Xin Jiang, Ph.D., Assistant Professor. http://www.cs.trinity.edu/~xjiang/

Job Description:
The successful candidate will be working with Dr. Jiang on topics at the interface of artificial intelligence and game theory. You would ideally have research background on at least one of the following: computational game theory/multi-agent systems, machine learning, graphical models, and optimization. Experience with and/or willingness to do interdisciplinary research is desired.

Interested applicants may send their CV and reference letters to xjiang@trinity.edu

University of Edinburgh, UK

School of Informatics

Professor of Cyber Security and Privacy

The University of Edinburgh is seeking a chair (full professor) in Cyber Security and Privacy, to join its School of Informatics, the top-performing Informatics and Computer Science department in the UK. The appointee will help lead our growth in security and privacy research and teaching.

Specific areas of interest include applied cryptography, systems and network security, but any others will be considered. The main criteria will be demonstrated scientific excellence and leadership in research at a professorial level.

Full details: http://secpriv.inf.ed.ac.uk/chair

Deadline: 11th May, 2015

Informal approaches are welcomed before application.

University of Nebraska at Omaha

College of Information Science & Technology

Big Data Faculty Position in School of Interdisciplinary Informatics

The School of Interdisciplinary Informatics at the University of Nebraska at Omaha (UNO) invites applications for a tenure-track position at the rank of Assistant Professor. The successful candidate will have completed a doctorate in computer science, information technology, or related disciplines and have a strong potential to generate external research and development grants and engage in teaching. The School is particularly interested in candidates with experience in applying Big Data technologies in interdisciplinary fields like Bioinformatics, IT Innovation, and Information Assurance and Security. Candidates with expertise in large-scale data mining, statistical learning and an ability to apply such expertise towards interdisciplinary analytics applications are highly encouraged to apply.

The selected faculty will be part of the college wide big data recruitment initiative including a cluster of hires across several departments with opportunities for joint and inter-disciplinary collaborations. The University and department have a strong commitment to achieving diversity among faculty and staff.

To apply for this position go to http://www.unomaha.edu/humanresources/employment.php Current curriculum vita, a cover letter and the names and contact information of three references must be attached to the electronic application. For more information contact Dr. Robin Gandhi Chair of Si2 Big Data Search Committee at rgandhi@unomaha.edu or phone number (402) 554-3363.

Professional Opportunities

University of Virginia

Department of Computer Science

Postdoctoral Research Associate

The Department of Computer Science at the University of Virginia invites applicants for two Hobby postdoctoral research associate positions to contribute to research and education in data science, computational science, and other aspects of "Big Data." The Department is entering an exciting phase of significant growth, especially in areas related to these topics.

Successful applicants will become part of an exciting cross-disciplinary research group spanning traditional statistical and computer science research modes. Postdoctoral research associates will benefit from close relationships with faculty in U.Va.'s Data Science Institute, as well as the opportunity to expand their professional networks and travel to conferences and workshops. In order to give the postdoctoral associates experience that helps them prepare for faculty careers, the postdocs will be expected to teach one course per semester in an area related to data and computational sciences, and help advise an interdisciplinary group of graduate students.

Applicants must present evidence of outstanding accomplishments and promise in research, as well as evidence of ability and commitment to collaborative research. Priority will be given to applicants with strengths in one of the following areas of research (broadly defined): Machine Learning, Data/Network/Graph Mining, Information Retrieval, Natural Language Processing, or Analysis of High-Dimensional Massive Data.

The anticipated start date of these positions is July 1, 2015.

Centrally located in Virginia, Charlottesville boasts a thriving cultural life, easy access to recreational venues, and consistently ranks among the top cities in which to live and work. U.Va. is consistently ranked as a top public university as well as a Carnegie Research I university, and includes top-ranked medical and business schools.

Qualifications:

Applicants must have in hand a Ph.D. in Computer Science or a related field by the hire date.

Application Instructions:

Review of applications will begin April 6, 2015; however, positions will remain open until filled.

To apply candidates must submit a Candidate Profile through Jobs@UVa (https://jobs.virginia.edu), search on posting number 0616111 and attach the following required documents: Cover letter, CV, research statement, teaching statement, and contact information for three references.

For all questions, contact deptchair@mail.cs.virginia.edu.

The University of Virginia is an equal opportunity and affirmative action employer committed to developing diversity in faculty and welcomes applications from women, minorities, veterans and persons with disabilities.

U.Va. is an active dual-career employer.