

2016 Taulbee Survey

Generation CS Continues to Produce Record Undergrad Enrollment; Graduate Degree Production Rises at both Master's and Doctoral Levels

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This article and the accompanying figures and tables present the results from the 46th annual CRA Taulbee Survey¹. 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 February 17, 2017 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 (2015-16). Data for new students in all categories refer to the current academic year (2016-17). Projected student production and information on faculty salaries are also for the current academic year; salaries are those effective January 1, 2017.

We surveyed a total of 268 Ph.D.-granting departments; we received salary responses from 173 and main survey responses from 168, for a total of 183 departments responding to one or both parts of the survey. The response rate was 68 percent, similar to last year's 67 percent. The response rates from CE and Canadian departments continue to be rather low, and this year the CE response rate is the same as last year's unusually low rate. U.S. CS, U.S. I, and Canadian response rates were similar to last year, with U.S. CS slightly up and Canadian slightly down. Figure 1 shows the history of the survey's response rates. 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 2015 and 2016 surveys. This is a more meaningful indication of the one-year changes affecting the data.

Departments that responded to the survey were sent preliminary results about faculty salaries in December 2016; 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 is also 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.

In this year's survey, we made some modifications to the list of research areas for doctoral degree graduates in order to better reflect current areas of focus. We also began to

Figure I. 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%)
2015	146/190 (77%)	8/32 (25%)	12/26 (46%)	12/18 (67%)	178/266 (67%)
2016	150/188 (80%)	8/33 (24%)	11/26 (42%)	14/21 (67%)	183/268 (68%)

collect enrollment data from certain key undergraduate CS courses, in a format similar to what was used in last year’s CRA Enrollment Survey, the results of which can be found at www.cra.org/data/generation-cs. This will enable some ongoing tracking of enrollment changes at a finer level of detail than is now possible with the Taulbee Survey. Finally, this year we asked departments about their interest in getting additional data about the employment of teaching faculty as part of the survey. The responses will guide decisions that will be implemented in future Taulbee Surveys.

We thank all of the respondents to this year’s questionnaire. The participating departments are listed at the end of this article. CRA member respondents will again be given the opportunity to obtain certain survey information for a self-selected peer group. Instructions for doing this will be emailed to all such departments.

Doctoral Degree Production, Enrollment, and Employment

(Tables D1-D10; Figures D1-D6)

Degree Production

Doctoral degree production rose this year, after last year’s dip. This year’s respondents produced 1,888 doctoral degrees in 2015-16, an increase of 6.1 percent overall and 6.7 percent on a per department basis. Total production is still below the record of 1,991 set in 2012-13. There were increases, on average, for all department types (Table D1).

Among all departments reporting both this year and last year, the number of total doctoral degrees increased by 7.4 percent, but among U.S. CS departments reporting both years, the increase was 6.3 percent.

Women comprised 17.1 percent of CS doctoral graduates and 18.5 percent of all doctoral computing graduates (Table D2).

Both values are lower than those reported last year (last year's values were 18.3 and 20.2 percent, respectively). The percentage of CS doctoral degrees that went to Non-resident Aliens continued to rise, to 63.1 percent compared with last year's reported 60.7 percent, while the percentage that went to resident Asians rose to 7.6 percent from 6.4 percent. CE had a similar percentage of Non-resident Aliens to CS, and was less gender diverse. Among I doctoral degrees, Non-resident Aliens now comprise more than 50 percent of the

doctoral graduates, though a smaller percentage than for CS or CE; the fraction of I doctoral degrees going to Whites remained at 33.8 percent.

The percentage of CS doctoral graduates who were American Indian or Alaska Native, Black or African American, Native Hawaiian/Pacific Islander, Hispanic, or Multiracial Non-Hispanic was just 2.6 percent, down from 4.0 percent and to the same level reported in 2013-14. In aggregate across CS,

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	95	1,211	12.7	1,337	14.1	1,289	14.5	906	76	11.8
US CS Private	34	444	13.5	593	17.4	409	12.4	158	22	8.8
US CS Total	129	1,655	12.9	1,930	15.0	1,698	13.9	1,064	98	11.1
US CE	5	28	4.7	69	13.8	90	18.0	60	3	28.9
US Info	12	83	8.3	95	7.9	119	9.2	64	10	8.0
Canadian	11	122	12.2	154	14.0	118	11.8	95	7	12.8
Grand Total	157	1,888	12.3	2,248	14.3	2,025	13.5	1,283	118	12.0

Table D2. PhDs Awarded by Gender

	CS		CE		I		Total	
Male	1,368	82.9%	78	87.6%	83	60.6%	1,529	81.5%
Female	282	17.1%	11	12.4%	54	39.4%	347	18.5%
Total Known Gender	1,650		89		137		1,876	
Gender Unknown	9		1		2		12	
Grand Total	1,659		90		139		1,888	

Table D3. PhDs Awarded by Ethnicity

	CS		CE		I		Total	
Nonresident Alien	964	63.1%	53	60.2%	67	51.5%	1084	62.1%
Amer Indian or Alaska Native	1	0.1%	0	0.0%	0	0.0%	1	0.1%
Asian	116	7.6%	12	13.6%	7	5.4%	135	7.7%
Black or African-American	17	1.1%	3	3.4%	4	3.1%	24	1.4%
Native Hawaiian/Pac Islander	5	0.3%	1	1.1%	0	0.0%	6	0.3%
White	407	26.7%	15	17.0%	44	33.8%	466	26.7%
Multiracial, not Hispanic	2	0.1%	3	3.4%	1	0.8%	6	0.3%
Hispanic, any race	15	1.0%	1	1.1%	7	5.4%	23	1.3%
Total Residency & Ethnicity Known	1,527		88		130		1,745	
Resident, ethnicity unknown	64		1		4		69	
Residency unknown	68		1		5		74	
Grand Total	1,659		90		139		1,888	

Table D4. Employment of New PhD Recipients By Specialty

	Artificial Intelligence	Computing Education	Databases/Information Retrieval	Graphics/Visualization	Hardware/Architecture	Human-Computer Interaction	High-Performance Computing	Informatics: Biomedical/ Other Science	Information Science	Information Systems	Networks	Operating Systems	Programming Languages/Compilers	Robotics/Vision	Scientific/Numerical Computing	Security/Information Assurance	Social Computing/Social Informatics	Software Engineering	Theory and Algorithms	Other	Total	
North American PhD Granting Depts.																						
Tenure-track	7	2	8	5	1	7	10	4	16	2	6	9	8	4	1	11	5	8	9	12	135	9.0%
Researcher	2	0	0	3	0	0	1	9	0	1	3	0	0	1	1	2	1	2	0	2	28	1.9%
Postdoc	44	4	9	13	3	2	12	17	6	0	9	5	6	13	2	10	2	7	23	27	214	14.3%
Teaching Faculty	6	5	3	3	0	1	1	1	0	0	6	2	3	1	1	2	4	4	2	11	56	3.7%
North American, Other Academic																						
Other CS/CE/I Dept.	2	0	1	0	0	0	0	0	0	2	4	0	1	1	1	0	1	1	4	6	24	1.6%
Non-CS/CE/I Dept	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0.2%
North American, Non-Academic																						
Industry	134	3	65	51	39	26	21	22	13	11	54	32	30	45	11	53	10	84	39	115	858	57.2%
Government	4	0	3	1	3	4	2	2	1	1	0	1	1	1	1	4	0	3	0	1	33	2.2%
Self-Employed	5	0	0	2	0	0	0	1	0	1	0	0	1	2	1	3	1	0	1	0	18	1.2%
Unemployed	3	0	1	0	2	0	0	1	0	0	0	0	1	0	1	1	0	0	0	4	14	0.9%
Other	1	0	1	0	0	0	2	0	0	0	1	0	0	0	1	0	0	0	1	0	7	0.5%
Total Inside North America																						
	210	14	91	78	48	40	49	57	36	18	83	49	51	68	20	87	24	109	79	179	1,390	92.7%
Outside North America																						
Ten-Track in PhD	4	2	2	4	0	2	2	1	1	0	3	0	0	1	1	2	0	3	1	7	36	2.4%
Researcher in PhD	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	0.2%
Postdoc in PhD	1	0	0	0	0	0	1	2	0	0	3	1	0	1	0	1	0	1	3	2	16	1.1%
Teaching in PhD	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	5	0.3%
Other Academic	0	0	0	0	2	0	0	0	0	0	1	1	0	0	1	1	2	0	1	9	9	0.6%
Industry	8	0	1	0	3	0	0	1	0	1	1	2	5	0	1	3	0	2	1	2	31	2.1%
Government	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2	0.1%
Self-Employed	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0.1%
Unemployed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6	0.4%
Total Outside NA	16	2	3	5	5	3	3	5	1	1	8	4	6	3	2	7	1	9	7	19	110	7.3%
Total with Employment Data, Inside North America plus Outside North America																						
	226	16	94	83	53	43	52	62	37	19	91	53	57	71	22	94	25	118	86	198	1,500	
Employment Type & Location Unknown																						
	30	3	17	11	14	4	9	9	5	4	11	3	6	6	3	12	3	13	12	213	388	
Grand Total	256	19	111	94	67	47	61	71	42	23	102	56	63	77	25	106	28	131	98	411	1,888	

CE, and I graduated 3.4 percent from these categories (vs. 4.5 percent in 2014-15). As we have found in previous years, Non-resident Aliens again comprised a higher percentage of the CS female doctoral graduates than they did CS male graduates, while Whites comprised a lower percentage of the female

graduates as compared with male graduates. This year's respondents reported that Resident Asians comprised an equal percentage of male CS doctoral graduates and female CS doctoral graduates; in previous years, Asians comprised a higher percentage of female graduates (Table D9).

Table D4a. Detail of Industry Employment

	Artificial Intelligence	Computing Education	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	84	0	43	20	20	11	15	14	8	5	29	23	16	31	6	33	5	30	20	11	49	473	55.1%
Non-Research	37	1	18	24	16	14	6	4	3	5	21	8	12	12	2	15	5	49	13	12	17	294	34.3%
Postdoctorate	5	0	0	2	1	1	0	2	0	0	0	0	0	2	1	2	0	1	0	0	0	17	2.0%
Type Not Specified	8	2	4	5	2	0	0	2	2	1	4	1	2	0	2	3	0	4	6	20	6	74	8.6%
Total Inside NA	134	3	65	51	39	26	21	22	13	11	54	32	30	45	11	53	10	84	39	43	72	858	
Outside North America																							
Research	6	0	1	0	2	0	0	1	0	0	1	1	5	0	1	2	0	2	0	0	0	22	71.0%
Non-Research	1	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	6	19.4%
Postdoctorate	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	6.5%
Type Not Specified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3.2%
Total Outside NA	8	0	1	0	3	0	0	1	0	1	1	2	5	0	1	3	0	2	1	1	1	31	

Table D5. New PhD Students by Department Type

Department Type	CS				CE				I				Total	
	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	1,512	228	1,740	18.3	84	20	104	5.2	94	2	96	12.0	1,940	20.2
US CS Private	685	22	707	20.8	13	1	14	2.8	11	0	11	3.7	732	21.5
US CS Total	2,197	250	2,447	19.0	97	21	118	4.7	105	2	107	9.7	2,672	20.6
US CE	0	0	0	0.0	54	3	57	9.5	0	0	0	0.0	57	9.5
US Information	6	1	7	7.0	0	0	0	0.0	121	17	138	9.9	145	10.4
Canadian	105	17	122	11.1	0	0	0	0.0	0	0	0	0.0	122	11.1
Grand Total	2,308	268	2,576	18.3	151	24	175	5.6	226	19	245	9.8	2,996	18.6

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	1,148	71	56	1,275	1,940	65.7%
US CS Private	381	11	9	401	732	54.8%
Total US CS	1,529	82	65	1,676	2,672	62.7%
US CE	0	32	0	32	57	56.1%
US Info	5	0	73	78	145	53.8%
Canadian	73	0	0	73	122	59.8%
Grand Total	1,607	114	138	1,859	2,996	62.0%

Table D6. PhD Enrollment by Department Type

Department Type	# Depts	CS		CE		I		Total	
US CS Public	100	8,903	66.2%	636	66.2%	386	66.2%	9,925	66.2%
US CS Private	37	3,206	24.2%	74	24.2%	38	24.2%	3,318	24.2%
Total US CS	137	12,109	90.3%	710	90.3%	424	90.3%	13,243	90.3%
US CE	6	0	0.1%	293	0.1%	16	0.1%	309	0.1%
US Info	12	28	0.2%	0	0.2%	643	0.2%	671	0.2%
Canadian	11	848	9.3%	0	9.3%	22	9.3%	870	9.3%
Grand Total	166	12,985		1,003		1,105		15,093	

Table D7. PhD Enrollment by Gender

	CS		CE		I		Total	
Male	9,964	79.9%	744	79.2%	667	60.6%	11,375	78.4%
Female	2,508	20.1%	195	20.8%	434	39.4%	3,137	21.6%
Total Known Gender	12,472		939		1,101		14,512	
Gender Unknown	513		64		4		581	
Grand Total	12,985		1,003		1,105		15,093	

Table D8. PhD Enrollment by Ethnicity

	CS		CE		I		Total	
Nonresident Alien	7,596	63.9%	673	69.7%	517	51.0%	8,786	63.4%
Amer Indian or Alaska Native	54	0.5%	2	0.2%	3	0.3%	59	0.4%
Asian	841	7.1%	61	6.3%	60	5.9%	962	6.9%
Black or African-American	152	1.3%	20	2.1%	36	3.6%	208	1.5%
Native Hawaiian/Pac Islander	27	0.2%	1	0.1%	5	0.5%	33	0.2%
White	2,963	24.9%	169	17.5%	351	34.6%	3,483	25.1%
Multiracial, not Hispanic	58	0.5%	9	0.9%	16	1.6%	83	0.6%
Hispanic, any race	195	1.6%	30	3.1%	26	2.6%	251	1.8%
Total Known	11,886		965		1,014		13,865	
Resident, ethnicity unknown	677		15		23		715	
Residency unknown	422		23		68		513	
Grand Total	12,985		1,003		1,105		15,093	

Table D9. PhDs Awarded by Gender and Ethnicity, From 154 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	795	169	0	63	66	44	9	0	57	82	46	21	0	60	40	1,084	62.1
Amer Indian or Alaska Native	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1
Asian	95	21	0	8	8	11	1	0	14	9	4	3	0	5	6	135	7.7
Black or African-American	9	8	0	1	3	3	0	0	4	0	1	3	0	1	6	24	1.4
Native Hawaiian/Pac Islander	4	1	0	0	0	1	0	0	1	0	0	0	0	0	0	6	0.3
White	352	55	0	28	21	15	0	0	20	0	21	23	0	27	43	466	26.7
Multiracial, not Hispanic	1	1	0	0	0	2	1	0	3	9	1	0	0	1	0	6	0.3
Hispanic, any race	13	2	0	1	1	1	0	0	1	0	4	3	0	5	6	23	1.3
Total Res & Ethnicity Known	1,270	257	0	0	0	77	11	0			77	53	0			1,745	
Resident, ethnicity unknown	49	15	0			1	0	0			3	1	0			69	
Not Reported (N/R)	49	10	9			0	0	1			3	0	2			74	
Gender Totals	1,368	282	9			78	11	1			83	54	2			1,888	
%	82.9%	17.1%				87.6%	12.4%				60.6%	39.4%					

* % 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 D10. PhD Enrollment by Gender and Ethnicity, From 164 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	5,605	1,456	269	63	66	502	130	41	70	69	326	191	0	54	47	8,786	63.4%
Amer Indian or Alaska Native	37	12	1	0	1	1	1	0	0	1	1	2	0	0	1	59	0.4%
Asian	633	183	20	7	8	48	10	3	7	5	32	28	0	5	7	962	6.9%
Black or African-American	95	49	3	1	2	9	10	1	1	5	20	16	0	3	4	208	1.5%
Native Hawaiian/Pac Islander	20	7	0	0	0	0	1	0	0	1	4	1	0	1	0	33	0.2%
White	2,333	471	145	26	21	135	28	6	19	15	200	151	0	33	37	3,483	25.1%
Multiracial, not Hispanic	37	10	6	0	1	8	1	0	1	1	8	8	0	1	2	83	0.6%
Hispanic, any race	155	32	8	2	1	19	7	4	3	4	13	13	0	2	3	251	1.8%
Total Res & Ethnicity Known	8,915	2,220	452			722	188				604	410	0			13,865	
Resident, ethnicity unknown	457	123	8			8	5				16	7	0			715	
Not Reported (N/R)	292	77	53			14	2				47	17	4			513	
Gender Totals	9,964	2,508	513			744	195				667	434	4			15,093	
%	79.9%	20.1%				79.2%	20.8%				60.6%	39.4%	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 D1. PhD Production
CRA Taulbee Survey 2016

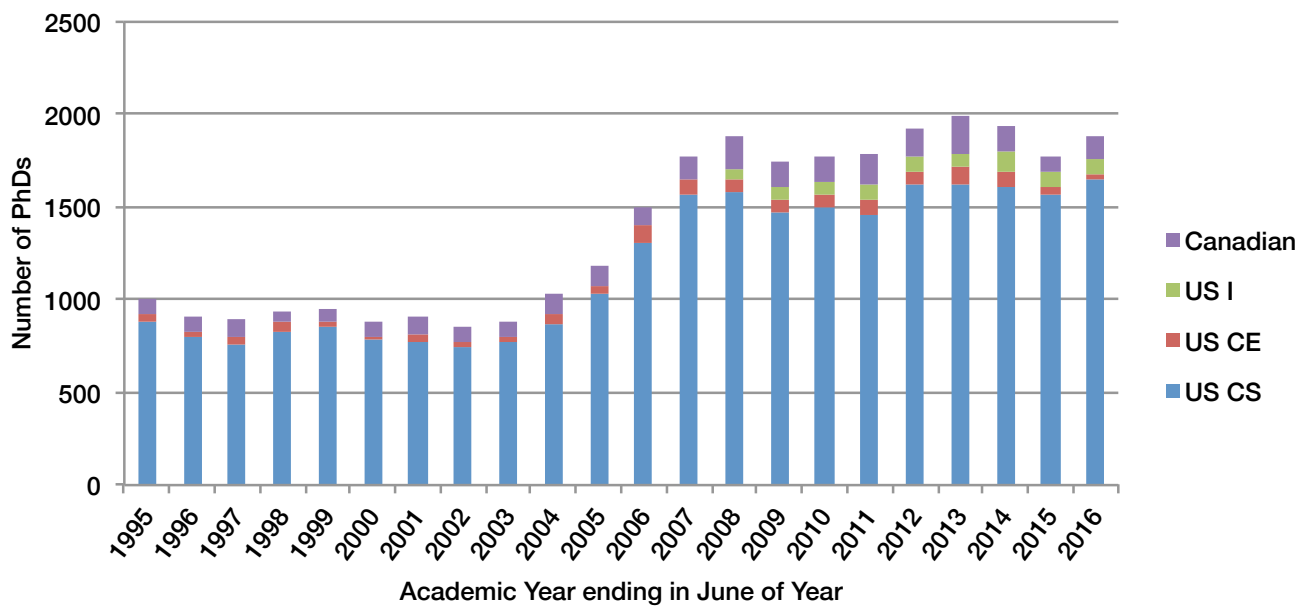


Figure D2. Nonresident Aliens as Fraction of PhD Enrollments
CRA Taulbee Survey 2016

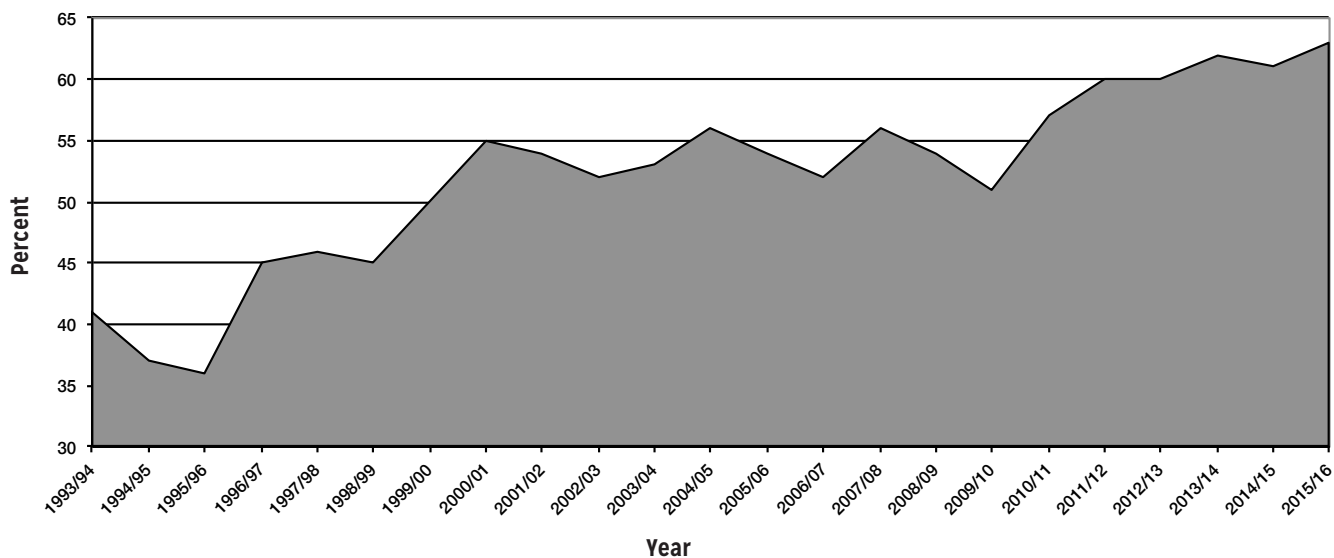


Figure D3. PhD Degrees Granted by Tenure-Track Size
CRA Taulbee Survey 2016

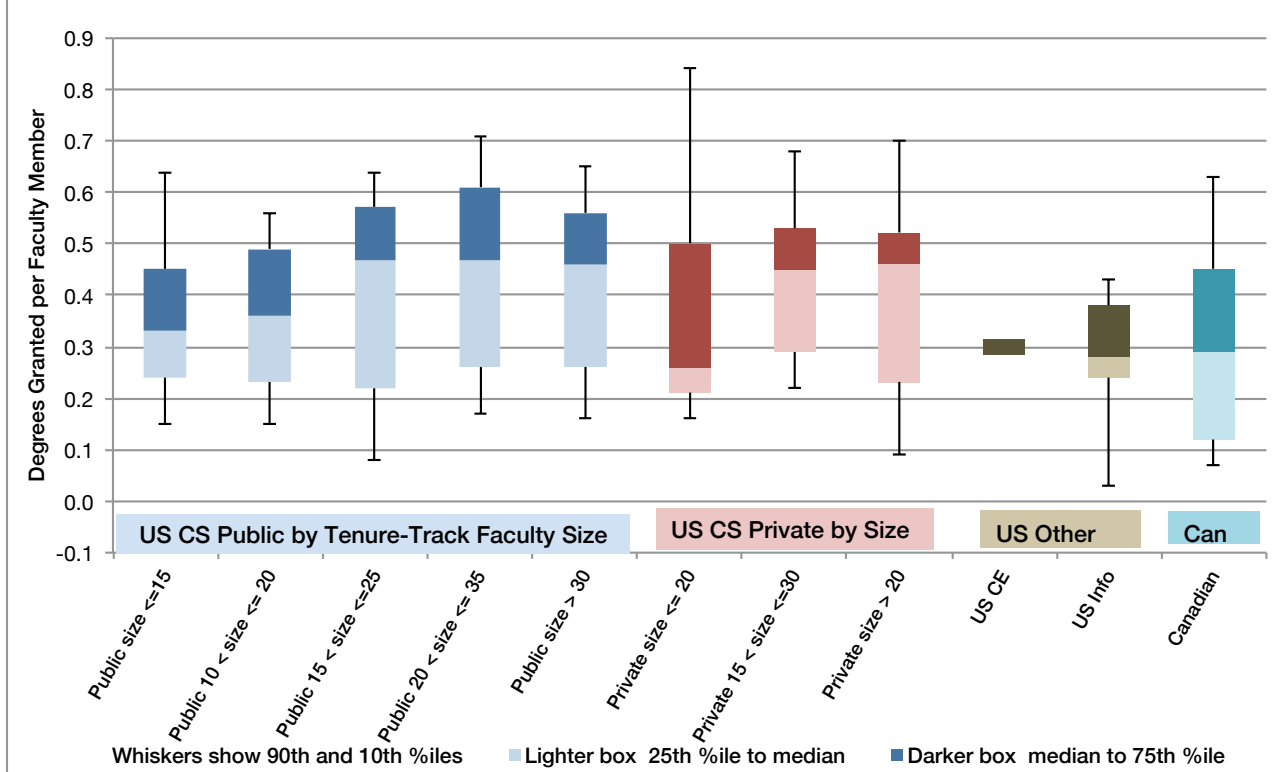


Figure D4. PhD Enrollment Normalized by Tenure-Track Size
CRA Taulbee Survey 2016

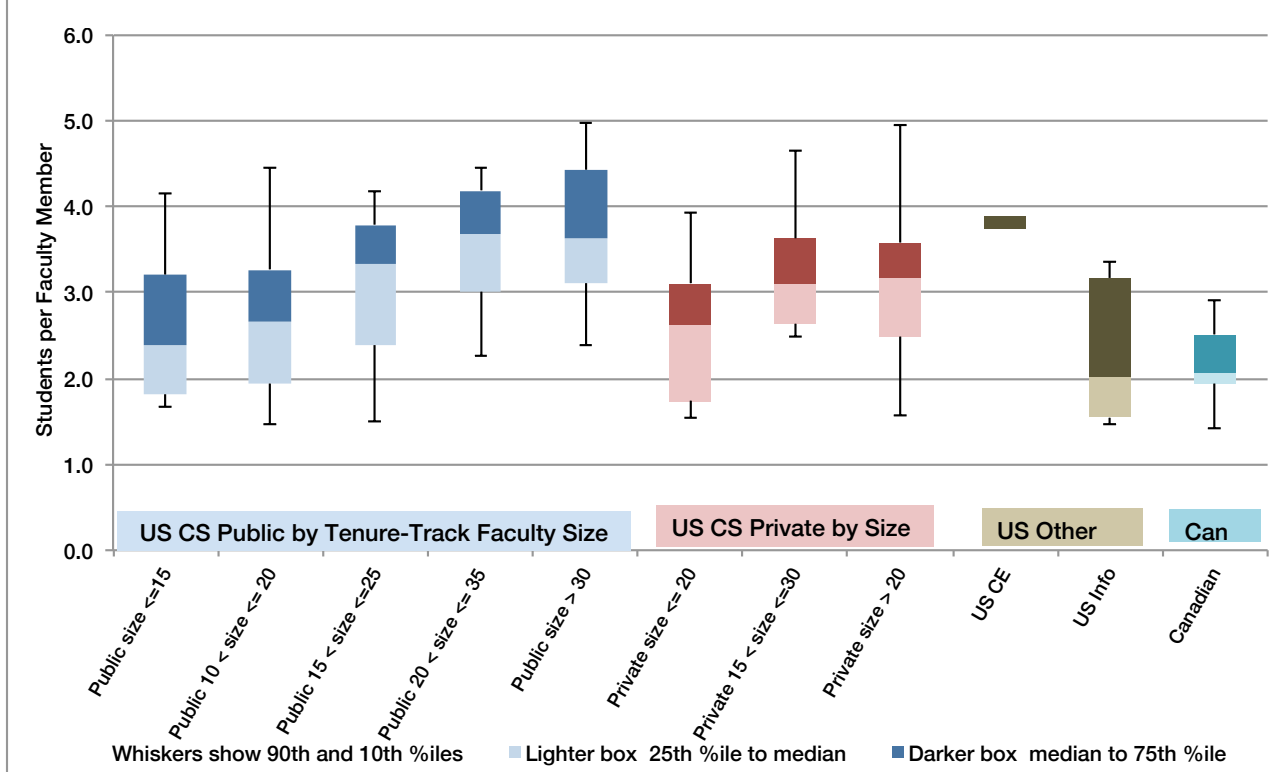


Figure D5. CS Pipeline corrected for year of entry
CRA Taulbee Survey 2016

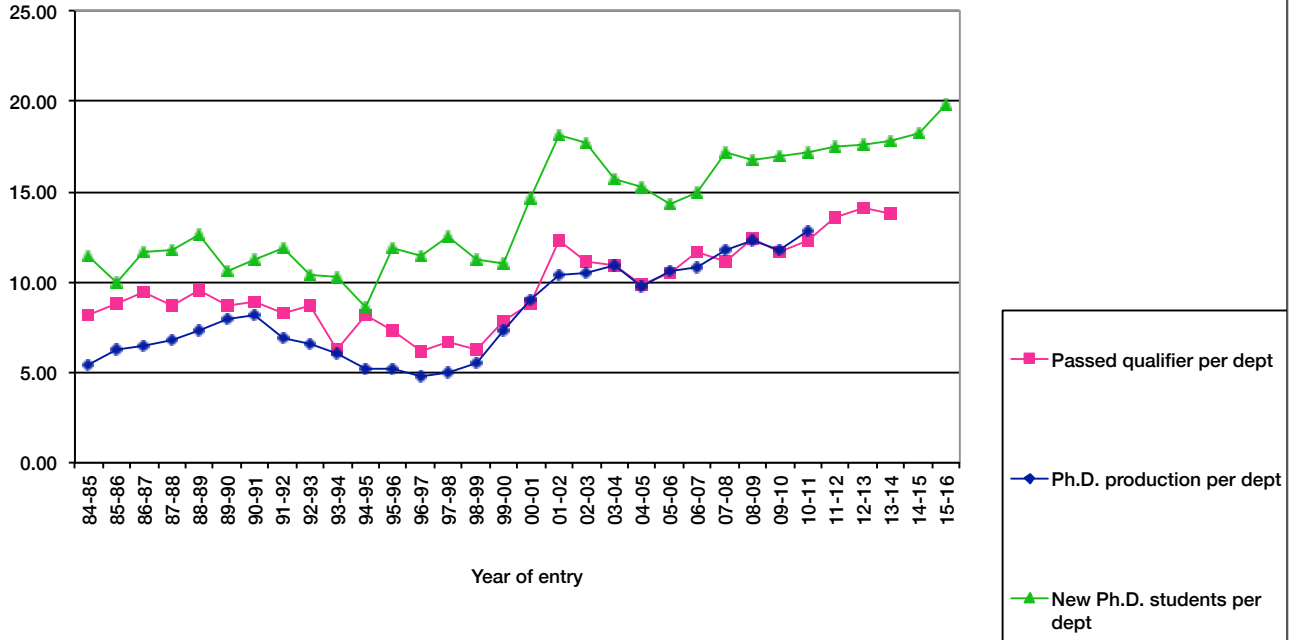
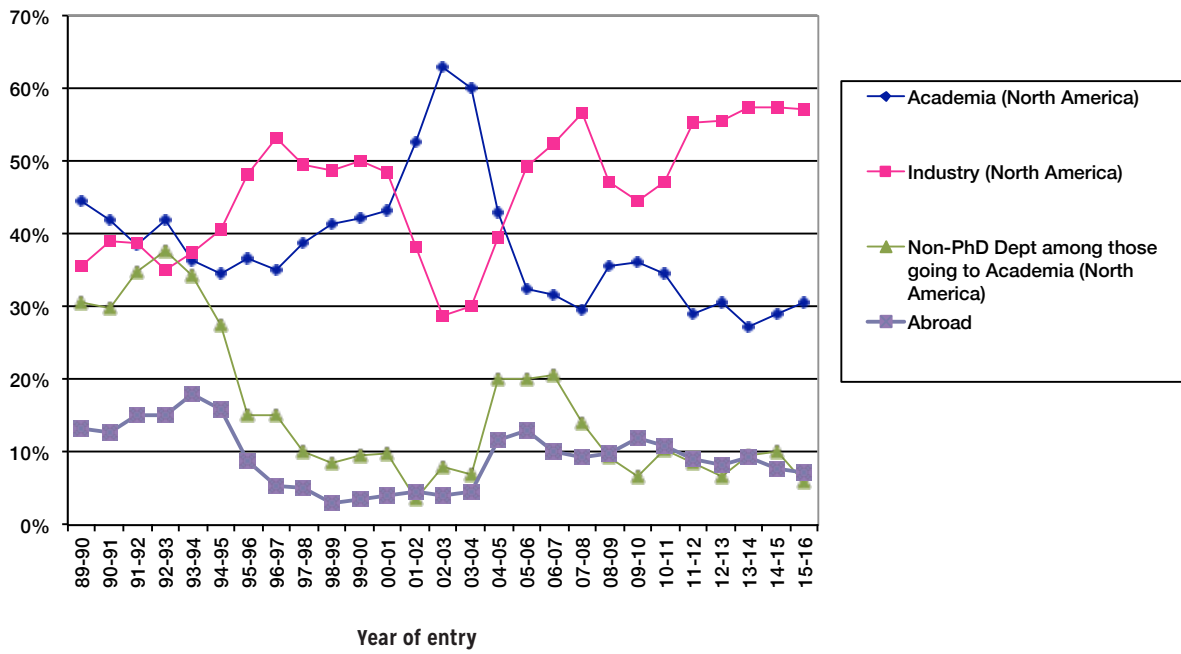


Figure D6. Employment Trends for New Ph.D.s
CRA Taulbee Survey 2016



Doctoral Program Enrollment

Among programs that reported both years, total doctoral enrollment decreased slightly, by 1.4 percent. If only U.S. computer science departments are considered, there was a very slight increase of 0.7 percent (Table I). Total doctoral enrollment by gender is more diverse compared with last year, with increases in diversity in all department areas (CS, CE, and I). The overall fraction of current doctoral students who are women is 21.6 percent, versus 20.2 percent last year (Table D7). The fraction of doctoral students who are not either Non-resident Aliens, Asian, or White remains below 5 percent (Table D8).

Among currently enrolled CS doctoral students whose ethnicity is known, we see the same direction of difference among Non-resident Aliens and Whites; Non-resident Aliens 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 previous years' observations, and suggests that these directional differences among Non-resident aliens and Whites will continue to be seen in future years' graduation statistics. Resident Asians comprise a similar percentage of enrolled Asian men and Asian women (Table D10).

Among those pursuing I degrees, 59 percent of the men and 54 percent of the women are Non-resident Aliens or Resident Asians. Last year these percentages were 62 and 55, respectively. This year, Whites comprise a slightly higher percentage of women than they do men among those pursuing I degrees.

At U.S. CS departments, the average number of students per department who passed qualifier exams declined from 14.3 in 2014-15, to 13.9 in 2015-16. The 13.9 average is the same as it was in 2013-14. The drop was due to departments in public institutions; there was a slight increase in private institutions. The average number per department who passed thesis candidacy exams in 2015-16 (most, but not all, departments have such exams) decreased from 2014-15 at both public and private U.S. CS departments (Table D1).

The number of new Ph.D. students per department reporting increased slightly this year compared with the total from last year's reporting departments (Tables I and D5). This reflects increases in all categories of departments (CS, CE, I, and Canadian). Among all departments that reported both years, the number of new Ph.D. students increased 5.5 percent. If only U.S. CS departments that reported both years are considered, the increase was 4.2 percent.

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	2015	2016	% chg	2015	2016	% chg	2015	2016	% chg	2015	2016	% chg
PhD Awarded	1,570	1,655	5.4%	1,780	1,888	6.1%	1,482	1,569	5.9%	1,650	1,756	6.4%
#Units PhD Awd	136	128		164	154		117	117		138	138	
PhD Enrollment	13,063	13,243	1.4%	15,397	15,093	-2.0%	12,439	12,531	0.7%	14,395	14,196	-1.4%
#Units PhD Enr	137	134		166	164		123	123		149	149	
New PhD Enroll	2,475	2,672	8.0%	2,752	2,996	8.9%	2,307	2,395	3.8%	2,552	2,684	5.2%
#Units New PhD	133	130		162	161		114	114		140	140	
Bachelor's	2015	2016	% chg	2015	2016	% chg	2014	2015	% chg	2014	2015	% chg
BS Awarded	17,401	20,709	19.0%	21,880	25,508	16.6%	16,467	19,219	16.7%	20,290	23,972	18.1%
#Units BS Awd	137	131		165	156		120	120		144	144	
BS Enrollment	98,377	114,607	16.5%	119,919	136,589	13.9%	91,595	107,536	17.4%	110,777	129,362	16.8%
#Units BS Enr	138	131		165	155		121	121		144	144	
New BS Majors	25,256	27,266	8.0%	30,147	32,216	6.9%	21,906	23,344	6.6%	26,289	27,694	5.3%
#Units New BS	123	112		147	137		97	97		117	117	
BS Enroll/Dept	712.9	874.9	22.7%	726.8	881.2	21.2%	757.0	888.7	17.4%	769.3	898.3	16.8%

The proportion of new doctoral students from outside North America fell this year. It is now slightly lower than it was two years ago. This year's overall proportion is 62.0 percent while last year's was 65.7 percent. There were decreases in all categories of departments (Table D5a).

Figure D5 shows a graphical view of the Ph.D. pipeline for U.S. computer science and Canadian departments, the main producers of CS doctoral degrees. The data in this graph are normalized by the number of reporting departments. The graph 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 there may be some further rise in doctoral production during the next few years. The departments are, in fact, forecasting a considerable increase in production during 2016-17 (Table D1).

Ph.D. Employment

Figure D6 shows the employment trend of new Ph.D.s in academia and industry within North America, those taking employment outside of North America, and those going to academia in North America who took positions in departments other than Ph.D.-granting CS and CE departments. Table D4 shows a more detailed breakdown of the employment data for new Ph.D.s. The percentage of new Ph.D.s who took positions in North American industry was 57.2 percent, similar to the percentage reported last year. Among those doctoral graduates who went to North American industry and for whom the type of industry position was known, about 60 percent took research positions (Table D4a). This is higher than the 57 percent reported in 2015. This year, definitive data was provided for 91 percent of the graduates who went to North American industry.

The percentage of Ph.D. graduates who took North American academic jobs rose in 2015-16 for the second straight year, to 30.7 from 29.0 last year. However, the percentage of graduates taking tenure-track positions in North American doctoral-granting computing departments fell from 10.0 in 2014-15 to 9.0 in 2015-16. The percentage taking positions in

North American non-Ph.D.-granting computing departments fell from 2.3 percent to 1.6 percent, while the percentage taking North American academic postdoctoral positions jumped from 9.7 percent to 14.3 percent.

Among those whose employment is known, the proportion of Ph.D. graduates who were reported taking positions outside of North America fell from 7.8 percent to 7.3 percent. In 2015-16, 28 percent of those employed outside of North America went to industry compared to 24 percent reported last year. About 33 percent went to tenure-track academic positions, almost doubling last year's 17 percent, while approximately 15 percent went to academic postdoctoral positions, down from 20 percent last year. Of the doctoral graduates who went to non-North American industry positions, the positions were in research by more than a three-to-one margin. Definitive data was provided for 97 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 16.6 percent of 2015-16 doctoral graduates took some type of postdoctoral position, up from 12.6 percent last year and greater than the 15.6 percent in 2013-14. Only about 8 percent of these were industry postdocs, continuing a downward trend.

The unemployment rate for new Ph.D.s again this year was below 1 percent. In 2015-16, 20.6 percent of new Ph.D.s' employment status was unknown; in 2014-15 it was 21.0 percent. The lack of information about the employment of more than one in five graduates may skew the real overall percentages for certain employment categories.

Table D4 also indicates the areas of specialty of new Ph.D.s, using this year's slightly modified category names. Artificial intelligence/machine learning, software engineering, databases, security/information assurance, and networks are the most popular areas of specialization for doctoral graduates, in that order. Security/information assurance made the biggest gain of any area this past year. There are many Ph.D.s categorized as "other," which includes "unknown." It is unclear how many of these are really "other" and how many were just not categorized.

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 MI-M8; Figures MI-M2)

On a per department basis, CS master's degree production in U.S. CS departments rose nearly 17 percent in 2015-16; this follows a nearly 25 percent increase in 2014-15. Both public and private departments again reported large increases.

Overall production of master's degrees in the CE and Information areas also rose in 2015-16. U.S. CS departments, both public and private, showed an increased production of information master's degrees, as did U.S. I departments (Table MI).

The proportion of female graduates among CS master's degree recipients rose very slightly, from 24.9 percent to

25.2 percent. The overall percentage of master's degrees to women increased only 0.1 to 29.4 percent, due to a drop in CE from 23.9 percent to 21.4 percent while the I area was fairly constant with just a change of 0.1 percent downward (Table M2).

In CS, 75.6 percent of master's degrees went to Non-resident Aliens, a large increase over the 68.1 percent in 2014-15. In the Information area, the percentage of the master's recipients that were Non-resident Aliens also showed a large increase in 2015-16, to 49.9 percent as compared with 33.3 percent in 2014-15 and 28.1 percent 2013-14. In both CS and I, the fraction of master's degrees going to Whites and domestic Asians declined. The percentage of master's recipients among American Indian/Alaska Native, Black/African-American, Native Hawaiian/Pacific Islander, Hispanic, and Multiracial dropped in CS from nearly 4 percent in 2014-15 to under 3 percent in 2015-16. This percentage also dropped in I from 13.2 percent to 10.6 percent (Table M3).

Non-resident Aliens comprised a much larger proportion of female CS degree recipients than male CS degree recipients, while Whites comprised a larger percentage of male CS degree recipients than female CS degree recipients (Table M7). With somewhat differing percentages, the same observations

Table MI. Master's Degrees Awarded by Department Type

Department Type	# Depts	CS		CE		I		Total	
US CS Public	100	6,500	57.8%	418	56.7%	832	30.2%	7,750	52.6%
US CS Private	34	4,098	36.5%	78	10.6%	392	14.2%	4,568	31.0%
Total US CS	134	10,598	94.3%	496	67.3%	1,224	44.4%	12,318	83.6%
US CE	6	0	0.0%	236	32.0%	0	0.0%	236	1.6%
US Info	12	34	0.3%	0	0.0%	1,516	55.0%	1,550	10.5%
Canadian	11	607	5.4%	5	0.7%	15	0.5%	627	4.3%
Grand Total	163	11,239		737		2,755		14,731	

Table M2. Master's Degrees Awarded by Gender

	CS		CE		I		Total	
Male	8,041	74.8%	562	78.6%	1,401	52.1%	10,004	70.6%
Female	2,715	25.2%	153	21.4%	1,288	47.9%	4,156	29.4%
Total Known Gender	10,756		715		2,689		14,160	
Gender Unknown	483		22		66		571	
Grand Total	11,239		737		2,755		14,731	

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 Whites comprised a smaller fraction of male master's graduates than female master's graduates. These observations are

consistent with those of previous years, and the current enrollment breakdown by gender and ethnicity (Table M8) suggests that these observations will continue to be reflected in master's recipients in the near future.

Table M3. Master's Degrees Awarded by Ethnicity

	CS		CE		I		Total	
Nonresident Alien	7,883	75.6%	526	73.6%	1,256	49.9%	9,665	70.8%
Amer Indian or Alaska Native	14	0.1%	3	0.4%	9	0.4%	26	0.2%
Asian	731	7.0%	44	6.2%	132	5.2%	907	6.6%
Black or African-American	78	0.7%	4	0.6%	117	4.6%	199	1.5%
Native Hawaiian/Pac Island	8	0.1%	0	0.0%	1	0.0%	9	0.1%
White	1,536	14.7%	111	15.5%	863	34.3%	2,510	18.4%
Multiracial, not Hispanic	48	0.5%	9	1.3%	42	1.7%	99	0.7%
Hispanic, any race	126	1.2%	18	2.5%	97	3.9%	241	1.8%
Total Residency & Ethnicity Known	10,424		715		2,517		13,656	
Resident, ethnicity unknown	285		10		86		381	
Residency unknown	530		12		152		694	
Grand Total	11,239		737		2,755		14,731	

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

Department Type	# Depts	CS		CE		I		Total	
US CS Public	97	5,807	62.7%	308	49.8%	624	24.8%	6,739	54.4%
US CS Private	27	2,866	30.9%	74	12.0%	353	14.0%	3,293	26.6%
Total US CS	124	8,673	93.7%	382	61.8%	977	38.8%	10,032	80.9%
US CE	6	0	0.0%	226	36.6%	0	0.0%	226	1.8%
US Info	12	35	0.4%	0	0.0%	1,538	61.2%	1,573	12.7%
Canadian	11	553	6.0%	10	1.6%	0	0.0%	563	4.5%
Grand Total	153	9,261		618		2,515		12,394	

Table M5. New Master's Students by Department Type

Department Type	CS			CE			I			Total			Outside North America	
	Total	# Depts	Avg. per Dept.	Total	# Depts	Avg. per Dept.	Total	# Depts	Avg. per Dept.	Total	# Depts	Avg. per Dept.	# Depts	%
US CS Public	6,735	98	68.7	326	19	17.2	886	15	59.1	7,947	98	81.1	5,612	70.6%
US CS Private	3,275	32	102.3	113	5	22.6	252	3	84.0	3,640	32	113.8	2,213	60.8%
Total US CS	10,010	130	77.0	439	24	18.3	1,138	18	63.2	11,587	130	89.1	7,825	67.5%
US CE	0	0	0.0	259	6	43.2	0	0	0.0	259	6	43.2	203	78.4%
US Info	18	1	18.0	0	0	0.0	1,160	11	105.5	1,178	11	107.1	581	49.3%
Canadian	468	11	42.5	6	1	6.0	0	0	0.0	474	11	43.1	319	67.3%
Grand Total	10,496	142	73.9	704	31	22.7	2,298	29	79.2	13,498	158	85.4	8,928	66.1%

There were increases once again in the number of new master's students enrolled in U.S. CS departments, from an average of 80.7 per department in 2015 to 89.1 in 2016 (an increase of slightly over 10 percent). U.S. CS departments at both public and private institutions experienced similar increases (Table M5).

The fraction of new master's students in U.S. CS departments that is reported to be from outside North America rose from

63.3 percent in 2015-16 to 67.5 percent in 2016-17 (Table M5). The increase was in departments at public institutions; private institutions showed a slight decrease, from 61.3 percent to 60.8 percent. At U.S. Information departments, the fraction of new master's students from outside North America rose from 32.4 percent to 49.3 percent, following a decrease last year.

Table M6. Total Master's Enrollment by Department Type

Department Type	CS			CE			I			Total		
	Total	# Depts	Avg. per Dept.	Total	# Depts	Avg. per Dept.	Total	# Depts	Avg. per Dept.	Total	# Depts	Avg. per Dept.
US CS Public	16,999	100	170.0	881	26	33.9	2,291	16	143.2	20,171	100	201.7
US CS Private	10,424	34	306.6	151	6	25.2	1,105	3	368.3	11,680	34	343.5
Total US CS	27,423	134	204.6	1,032	32	32.3	3,396	19	178.7	31,851	134	237.7
US CE	0	0	0.0	679	6	113.2	0	0	0.0	679	6	113.2
US Info	88	1	88.0	0	0	0.0	3,334	11	303.1	3,422	11	311.1
Canadian	1,164	11	105.8	17	1	17.0	48	1	48.0	1,229	11	111.7
Grand Total	28,675	146	196.4	1,728	39	44.3	6,778	31	218.6	37,181	162	229.5

Table M7. Masters Degrees Awarded by Gender and Ethnicity, From 163 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	5,652	2,086	92	74	81	390	124	12	72	83	689	528	39	54	44	9,665	70.8
Amer Indian or Alaska Native	5	8	1	0	0	3	0	0	1	0	6	3	0	1	0	26	0.2
Asian	508	211	6	7	8	31	11	2	6	7	73	55	4	6	5	907	6.6
Black or African-American	52	25	1	1	1	3	1	0	1	1	65	49	3	5	4	199	1.5
Native Hawaiian/Pac Islander	7	1	0	0	0	0	0	0	0	0	1	0	0	0	0	9	0.1
White	1,262	227	44	17	9	95	10	6	17	7	382	475	6	30	40	2,510	18.4
Multiracial, not Hispanic	33	12	2	0	1	7	2	0	1	1	9	33	0	1	3	99	0.7
Hispanic, any race	105	19	2	1	1	16	2	0	3	1	44	53	0	4	4	241	1.8
Total Res & Ethnicity Known	7,624	2,589	148			545	150	20			1,269	1,196	52			13,656	
Resident, ethnicity unknown	223	59	3			8	1	1			43	43	0			381	
Not Reported (N/R)	151	47	332			9	2	1			89	49	14			694	
Gender Totals	8,041	2,715	483			562	153	22			1,401	1,288	66			14,731	
%	74.8%	25.2%				78.6%	21.4%				52.1%	47.9%					

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

Table M8. Masters Enrollment by Gender and Ethnicity, From 162 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	11,486	5,169	886	63	78	955	328	29	76	86	1,784	1,275	13	51	45	22,211	65.0
Amer Indian or Alaska Native	19	5	0	0	0	6	0	0	1	0	1	4	0	0	0	36	0.1
Asian	1,619	610	11	9	9	50	15	6	4	4	261	167	0	8	6	2,742	8.0
Black or African-American	284	85	2	2	1	10	5	0	1	1	191	131	0	6	5	711	2.1
Native Hawaiian/Pac Islander	16	3	0	0	0	0	0	0	0	0	5	3	0	0	0	27	0.1
White	4,178	626	94	23	10	180	27	13	14	7	1,051	1,112	20	30	39	7,309	21.4
Multiracial, not Hispanic	137	31	0	1	1	9	1	0	1	0	44	62	0	1	2	285	0.8
Hispanic, any race	491	76	6	3	1	41	7	3	3	2	139	100	0	4	4	865	2.5
Total Res & Ethnicity Known	18,230	6,605	999			1,251	383	51			3,476	2,854	33			34,186	
Resident, ethnicity unknown	874	229	12			13	2	3			188	143	2			1558	
Not Reported (N/R)	694	246	390			6	1	18			53	15	14			1,437	
Gender Totals	20,108	7,166	1401			1,270	386	72			3,717	3,012	49			37,181	
%	73.7%	26.3%				76.7%	23.3%				55.2%	44.8%					

* % 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 2016

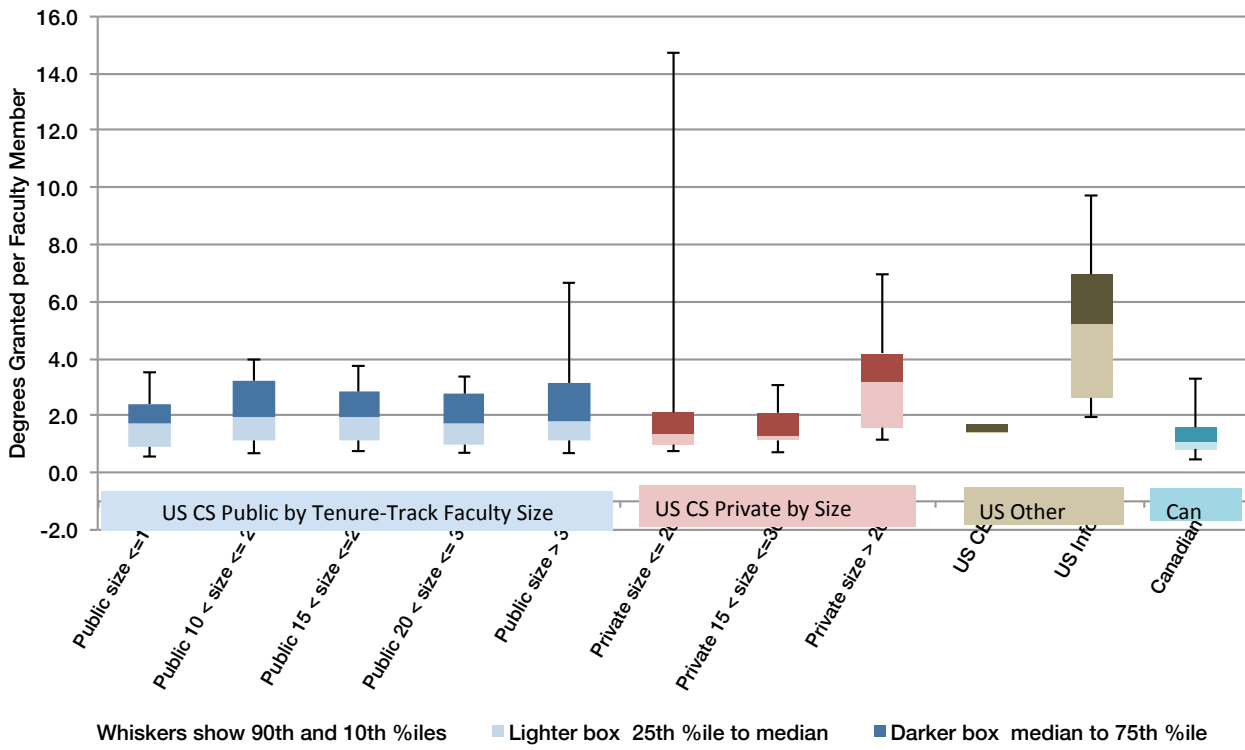
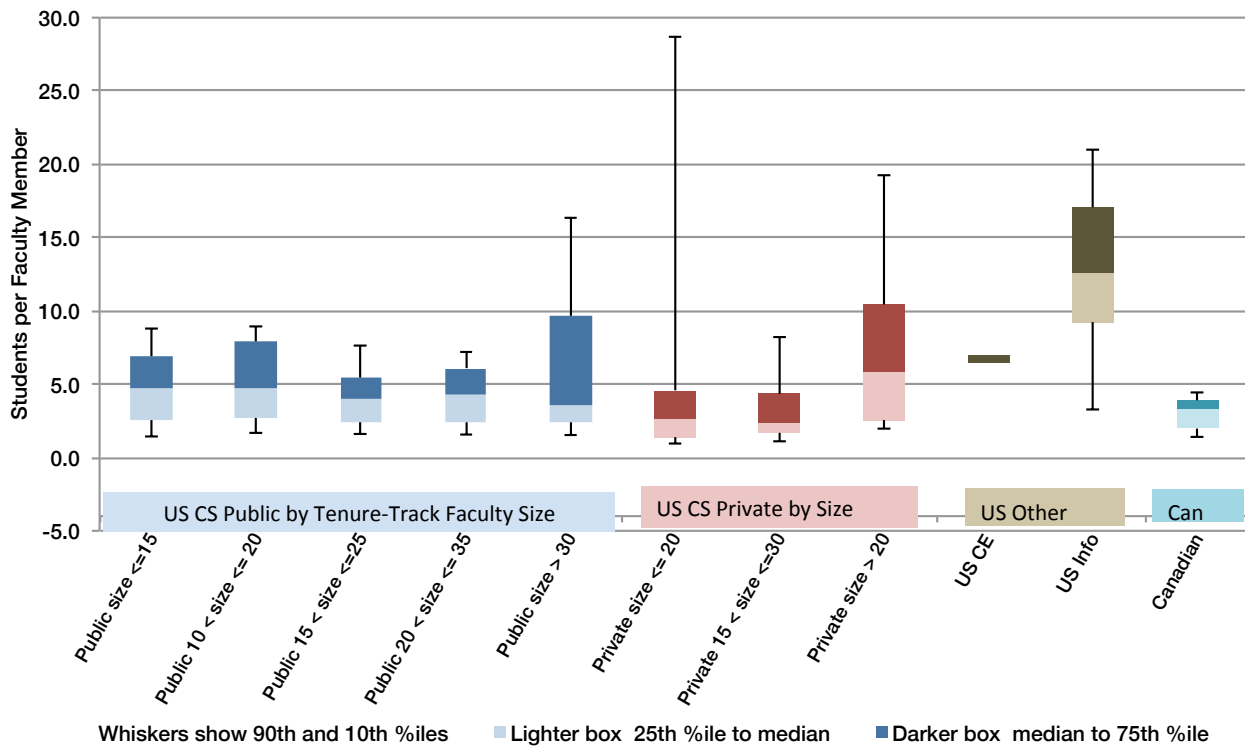


Figure M2. Master's Enrollment Normalized by Tenure-Track Size
CRA Taulbee Survey 2016



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

When comparing bachelor's degree production reported by all departments this year to that reported by all departments last year, there was an overall increase in of 16.6 percent, and an increase of 23.3 percent per department. When considering only those departments that reported both years, the increase was 18.1 percent (Table 1). Among U.S. computer science departments, the increases in overall bachelor's degree production were 19.0 percent overall and 24.5 percent

per department. The increase was 16.7 percent for those U.S. CS departments that reported both years. When only the CS area is considered, bachelor's degree production per department increased 26.2 percent at U.S. CS departments, and it increased 30.6 percent among all reporting departments (Table BI).

This marks the third consecutive year of double-digit percentage increases in bachelor's degree production. It is a natural outgrowth of the bachelor's enrollments surge reported for the past several years. Sizeable increases in bachelor's

Table BI. Bachelor's Degrees Awarded by Department Type

Department Type	# Depts	CS		CE		I		Total	
US CS Public	98	12,630	66.6%	1,858	71.2%	1,835	46.5%	16,323	64.0%
US CS Private	33	3,800	20.0%	254	9.7%	332	8.4%	4,386	17.2%
Total US CS	131	16,430	86.7%	2,112	80.9%	2,167	55.0%	20,709	81.2%
US CE	6	0	0.0%	431	16.5%	201	5.1%	632	2.5%
US Info	9	98	0.5%	0	0.0%	1,208	30.6%	1,306	5.1%
Canadian	10	2,426	12.8%	68	2.6%	367	9.3%	2,861	11.2%
Grand Total	156	18,954		2,611		3,943		25,508	

Table B2. Bachelor's Degrees Awarded by Gender

	CS		CE		I		Total	
Male	14,259	82.1%	2,103	87.4%	2,830	77.1%	19,192	81.9%
Female	3,107	17.9%	304	12.6%	840	22.9%	4,251	18.1%
Total Known Gender	17,366		2,407		3,670		23,443	
Gender Unknown	1,588		204		273		2,065	
Grand Total	18,954		2,611		3,943		25,508	

Table B3. Bachelor's Degrees Awarded by Ethnicity

	CS		CE		I		Total	
Nonresident Alien	1,493	10.4%	214	9.0%	188	5.6%	1,895	9.4%
Amer Indian or Alaska Native	53	0.4%	6	0.3%	7	0.2%	66	0.3%
Asian	3,625	25.3%	630	26.4%	596	17.8%	4,851	24.2%
Black or African-American	440	3.1%	99	4.1%	256	7.6%	795	4.0%
Native Hawaiian/Pac Islander	26	0.2%	2	0.1%	18	0.5%	46	0.2%
White	7,202	50.3%	1,172	49.1%	1,760	52.4%	10,134	50.5%
Multiracial, not Hispanic	409	2.9%	59	2.5%	119	3.5%	587	2.9%
Hispanic, any race	1,069	7.5%	205	8.6%	412	12.3%	1,686	8.4%
Total Residency & Ethnicity Known	14,317		2,387		3,356		20,060	
Resident, ethnicity unknown	677		59		116		852	
Residency unknown	3,960		165		471		4,596	
Grand Total	18,954		2,611		3,943		25,508	

degree production are likely to continue for the next few years based on current enrollments. Figure B1 shows the trend in total computing bachelor's degree production since 1995 for all departments reporting to the Taulbee Survey.

For the ninth consecutive year, there was an increase in the number of new undergraduate computing majors. This year's respondents reported 6.9 percent more new majors (but 14.7

percent more per department) than did last year's respondents. The increase is only 5.3 percent when considering only those departments reporting both this year and last year. Among U.S. computer science departments, the increase was 10.1 percent overall (18.6 percent per department), and 6.6 percent among departments reporting both this year and last year. If only increases in new CS majors at U.S. CS departments are considered, the average increase is 19.9 percent per

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

Department Type	# Depts	CS		CE		I		Total	
US CS Public	91	13,140	67.4%	1,800	64.4%	1,430	51.0%	16,370	65.3%
US CS Private	27	3,830	19.7%	294	10.5%	23	0.8%	4,147	16.5%
Total US CS	118	16,970	87.1%	2,094	75.0%	1,453	51.8%	20,517	81.8%
US CE	6	0	0.0%	607	21.7%	0	0.0%	607	2.4%
US Info	8	0	0.0%	0	0.0%	1,344	47.9%	1,344	5.4%
Canadian	10	2,513	12.9%	92	3.3%	7	0.2%	2,612	10.4%
Grand Total	142	19,483		2,793		2,804		25,080	

Table B5. New Bachelor's Students by Department Type

Department Type	CS				CE				I				Total	
	Major	Pre-Major	# Depts	Avg. Major /Dept	Total	Pre-Major	# Depts	Avg. Major /Dept	Total	Pre-Major	# Depts	Avg. Major /Dept	Total Major	Avg. Major /Dept
US CS Public	18,302	8,450	85	215.3	2,217	849	27	82.1	836	234	21	39.8	21,355	251.2
US CS Private	5,239	1,771	27	194.0	353	15	8	44.1	319	13	4	79.8	5,911	218.9
US CS Total	23,541	10,221	112	210.2	2,570	864	35	73.4	1,155	247	25	46.2	27,266	243.4
US CE	0	0	0	0.0	470	363	6	78.3	0	0	0	0.0	470	78.3
US Information	200	0	1	200.0	0	0	0	0.0	935	150	10	93.5	1,135	113.5
Canadian	3,178	782	9	353.1	167	0	2	83.5	0	0	0	0.0	3,345	371.7
Grand Total	26,919	11,003	122	220.6	3,207	1,227	43	74.6	2,090	397	35	59.7	32,216	235.2

Table B6. Total Bachelor's Enrollment by Department Type

Department Type	CS				CE				I				Total	
	Major	Pre-Major	# Depts	Avg. Major /Dept	Total	Pre-Major	# Depts	Avg. Major /Dept	Total	Pre-Major	# Dept	Avg. Major /Dept	Total Major	Avg. Major /Dept
US CS Public	72,159	15,347	98	736.3	9,646	1,570	36	267.9	7,989	698	26	307.3	89,794	916.3
US CS Private	22,342	2,397	33	677.0	1,120	18	9	124.4	1,351	9	4	337.8	24,813	751.9
US CS Total	94,501	17,744	131	721.4	10,766	1,588	45	239.2	9,340	707	30	311.3	114,607	874.9
US CE	0	0	0	0.0	2,244	1,098	6	374.0	837	0	1	837.0	3,081	513.5
US Info	802	0	1	802.0	0	0	0	0.0	3,919	679	9	435.4	4,721	524.6
Canadian	9,845	3,042	9	1,093.9	216	499	1	216.0	4,119	0	4	1,029.8	14,180	1,575.6
Grand Total	105,148	20,786	141	745.7	13,226	3,185	52	254.3	18,215	1,386	44	414.0	136,589	881.2

department. Figure B2 illustrates the trend in the total number of newly declared computing undergraduate majors as reported in the Taulbee Survey.

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 16.4 percent (21.2 percent per department) when all respondents are compared, and increased 16.8 percent among U.S. CS departments reporting both this year and last year. Aggregate total enrollment (which combines CS departments, CE departments, I departments, and Canadian departments) once again increased in all three computing areas (CS, CE, and I), although the increase in CE was less than 1 percent and actually decreased slightly on a per-department basis (Table B6).

Per-department averages smooth out comparisons from year to year when there are differences in the number of reporting departments, but the averages include both very large and very small departments. Figures B3 and B4 show the distribution of

number of degrees awarded (Figure B3) and total enrollment (Figure B4) per tenured or tenure-track faculty member, in department size groupings for the U.S. CS departments.

The enrollment increases in CS are of particular interest to our community, and the recent CRA Enrollment Report (www.cra.org/data/generation-cs) discusses the current surge in considerable detail. This year's Taulbee Survey data shows that the per-department enrollment of CS bachelor's majors in U.S. CS departments increased by 24.8 percent over last year. Figure B5 shows the enrollment trend from Taulbee Survey data since this surge began a decade ago. The average enrollment per U.S. CS department has increased approximately 275 percent during this period; that is, it has nearly quadrupled. For the past three years, it has exceeded the previous peak reached during the dot-com enrollment surge. Analysis of the newly collected course-level enrollment data will be presented in future Taulbee Survey reports.

Table B7. Bachelors Degrees Awarded by Gender and Ethnicity, From 156 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	1,141	344	3	10	14	171	41	2	9	14	140	43	5	6	6	1,895	9.4
Amer Indian or Alaska Native	46	5	2	0	0	5	1	0	0	0	7	0	0	0	0	66	0.3
Asian	2,738	870	8	24	35	522	97	11	26	33	398	181	17	16	24	4,851	24.2
Black or African-American	350	79	5	3	3	73	19	7	4	7	174	62	20	7	8	795	4.0
Native Hawaiian/Pac Islander	22	4	0	0	0	2	0	0	0	0	12	6	0	1	1	46	0.2
White	6,120	931	121	53	38	1,015	103	54	51	35	1,349	336	75	55	45	10,134	50.5
Multiracial, not Hispanic	322	75	6	3	3	49	10	0	3	3	75	41	3	3	6	587	2.9
Hispanic, any race	875	173	21	8	7	153	23	29	8	8	312	79	21	13	11	1,686	8.4
Total Res & Ethnicity Known	11,614	2,481	166			1,990	294	103			2,467	748	141			20,060	
Resident, ethnicity unknown	540	125	8			55	4	0			98	18	0			852	
Not Reported (N/R)	2,058	488	1,414			58	6	101			265	74	132			4,596	
Gender Totals	14,259	3,107	1,588			2,103	304	204			2,830	840	273			25,508	
%	82.1%	17.9%				87.4%	12.6%				77.1%	22.9%					
* % of M and % of F columns are the percent of that gender who are of the specified ethnicity, of those whose ethnicity is known																	

Table B8. Bachelors Enrollment by Gender and Ethnicity, From 155 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	6,717	1,916	20	11	14	866	176	11	9	11	451	177	12	5	7	10,360	10.0
Amer Indian or Alaska Native	221	40	5	0	0	19	10	0	0	1	34	6	2	0	0	337	0.3
Asian	14,175	4,312	128	22	32	2,390	589	38	24	36	1,675	668	72	17	26	24,175	23.2
Black or African-American	2,874	787	93	5	6	485	97	43	5	6	833	248	85	8	10	5,601	5.4
Native Hawaiian/Pac Islander	168	34	5	0	0	16	3	0	0	0	43	11	0	0	0	280	0.3
White	31,707	4,627	770	50	35	4,821	556	193	49	34	5,231	1,093	381	53	43	49,633	47.7
Multiracial, not Hispanic	1,849	423	55	3	3	289	36	9	3	2	324	87	22	3	3	3,114	3.0
Hispanic, any race	5,998	1,150	264	9	9	1,058	184	107	11	11	1,359	282	148	14	11	10,567	10.2
Total Res & Ethnicity Known	63,709	13,289	1,340			9,944	1,651	401			9,950	2,572	722			104,067	
Resident, ethnicity unknown	3,477	888	2,130			337	50	8			433	86	11			7,445	
Not Reported (N/R)	11,245	3,435	5,121			362	59	414			3,272	966	203			25,077	
Gender Totals	78,853	17,704	8,591			10,643	1,760	823			13,655	3,624	936			136,589	
%	81.7%	18.3%				85.8%	14.2%				79.0%	21.0%					

* % 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 BI. BS Production (CS & CE)
CRA Taulbee Survey 2016**

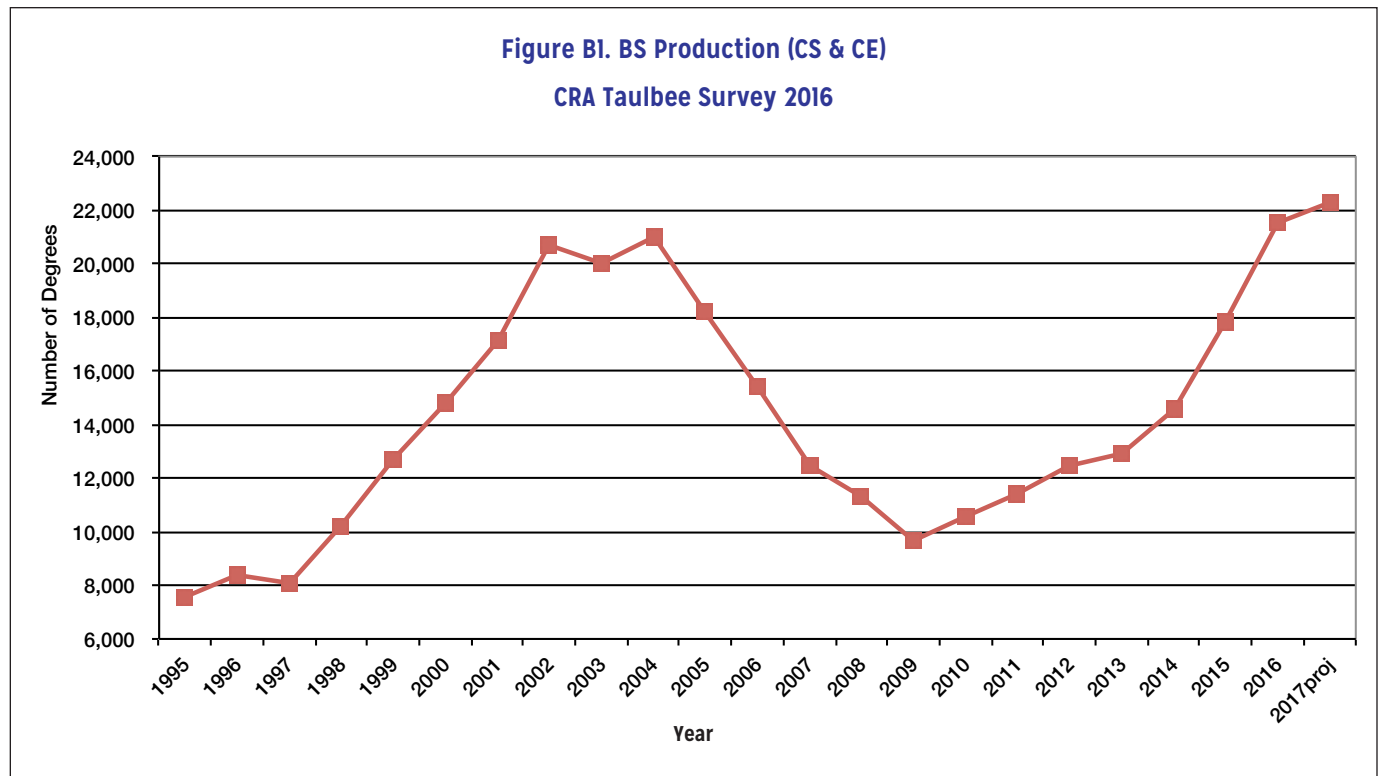


Figure B2. Newly Declared Undergraduate Majors: CS, CE, and I (beginning in 2008)
CRA Taulbee Survey 2016

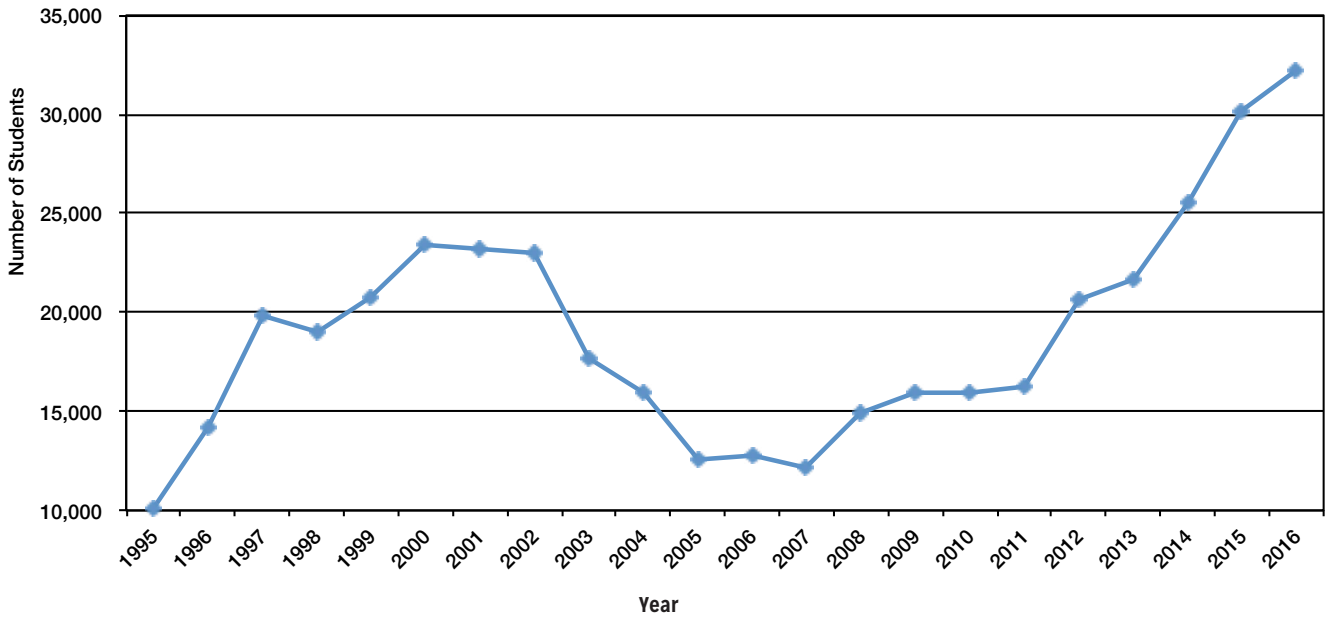


Figure B3. Bachelor's Degrees Granted by Tenure-Track Size
CRA Taulbee Survey 2016

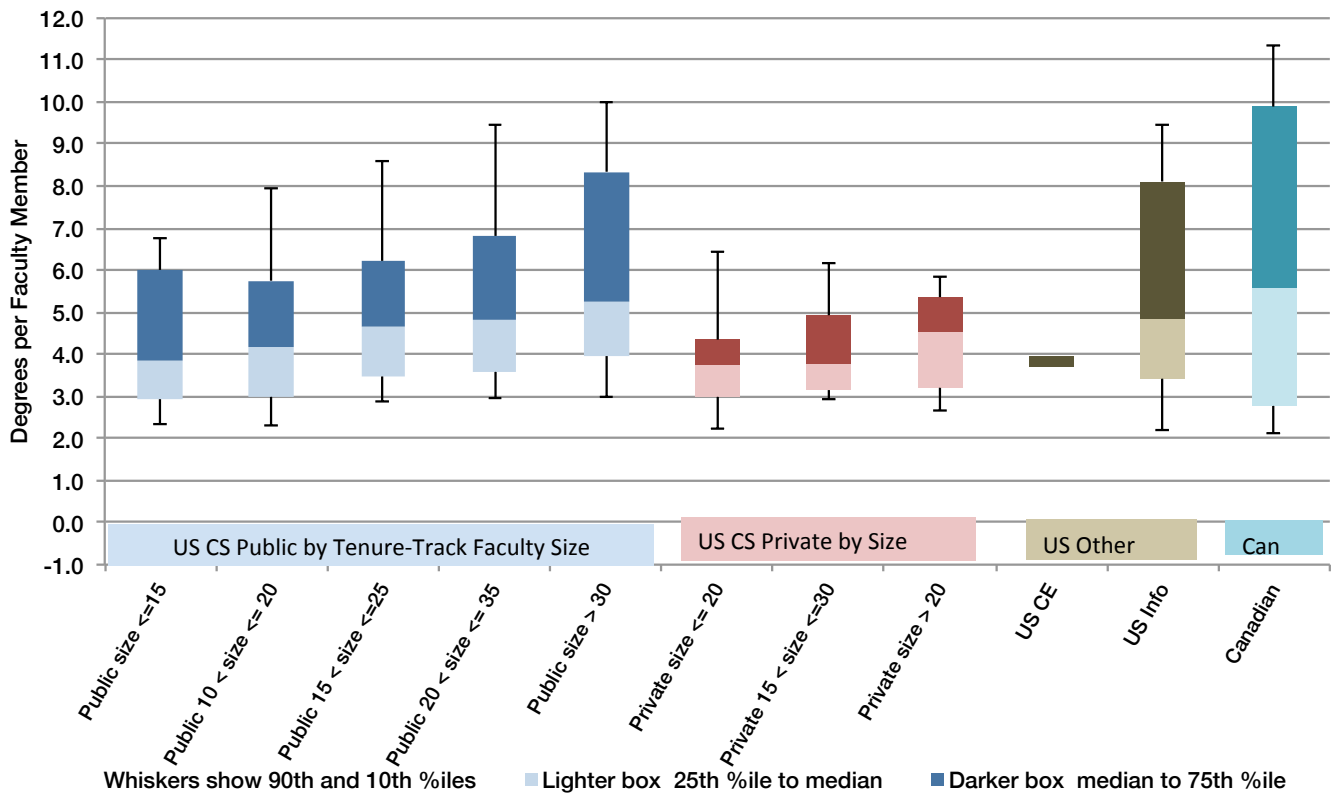


Figure B4. Bachelor's Enrollment Normalized by Tenure-Track Size
CRA Taulbee Survey 2016

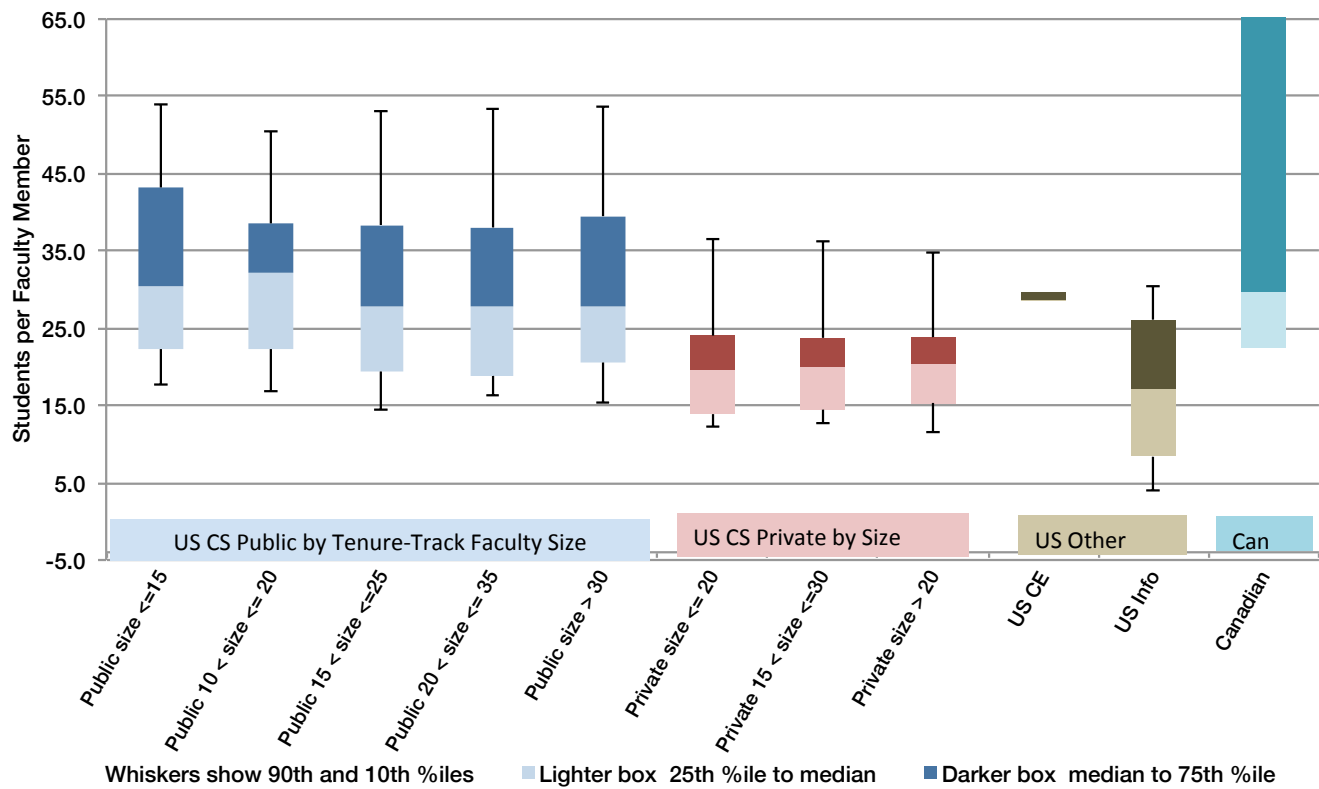


Figure B5. Average New and Continuing CS Majors per Academic Unit (U.S. CS Programs Only)
CRA Taulbee Survey 2016

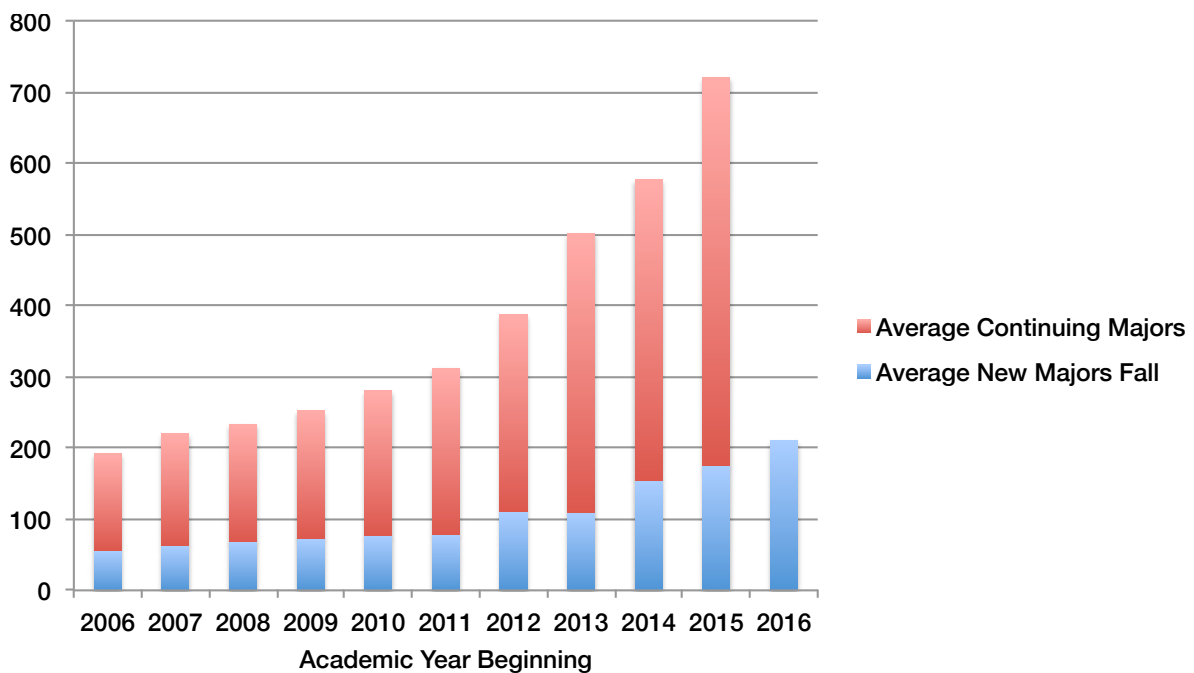


Table FI. Actual and Anticipated Faculty Size by Position and Department Type

	Actual		Projected				Expected 2-Yr Growth	
	2015-2016		2016-2017		2017-2018			
	Total	Average	Total	Average	Total	Average	#	%
US CS Public								
TenureTrack	2,858	28.9	3,027	30.6	3,148	31.8	290	10.1%
Teaching	635	7.4	708	8.0	756	8.7	121	19.1%
Research	237	4.8	267	5.3	283	5.7	46	19.4%
Postdoc	282	5.2	321	5.7	339	6.1	57	20.2%
Total	4,002	40.4	4,315	43.6	4,519	45.6	517	12.9%
US CS Private								
TenureTrack	1,113	30.9	1,186	32.9	1,248	34.7	135	12.1%
Teaching	269	8.7	288	9.3	302	9.7	33	12.3%
Research	127	8.5	133	8.9	133	8.9	6	4.7%
Postdoc	209	10.0	233	10.1	254	11.0	45	21.5%
Total	1,716	47.7	1,839	51.1	1,935	53.8	219	12.8%
All US CS								
TenureTrack	3,971	29.4	4,212	31.2	4,396	32.6	425	10.7%
Teaching	903	7.7	996	8.4	1,057	9.0	154	17.1%
Research	364	5.7	400	6.1	416	6.4	52	14.3%
Postdoc	491	6.5	554	7.0	593	7.5	102	20.8%
Total	5,718	42.4	6,154	45.6	6,454	47.8	736	12.9%
US CE								
TenureTrack	82	13.7	86	14.4	89	14.9	7	8.5%
Teaching	10	2.1	11	2.2	12	2.3	2	20.0%
Research	3	3.0	4	1.8	4	2.0	1	33.3%
Postdoc	6	2.0	7	2.2	7	2.3	1	16.7%
Total	101	16.8	107	17.8	111	18.5	10	9.9%
US I								
TenureTrack	329	23.5	356	25.4	365	26.1	36	10.9%
Teaching	148	11.4	158	12.1	158	12.1	10	6.8%
Research	17	1.9	13	1.7	13	1.9	-4	-23.5%
Postdoc	42	3.9	48	4.8	51	5.1	9	21.4%
Total	535	38.2	574	41.0	585	41.8	50	9.3%
Canadian								
TenureTrack	403	36.6	431	39.1	443	40.2	40	9.9%
Teaching	61	6.1	61	6.1	57	5.7	-4	-6.6%
Research	5	1.7	8	2.7	9	3.0	4	80.0%
Postdoc	50	8.3	48	8.0	50	8.3	0	0.0%
Total	517	47.0	546	49.6	557	50.6	40	7.7%
Grand Total								
TenureTrack	4,786	28.8	5,085	30.6	5,293	31.9	507	10.6%
Teaching	1,122	7.7	1,226	8.3	1,283	8.8	161	14.3%
Research	390	5.1	424	5.4	442	5.7	52	13.3%
Postdoc	589	6.2	656	6.7	701	7.2	112	19.0%
Total	6,871	41.4	7,381	44.5	7,707	46.4	836	12.2%

The proportion of women among bachelor's graduates in CS rose once again, from 15.7 percent in 2014-15 to 17.9 percent in 2015-16. This is the highest percentage of female CS graduates among Taulbee Survey respondents since 2002-03. In CE, the percentage of female bachelor's graduates rose from 11.6 percent to 12.6 percent and the percentage of female bachelor's graduates in I rose from 21.7 percent to 22.9 percent (Table B2). The percentage of CS bachelor's degrees awarded to Whites again declined from 55.0 percent in 2013-14 to 50.3 percent in 2014-15, while the percentage awarded to Asians rose again, from 22.8 percent to 25.3 percent and the percentage awarded to Non-resident Aliens rose from 8.8 percent to 10.4 percent. Changes in other ethnicity categories were less than 1 percent in CS. In aggregate across the three degree areas, 50.5 percent of the graduates were White, 24.2 percent Asian, 9.4 percent Non-resident Aliens, and 15.8 percent all other ethnicity categories combined. However, in I programs, the other ethnicity categories accounted for more than 24 percent of the graduates (Table B3).

In all three computing areas (CS, CE, and I), Resident Asians and Non-resident Aliens comprise a larger fraction of female enrollment than male enrollment, while Whites comprise a larger fraction of male enrollment than female enrollment (Table B8). Table B7 indicates that the same comparisons hold true for degree awardees with the exception of I degrees to Non-resident Aliens, whose relative percentages of men and women are equal.

Faculty Demographics (Tables FI-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 (3,971) represents only a 2.3 percent increase over last year. However, the average tenure-track faculty size per U.S. CS department grew from 28.1 to 29.4 during this period, a 4.6 percent increase. In these departments, the average number of teaching faculty increased from 6.9 to 7.7 and the average number of research faculty increased from 5.4 to 5.7, while the average number of postdocs remained at 6.5. Canadian, CE, and I departments have much more volatile data due to the small number of departments reporting in each of these categories.

As noted in previous Taulbee reports, Canadian universities, on average, have several more tenure-track faculty members per department than do U.S. universities, while U.S. I and CE

Table F2. Vacant Positions 2014-2015 by Position and Department Type

	Tried to fill	Filled
US CS Public		
TenureTrack	302	221
Teaching	121	104
Research	46	45
Postdoc	96	115
Total	565	485
US CS Private		
TenureTrack	116	83
Teaching	48	39
Research	22	24
Postdoc	90	84
Total	276	230
All US CS		
TenureTrack	418	304
Teaching	169	143
Research	68	69
Postdoc	186	199
Total	841	715
US CE		
TenureTrack	7	9
Teaching	18	18
Research	3	3
Postdoc	8	8
Total	36	38
US I		
TenureTrack	39	26
Teaching	16	11
Research	1	1
Postdoc	9	8
Total	65	45
Canadian		
TenureTrack	38	22
Teaching	11	11
Research	4	4
Postdoc	27	26
Total	80	63
Grand Total		
TenureTrack	502	361
Teaching	214	183
Research	76	77
Postdoc	230	241
Total	1,022	861

departments, on average, are somewhat 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 have more of each category of faculty, including postdocs, than do

those at public universities on average. This has held true for the past two years except for tenure-track faculty, where last year the average size at public universities was slightly larger than that at private universities. The average tenure-track size at private universities jumped from 27.6 to 30.9 while the average at public universities showed a slim increase, from 28.3 to 28.9. The specific set of departments reporting from one year to the next can impact these figures.

Table F2a. Reasons Positions Left Unfilled

Reason	# Reported	% of Reasons
Didn't find a person who met our hiring goals*	25	16.3%
Offers turned down	66	43.1%
Technically vacant, not filled for admin reasons	9	5.9%
Hiring in progress	47	30.7%
Other	6	3.9%
Total Reasons Provided	153	
*What hiring goals could not be met?		# Given
Specific specialty area not found (no two the same)		4
Poor qualifications for teaching faculty		4
Not right qualifications or complement to current faculty		9

Table F3. Gender of Newly Hired Faculty

	Tenure-Track		Teaching		Research		Postdoc		Total	
Male	271	75.7%	118	70.2%	51	77.3%	161	77.8%	601	75.2%
Female	87	24.3%	50	29.8%	15	22.7%	46	22.2%	198	24.8%
Unknown	0		0		0		1		1	
Total	358		168		66		208		800	

Table F4. Ethnicity of Newly Hired Faculty

	Tenure-Track		Teaching		Research		Postdoc		Total	
Nonresident Alien	62	18.8%	11	7.1%	13	21.0%	64	36.8%	150	20.9%
American Indian / Alaska Native	1	0.3%	1	0.6%	1	1.6%	1	0.6%	4	0.6%
Asian	95	28.9%	16	10.4%	11	17.7%	44	25.3%	166	23.1%
Black or African-American	12	3.6%	4	2.6%	0	0.0%	0	0.0%	16	2.2%
Native Hawaiian/ Pacific Islander	0	0.0%	5	3.2%	0	0.0%	0	0.0%	5	0.7%
White	144	43.8%	94	61.0%	28	45.2%	51	29.3%	317	44.1%
Multiracial, not Hispanic	1	0.3%	7	4.5%	2	3.2%	0	0.0%	10	1.4%
Hispanic, any race	2	0.6%	8	5.2%	3	4.8%	2	1.1%	15	2.1%
Resident, race/ethnic unknown	12	3.6%	8	5.2%	4	6.5%	12	6.9%	36	5.0%
Total known residency	329		154		62		174		719	
Residency Unknown	29		14		4		34		81	
Total	358		168		66		208		800	

Table F2 summarizes faculty hiring this past year. The success rate for hiring tenure-track faculty at U.S. CS departments rose slightly, from 70.8 percent last year to 72.7 percent this year. The success rate was similar at public (73.2 percent) and private (71.2 percent) departments. Again this year, Canadian departments had lower success rates, on average, than did U.S. CS, CE, and I departments. In aggregate, the tenure-track hiring success rate increased from 70.6 percent to 71.9 percent.

Among those hired into all categories of academic positions (tenure-track, teaching faculty, research faculty, and postdoc) for 2016-17, 24.8 percent were women, higher than the 21.6 percent newly hired for 2015-16 (Table F3). Considering only tenure-track positions, the proportion of women among those newly hired rose from 20.3 percent last year to 24.3 percent this year. Only among research faculty positions was there a decrease in the percentage of positions going to women as compared with those reported last year. This is the exact opposite from what happened last year. The percentage of women among new tenure-track and faculty hires and among newly hired faculty overall are higher than the percentage of new female Ph.D.s produced this past year.

Among new tenure-track faculty, the fraction who are White declined slightly, from 44.8 percent to 43.8 percent, while the fraction who are Non-resident Alien or Asian new hires rose from 43.5 percent to 47.7 percent. Once again, Whites dominated the newly hired teaching faculty, with Asians and Non-resident Aliens accounting for much of the remainder. Among research faculty, Whites comprised 45.2 percent of new

Table F5. Faculty Losses

Died	13
Retired	90
Took Academic Position Elsewhere	89
Took Nonacademic Position	42
Remained, but Changed to Part Time	13
Other	22
Unknown	1
Total	270

Table F6. Gender of Current Faculty

	Full		Associate		Assistant		Teaching		Research		Postdoc		Total	
Male	1,979	85.2%	1,040	77.6%	843	76.2%	893	72.5%	366	81.5%	534	79.7%	5,655	79.4%
Female	345	14.8%	301	22.4%	263	23.8%	339	27.5%	83	18.5%	136	20.3%	1,467	20.6%
Unknown	29		10		0		15		1		35		90	
Total	2,353		1,351		1,106		1,247		450		705		7,212	

Table F7. Ethnicity of Current Faculty

	Full		Associate		Assistant		Teaching		Research		Postdoc		Total	
Nonresident Alien	26	1.2%	11	0.9%	153	15.0%	40	3.6%	58	13.5%	220	36.0%	508	7.8%
American Indian / Alaska Native	3	0.1%	1	0.1%	3	0.3%	1	0.1%	1	0.2%	0	0.0%	9	0.1%
Asian	583	26.8%	375	31.8%	301	29.5%	113	10.0%	78	18.2%	135	22.1%	1,585	24.2%
Black or African-American	15	0.7%	33	2.8%	26	2.5%	57	5.1%	3	0.7%	7	1.1%	141	2.2%
Native Hawaiian / Pacific Islander	2	0.1%	1	0.1%	1	0.1%	14	1.2%	0	0.0%	1	0.2%	19	0.3%
White	1,411	64.8%	685	58.1%	487	47.7%	820	72.9%	265	61.8%	199	32.6%	3,867	59.1%
Multiracial, not Hispanic	11	0.5%	5	0.4%	4	0.4%	4	0.4%	1	0.2%	1	0.2%	26	0.4%
Hispanic, any race	46	2.1%	31	2.6%	20	2.0%	26	2.3%	11	2.6%	13	2.1%	147	2.2%
Resident, race/ethnic unknown	82	3.8%	36	3.1%	26	2.5%	50	4.4%	12	2.8%	35	5.7%	241	3.7%
Total known residency	2,179		1,178		1,021		1,125		429		611		6,543	
Residency Unknown	174		173		85		122		21		94		669	
Total	2,353		1,351		1,106		1,247		450		705		7,212	

Table F8. Current Tenured and Tenure-Track Faculty by Gender and Ethnicity, From 163 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	19	7	0	1	2	9	2	0	1	1	122	31	0	16	13	190	4.5
Amer Indian or Alaska Native	2	1	0	0	0	1	0	0	0	0	2	1	0	0	0	7	0.2
Asian	511	65	7	29	21	282	92	1	32	36	232	69	0	31	29	1,259	29.7
Black or African-American	12	3	0	1	1	19	14	0	2	5	15	11	0	2	5	74	1.7
Native Hawaiian/ Pac Islander	2	0	0	0	0	1	0	0	0	0	1	0	0	0	0	4	0.1
White	1,175	219	17	67	72	537	144	4	61	56	369	118	0	49	50	2,583	61.0
Multiracial, not Hispanic	11	0	0	1	0	5	0	0	1	0	2	2	0	0	1	20	0.5
Hispanic, any race	34	10	2	2	3	25	5	1	3	2	14	6	0	2	3	97	2.3
Total Res & Ethnicity Known	1,766	305	26			879	257	6			757	238	0			4,234	
Resident, ethnicity unknown	66	13	3			22	10	4			18	8	0			144	
Not Reported (N/R)	147	27	0			139	34	0			68	17	0			432	
Gender Totals	1,979	345	29			1,040	301	10			843	263	0			4,810	
%	85.2%	14.8%				77.6%	22.4%				76.2%	23.8%					

* %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 160 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	27	11	2	4	4	41	16	1	12	21	186	30	4	40	28	318	15
Amer Indian or Alaska Native	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2	0
Asian	75	38	0	10	13	66	12	0	19	16	100	30	5	22	28	326	16
Black or African-American	37	20	0	5	7	1	2	0	0	3	4	3	0	1	3	67	3
Native Hawaiian/ Pac Islander	8	6	0	1	2	0	0	0	0	0	0	1	0	0	1	15	1
White	599	221	0	78	73	225	40	0	66	53	160	39	0	35	36	1,284	62
Multiracial, not Hispanic	4	0	0	1	0	1	0	0	0	0	1	0	0	0	0	6	0
Hispanic, any race	19	7	0	3	2	7	4	0	2	5	9	4	0	2	4	50	2
Total Res & Ethnicity Known	770	303	2			341	75	1			460	107	9			2,068	
Resident, ethnicity unknown	36	14	0			11	1	0			28	6	1			97	
Not Reported (N/R)	87	22	13			14	7	0			46	23	25			237	
Gender Totals	893	339	15			366	83	1			534	136	35			2,402	
%	72.5%	27.5%				81.5%	18.5%				79.7%	20.3%					

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

hires, while Non-resident Aliens or resident Asians in aggregate comprised 38.7 percent of new hires. The latter figure is much lower than last year's 53.8 percent, in part due to hires in other ethnicity categories where there were none last year. Among postdoc new hires, Whites comprised 29.3 percent, compared to 19.8 percent last year, with Non-resident Aliens and resident Asians collectively comprising 62.1 percent compared with just more than 75 percent last year (Table F4).

The Taulbee Survey recently began collecting information on the number of new faculty hires who had been postdocs in the previous year. In 2015, the departments reporting to the survey hired 233 new assistant professors. Of those, 78 (33 percent) had received their Ph.D. in the previous academic year, and 72 (31 percent) had previously been in a postdoc. In 2016, 279 new assistant professors were hired, 87 of whom were new Ph.D.s (31 percent) and 86 of whom were recent postdocs (also 31 percent).

There were slightly more faculty losses reported this year as compared with last year (Table F5). Retirements were comparable to last year, but there was increased movement from one academic position to another, and from an academic position to a nonacademic position. The latter category took the biggest jump, from 24 reported last year to 42 reported this year. Although the movement is not yet at the level seen during the height of the dot-com boom era, this increase bears watching. Are increased faculty workloads due to the large enrollment increases starting to affect faculty employment choices?

The proportion of women at the full professor rank rose slightly from 14.3 percent last year to 14.8 percent this year, while the proportion at the associate professor level rose from 22.1 percent to 22.4 percent. The proportion at the assistant professor level was 23.8 percent, which is about the same as last year (Table F6). There were also slight increases in the proportion of women among teaching faculty and postdocs, while there was a slight decrease in the proportion of women among research faculty. This is the reverse of what happened last year. Whites, Asians, and Non-resident Aliens account for more than 90 percent of each category of faculty members except for teaching faculty, where they account for more than 85 percent of the total (Table F7).

Among the departments who report gender by ethnicity breakdowns (which the vast majority of departments do),

Whites again 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 6.1 percent growth in tenure-track faculty and an 9.1 percent growth in teaching faculty. They also forecast a 7.7 percent growth in postdocs. It should be noted that these departments missed last year's expectations for both tenure-track and postdoc hiring. They met their expectations for teaching faculty.

Non-Tenure-Track Teaching Faculty

The 2016 Taulbee Survey contained several questions about non-tenure-track teaching faculty to help us decide what, if anything, the survey should collect differently about those faculty. This is potentially a concern to many doctoral departments; in 2016, 87 percent of departments reporting faculty data to the Taulbee Survey indicated at least one non-tenure-track teaching faculty member. Of those, 80 percent have multiple titles and/or levels of teaching faculty and 20 percent have a single title and level.

There were 120 responses to an open-ended question about titles and levels used within an academic unit. As expected, units varied widely in the number of titles and the specific titles they used. The titles included:

- ▶ Multiple levels of Lecturer, reported by 49 units (41 percent). Examples are Lecturer and Senior Lecturer; Lecturer, Senior Lecturer, and Principal Lecturer; Lecturer I - IV; or Lecturer with or without Security of Employment.
- ▶ An Assistant-Associate or Assistant-Associate-Full pattern, reported by 39 (33 percent). There were many variations on the complete title (e.g., Teaching, Clinical, Instructional, Collegiate, or Professor of Practice).
- ▶ A single level of Lecturer, reported by 36 (30 percent). In some units this was the only non-tenure-track teaching title, but in others there were, for example, both Lecturers and Professors of the Practice.
- ▶ Professor of the Practice with no levels given, reported by 20 (17 percent).
- ▶ A single level of Instructor, reported by 12 (10 percent)

- Multiple levels of Instructor, reported by 9, (8 percent)
- Other, reported by 18 (15 percent), which included Fellow, Faculty Associate, Teaching Professor (without Assistant / Associate levels), Teaching Specialist, Security of Employment, and Visiting Faculty.

The majority of responding units (61 percent) were interested in having the Taulbee Survey provide more fine-grained information about non-tenure-track teaching faculty. Eighteen percent of units were not interested in the Taulbee Survey reporting more on this subject, and 21 percent had no opinion.

The survey committee will review these responses and determine what form any additional information should take before data collection begins in fall 2017.

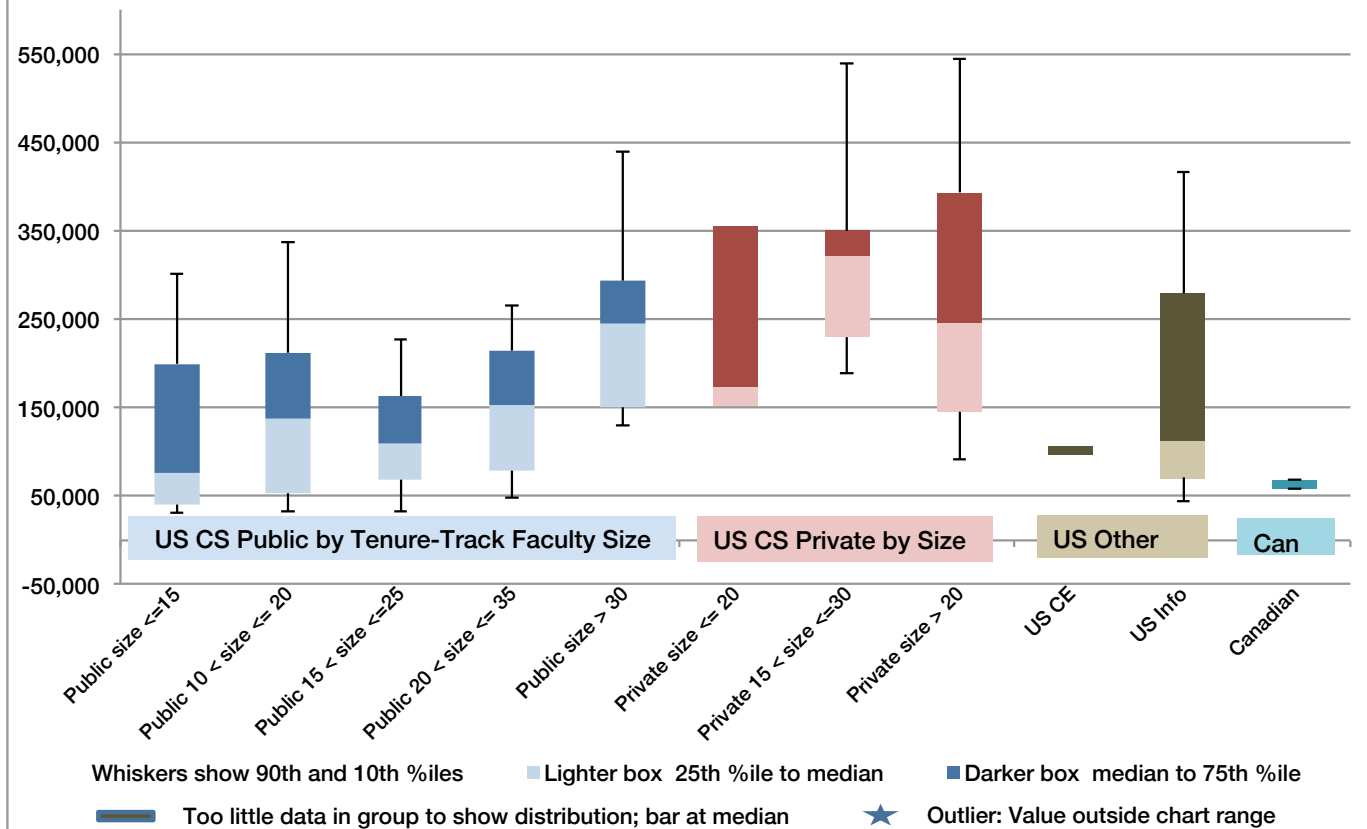
Research Expenditures (Table RI; Figures RI-R2)

Table RI shows the distribution of departments' total expenditure (including indirect costs or "overhead" as stated on project budgets) from external sources of support. Figures RI and R2 show the per capita expenditure, where capitation is computed two ways. The first (Figure RI) is relative to the number of tenure-track faculty members. The second (Figure R2)

Table RI. Total Expenditure from External Sources for Computing Research

Department Type	# Depts	10th	25th	50th	75th	90th
US CS Public	83	\$630,675	\$1,487,632	\$3,729,141	\$8,584,860	\$15,154,063
US CS Private	27	\$1,673,644	\$2,376,724	\$6,242,489	\$10,629,352	\$18,776,986
US CE	5			\$1,748,209		
US Information	11	\$941,347	\$2,027,403	\$2,820,124	\$3,747,854	\$4,083,321
Canadian	6		\$804,225	\$1,852,028	\$4,622,617	

Figure RI. Research Expenditures Normalized by Tenure-Track Size
CRA Taulbee Survey 2016



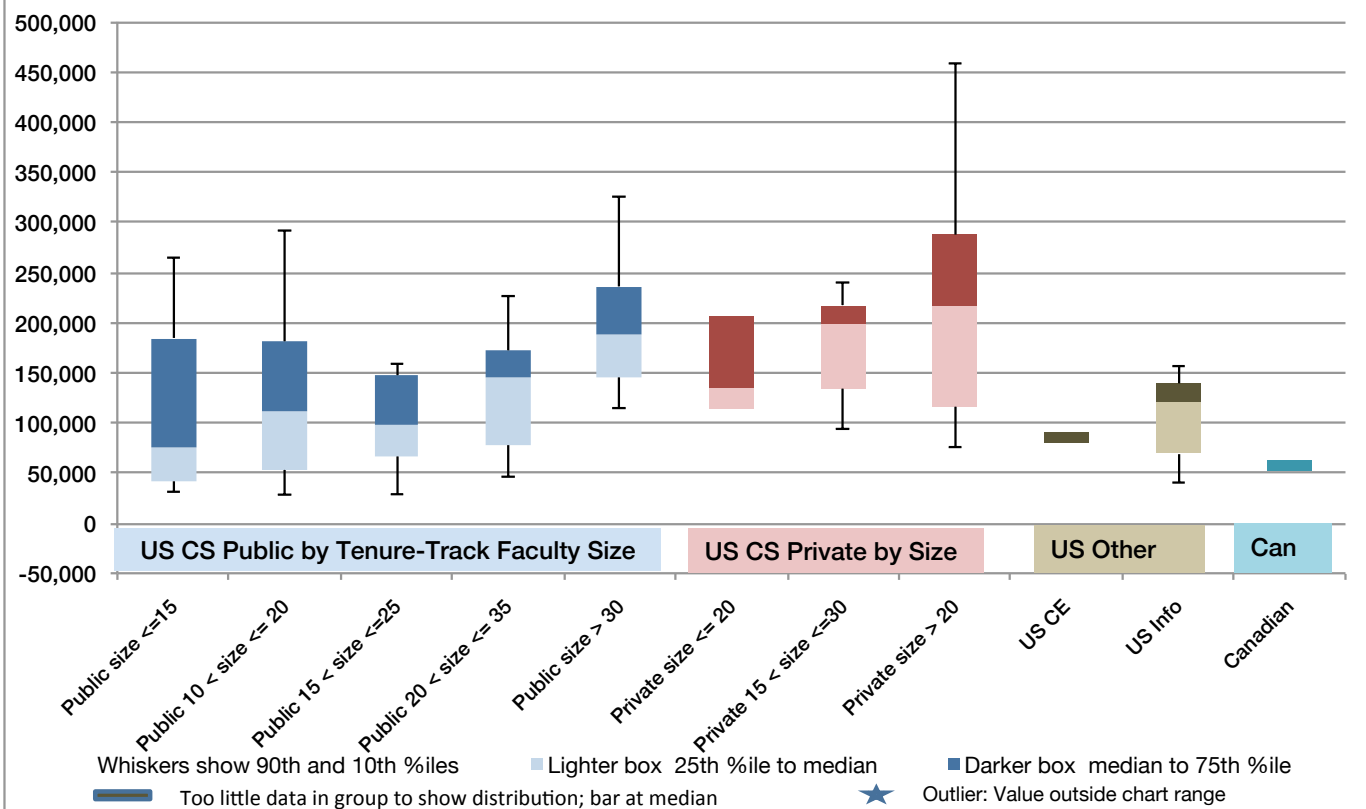
is relative to research faculty and postdocs as well as tenure-track faculty. Canadian levels are shown in Canadian dollars.

Overall median research expenditures for 2015-16 at U.S. CS public departments increased 5.7 percent in comparison with 2014-15. At U.S. CS departments in private institutions, median expenditures fell 9.3 percent. The direction of change in each case was the reverse of what was experienced last year. The median research expenditure at U.S. CS departments in private institutions is considerably higher than that of public institutions. Median expenditures fell slightly at U.S. I departments. Fewer I departments provided research

expenditure data this year than did so last year and the sample size is small, which makes these comparisons subject to more volatility. Due to an insufficient number of Canadian and CE departments reporting data, we are unable to provide any meaningful comparative results.

The U.S. CS data show a tendency for larger departments to have more external funding per capita than smaller departments. The effect of size of the department on research expenditures per capita at private institutions is more clearly seen when capitation includes research faculty and postdocs as well as tenure-track faculty.

Figure R2. Research Expenditures Normalized by Tenure-Track + Research Faculty + Postdoctorates
CRA Taulbee Survey 2016



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

Table GI shows the number of graduate students supported as full-time students as of fall 2016, 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 average number of TAs on institutional funds in U.S. CS departments was within 1 percent of its value last year. Public universities reported a slight increase, while the average at private universities declined by 7.6 percent after almost doubling last year. The reported values at private universities have been

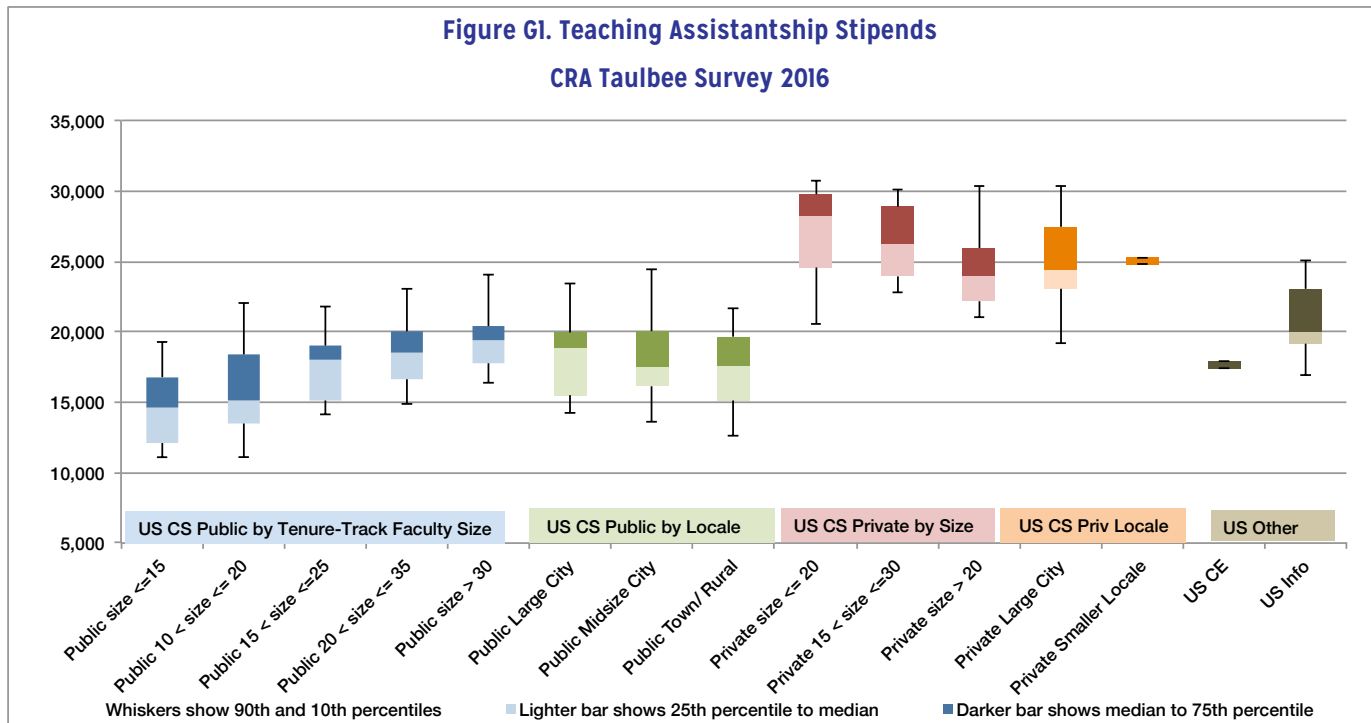
somewhat volatile in recent years. Since there are many less of them, compared with public universities, they are more sensitive to the specific units reporting in a given year. The small number of CE, I, and Canadian departments also make these comparative averages subject to volatility.

The average number of RAs on external funding stayed fairly constant at both public and private U.S. CS departments, while the average number of RAs supported on institutional funds declined sharply. The average number of full-support fellows on internal funds rose at in U.S. CS public departments and stayed fairly steady at U.S. private

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

Department Type	# Dept	On Institutional Funds						On External Funds						Total
		Teaching Assistants		Research Assistants		Full-Support Fellows		Teaching Assistants		Research Assistants		Full-Support Fellows		
US CS Public	89	3,225.4	41.7%	751.9	9.7%	432.4	5.6%	34.0	0.4%	3,127.5	40.4%	165.9	2.1%	7,737.1
US CS Private	32	1,044.0	27.7%	517.2	13.7%	232.0	6.1%	0.0	0.0%	1,838.9	48.7%	143.5	3.8%	3,775.5
US CS Total	121	4,269.4	37.1%	1,269.1	11.0%	664.4	5.8%	34.0	0.3%	4,966.4	43.1%	309.4	2.7%	11,512.6
US CE	5	180.0	34.6%	23.0	4.4%	13.0	2.5%	0.0	0.0%	299.5	57.7%	4.0	0.8%	519.5
US I	12	154.1	34.9%	82.6	18.7%	19.0	4.3%	0.9	0.2%	172.6	39.1%	12.0	2.7%	441.2
Canadian	7	257.5	57.2%	45.0	10.0%	0.0	0.0%	0.0	0.0%	148.0	32.9%	0.0	0.0%	450.5
Grand Total	145	4,861.0	37.6%	1,419.7	11.0%	696.4	5.4%	34.9	0.3%	5,586.4	43.2%	325.4	2.5%	12,923.8

Figure GI. Teaching Assistantship Stipends
CRA Taulbee Survey 2016



departments. The average number of full-support fellows on external funds declined at U.S. CS departments in both public and private universities.

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 increased 1.8 percent at public universities and increased 4.4 percent

at private universities. Median salaries of RAs rose 3.4 percent at public universities but rose 2.3 percent at private universities. For full-support fellows, median salaries rose 0.6 percent at U.S. public universities and 4.0 percent at U.S. private universities.

Stipends tend to be higher at private U.S. CS departments, compared with public U.S. CS departments, in each of the three stipend categories. Stipends at U.S. I schools fall in between those at public and private U.S. CS departments. These relationships are unchanged from last year.

Table G2. Fall 2016 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	98	\$13,522	\$15,300	\$18,000	\$19,901	\$23,225
US CS Private	26	\$18,900	\$21,508	\$23,963	\$26,858	\$28,900
US CE	6		\$14,695	\$17,665	\$21,744	
US Info	12	\$16,856	\$19,180	\$20,979	\$23,375	\$25,087
Canadian	8		\$10,924	\$14,044	\$17,657	
Research Assistantships						
Percentiles of Department Averages						
Department Type	# Depts	10th	25th	50th	75th	90th
US CS Public	96	\$14,240	\$16,285	\$18,737	\$22,041	\$24,702
US CS Private	33	\$20,731	\$22,419	\$24,855	\$27,330	\$30,468
US CE	6		\$17,286	\$18,634	\$21,699	
US Information	13	\$18,641	\$19,690	\$21,939	\$24,500	\$25,000
Canadian	7		\$8,600	\$13,000	\$18,000	
Full-Support Fellows						
Percentiles of Department Averages						
Department Type	# Depts	10th	25th	50th	75th	90th
US CS Public	64	\$14,463	\$18,936	\$22,143	\$25,200	\$30,900
US CS Private	33	\$21,896	\$23,625	\$25,685	\$30,000	\$32,000
US CE	5			\$25,000		
US Information	10			\$23,000		
Canadian	3			\$18,000		

Figure G2. Research Assistantship Stipends
CRA Taulbee Survey 2016

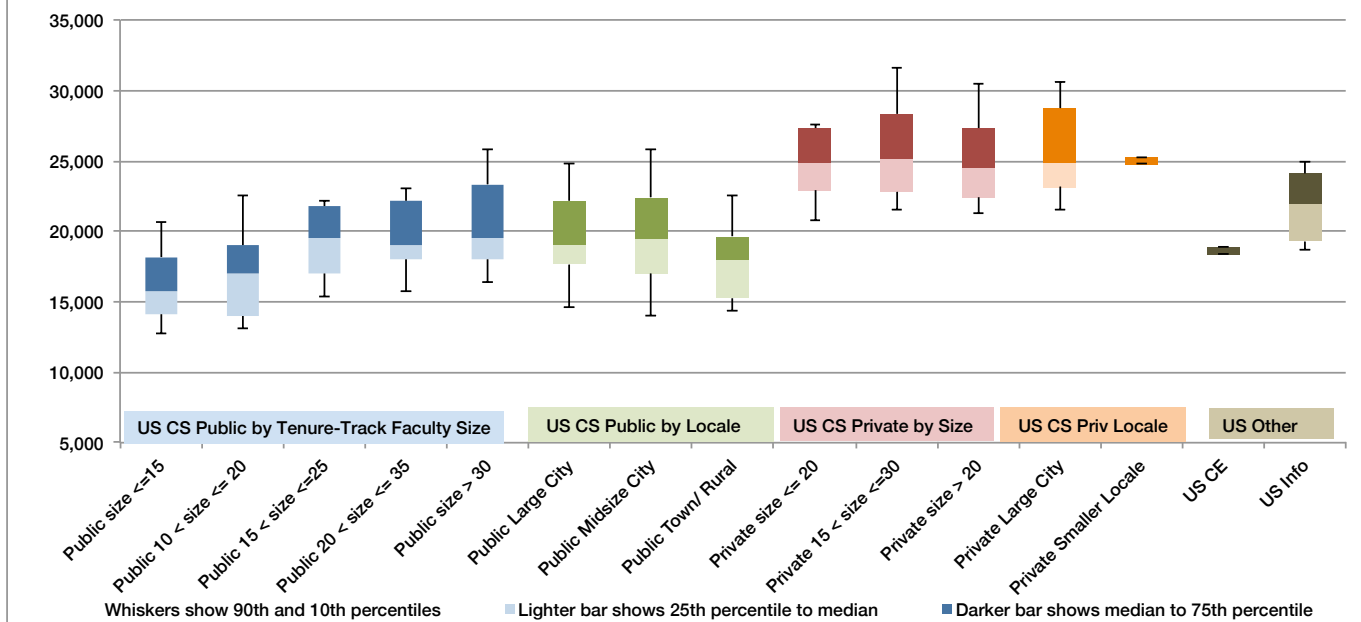
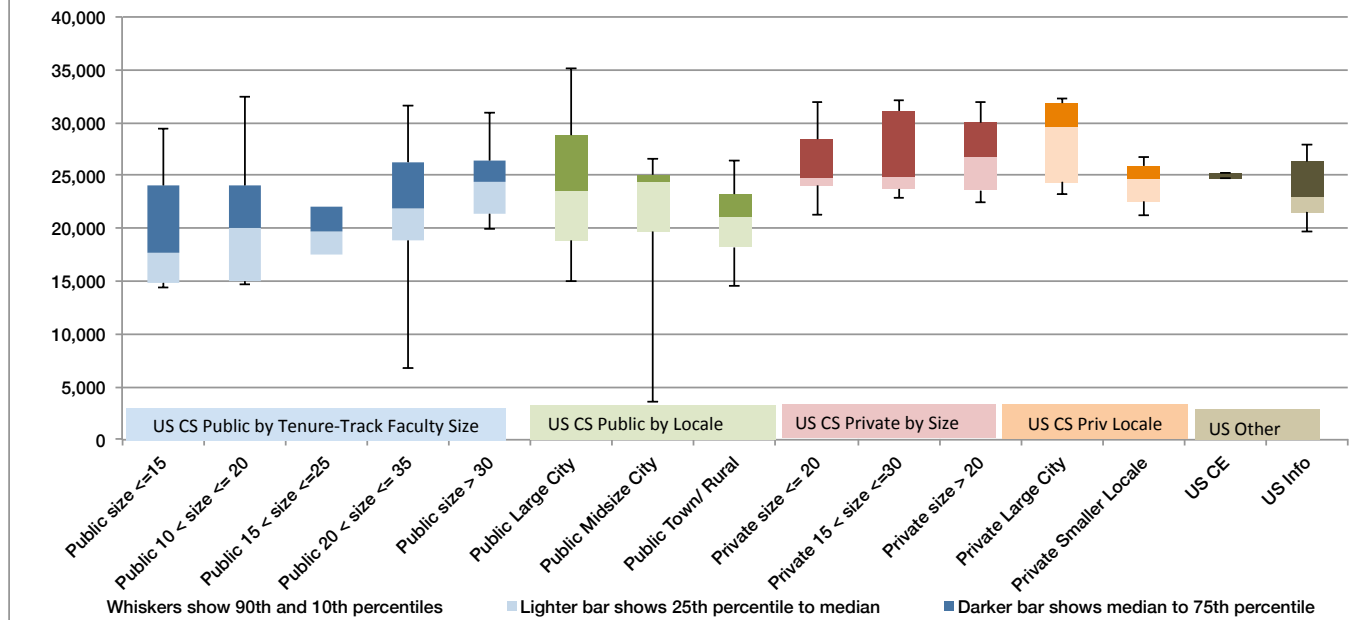


Figure G3. Full Support Fellows Stipends
CRA Taulbee Survey 2016



Faculty Salaries (Tables SI-S2I; Figures SI-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, 2017 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 SI-S16 and in the box and whiskers diagrams. Data for CE, I, Canadian, and new Ph.D.s are reported in Tables SI7-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). Therefore, it is not a true median of all of the salaries.

We also report salary data for senior faculty based on time in rank, for more 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 2016. Those departments that provided individual salaries were additionally provided more comprehensive distributional information based on these individual salaries. This year, 72 percent of those reporting salary data provided salaries at the individual level.

The remainder of this section summarizes the basic report provided in December 2016 to all departments that provided salary data. No additional salary data was received since the deadline for that report.

Table SI. Nine-month Salaries, 143 Responses of 191 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	111	119	118	142	111	125	139	136	100	48	51
Indiv	614	540	686	1,954	431	593	1,092	919	756	292	347
10	\$131,900	\$125,455	\$118,918	\$125,328	\$98,667	\$102,717	\$100,567	\$89,702	\$61,106	\$62,877	\$44,219
25	\$148,551	\$139,687	\$130,921	\$139,456	\$105,679	\$107,412	\$107,363	\$95,199	\$69,168	\$73,205	\$48,363
50	\$166,634	\$158,214	\$146,572	\$158,966	\$112,392	\$115,915	\$113,953	\$101,160	\$78,313	\$89,991	\$55,780
75	\$189,069	\$178,386	\$161,980	\$175,421	\$125,121	\$125,569	\$123,905	\$107,764	\$89,880	\$116,344	\$62,711
90	\$203,836	\$206,721	\$189,070	\$185,995	\$135,050	\$138,139	\$137,805	\$115,559	\$107,088	\$151,118	\$67,019

Table S2. Nine-month Salaries, 105 Responses of 138 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	83	90	93	105	86	95	102	100	71	31	36
Indiv	437	388	520	1,408	324	445	807	674	505	175	172
10	\$132,325	\$119,744	\$115,233	\$122,407	\$98,649	\$100,644	\$100,397	\$88,962	\$60,000	\$47,848	\$44,406
25	\$145,099	\$139,371	\$129,530	\$136,210	\$104,949	\$106,548	\$106,488	\$92,206	\$67,028	\$66,233	\$47,986
50	\$160,800	\$153,565	\$144,669	\$154,365	\$110,987	\$113,723	\$112,636	\$99,945	\$75,336	\$80,000	\$54,284
75	\$178,396	\$170,132	\$159,354	\$168,642	\$121,564	\$121,851	\$120,709	\$104,393	\$82,908	\$101,816	\$56,696
90	\$189,634	\$184,901	\$171,525	\$177,246	\$129,681	\$129,258	\$130,907	\$108,520	\$94,202	\$111,700	\$66,167

Salaries at private institutions tend to be higher than those at public institutions for all faculty types (Tables S2 and S3). This pattern is consistent with data from previous years.

When viewed relative to faculty size, salaries at each tenure-track rank tend to be higher for larger departments at both public (Tables S4-S8) and private (Tables S9-S11) institutions. This pattern is consistent with last year's pattern. Salaries for teaching faculty also exhibit this pattern at both public and private institutions.

When viewed relative to type of locale, public institution salaries appear to be generally lower in smaller locales

than in mid-size or large cities for all tenure-track faculty ranks (Tables S12-S14). Private institution salaries tend to be slightly higher in smaller locales, except for full professors in rank 8-15 years and associate professors in rank 8+ years (Tables S15-S16). In previous years, public institution salaries only were lower in smaller locales for more junior faculty, and private institution salaries exhibited no consistent pattern relative to type of locale. Teaching faculty salaries exhibit no pattern relative to locale size among public institutions, while among private institutions the salaries are higher at smaller locales.

Table S3. Nine-month Salaries, 38 Responses of 53 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	28	29	25	37	25	30	37	36	29	17	15
Indiv	177	152	166	546	107	148	285	245	251	117	175
10	\$140,348	\$132,222	\$130,646	\$134,527	\$105,047	\$106,167	\$105,734	\$97,411	\$77,412	\$74,750	\$47,884
25	\$163,840	\$155,025	\$140,413	\$155,665	\$108,722	\$115,195	\$112,533	\$101,516	\$81,275	\$105,653	\$55,877
50	\$194,698	\$184,379	\$160,156	\$181,700	\$125,459	\$127,200	\$122,441	\$111,083	\$90,680	\$127,872	\$61,191
75	\$212,205	\$221,082	\$189,332	\$198,985	\$131,250	\$138,424	\$137,667	\$120,920	\$103,883	\$153,198	\$65,062
90	\$236,181	\$232,099	\$212,918	\$216,827	\$139,455	\$146,162	\$143,908	\$124,530	\$114,123	\$181,250	\$66,865

Table S4. Nine-month Salaries, 28 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	15	19	23	28	23	21	26	26	13	2	2
Indiv	35	38	53	132	68	52	133	80	55		
10	\$107,945	\$115,104	\$111,783	\$115,066	\$95,414	\$95,019	\$94,369	\$85,105	\$54,678		
25	\$132,107	\$118,496	\$114,556	\$121,243	\$99,659	\$99,655	\$100,849	\$86,921	\$58,862		
50	\$143,802	\$140,489	\$130,515	\$135,100	\$107,808	\$105,434	\$106,725	\$91,969	\$68,986		
75	\$156,695	\$149,810	\$145,564	\$148,974	\$116,274	\$115,562	\$114,409	\$96,095	\$75,396		
90	\$164,102	\$167,213	\$161,619	\$159,988	\$130,803	\$121,282	\$125,428	\$98,585	\$81,459		

Our analysis of faculty salary changes from one year to the next uses only those departments that reported both years; otherwise, the departments that reported during only one year can skew the comparison. 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 report salary changes for all full professors and for all associate professors in the year-to-year comparison. Table S21 shows, by type of faculty and type of department,

the change in the median of the average salaries from departments that reported both years (the number of departments being compared is indicated in parentheses in each column heading). Using the cell showing full professors at U.S. CS departments as an example, the table indicates that the median of the 124 average salaries for full professors was 2.4 percent higher in 2016 than was the median of the average full professor salaries in 2015 from these same 124 departments.

Table S5. Nine-month Salaries, 35 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	23	28	28	35	32	31	35	34	18	3	4
Indiv	64	63	73	211	95	83	192	125	63		8
10	\$127,753	\$114,960	\$113,654	\$118,647	\$96,032	\$95,019	\$95,278	\$85,065	\$53,732		
25	\$132,661	\$122,591	\$117,900	\$126,413	\$98,872	\$99,974	\$101,083	\$88,400	\$59,147		
50	\$143,802	\$139,214	\$132,237	\$135,825	\$106,676	\$106,178	\$107,330	\$92,683	\$68,839		\$50,500
75	\$159,757	\$150,821	\$146,515	\$153,432	\$113,739	\$115,781	\$113,316	\$96,940	\$74,718		
90	\$186,681	\$178,092	\$163,208	\$167,728	\$127,183	\$122,965	\$123,920	\$99,867	\$80,559		

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	23	25	23	28	24	25	27	26	20	6	7
Indiv	82	74	88	253	79	90	173	117	83	28	11
10	\$129,476	\$116,252	\$120,260	\$126,038	\$97,314	\$99,737	\$95,854	\$90,083	\$58,502		
25	\$139,348	\$127,613	\$124,946	\$134,581	\$102,346	\$106,000	\$106,082	\$91,195	\$65,395		\$44,796
50	\$154,300	\$148,518	\$132,714	\$144,676	\$109,779	\$111,791	\$109,372	\$99,723	\$73,260	\$78,812	\$48,000
75	\$174,035	\$174,394	\$151,972	\$162,830	\$116,480	\$116,630	\$113,917	\$102,785	\$76,811		\$60,205
90	\$187,781	\$184,543	\$166,173	\$174,436	\$123,602	\$120,953	\$119,104	\$106,579	\$81,420		

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 a promotion causes an individual faculty member to 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, CE,

and I departments reporting, the values in those columns are considerably more volatile; this is evident in several of the entries in Table S21.

For new Ph.D.s in tenure-track positions at U.S. CS, CE, and I school departments (Table S20) the median of the averages was \$100,000, an increase of 1.5 percent vs. last year. This year there are not enough new tenure-track faculty salaries from Canadian institutions to report a salary distribution, so year-to-year comparisons cannot be made.

Table S7. Nine-month Salaries, 35 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	32	32	35	28	33	34	32	25	11	11
Indiv	150	125	166	458	102	135	257	184	153	28	31
10	\$136,081	\$129,506	\$120,991	\$134,849	\$101,406	\$102,881	\$103,702	\$90,873	\$61,077	\$37,923	\$44,592
25	\$148,475	\$144,715	\$128,230	\$142,271	\$106,845	\$110,083	\$109,267	\$95,832	\$65,678	\$52,854	\$46,472
50	\$159,609	\$155,150	\$142,664	\$154,279	\$111,734	\$113,562	\$112,421	\$102,729	\$72,723	\$77,623	\$50,000
75	\$178,879	\$170,115	\$158,481	\$170,252	\$118,539	\$118,567	\$118,461	\$106,751	\$77,418	\$91,566	\$66,167
90	\$188,836	\$176,840	\$169,517	\$178,803	\$124,561	\$123,079	\$123,257	\$108,300	\$90,426	\$105,293	\$70,000

Table S8. Nine-month Salaries, 39 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	36	37	37	39	31	39	39	39	33	19	25
Indiv	281	237	315	881	143	262	426	411	318	131	149
10	\$148,006	\$146,850	\$133,559	\$148,649	\$101,715	\$107,004	\$105,577	\$95,959	\$66,634	\$63,103	\$46,011
25	\$159,044	\$149,985	\$138,093	\$154,954	\$107,955	\$112,571	\$111,984	\$100,099	\$73,631	\$73,951	\$49,469
50	\$171,098	\$163,758	\$152,695	\$162,516	\$112,610	\$117,554	\$117,554	\$103,685	\$80,997	\$86,151	\$55,701
75	\$181,498	\$171,377	\$159,354	\$171,149	\$125,411	\$128,467	\$127,000	\$107,455	\$89,000	\$105,218	\$57,542
90	\$191,825	\$195,304	\$174,573	\$183,556	\$141,070	\$131,717	\$133,767	\$112,645	\$106,075	\$113,308	\$65,777

Table S9. Nine-month Salaries, 17 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 n		Teach	Research	Postdoc
Depts	11	11	7	16	11	13	16	15	11	6	5
Indiv	45	34	17	117	27	37	75	47	46	27	38
10	\$130,076	\$131,956		\$126,446	\$105,204	\$104,837	\$102,796	\$96,724	\$71,828		
25	\$152,371	\$134,310	\$131,596	\$145,786	\$107,776	\$114,942	\$110,002	\$101,372	\$78,851		
50	\$165,000	\$181,667	\$144,632	\$163,160	\$117,725	\$120,977	\$118,404	\$104,250	\$81,577	\$121,662	\$60,000
75	\$195,606	\$221,035	\$180,450	\$186,741	\$131,125	\$129,324	\$126,556	\$114,298	\$88,707		
90	\$203,230	\$239,873		\$202,146	\$136,639	\$139,517	\$138,940	\$124,007	\$90,680		

Table S10. Nine-month Salaries, 16 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	11	12	11	16	10	11	16	16	13	7	8
Indiv	53	57	54	194	26	28	62	88	61	23	76
10	\$179,850	\$155,466	\$133,190	\$146,491	\$104,711	\$115,954	\$110,311	\$99,559	\$74,041		
25	\$184,908	\$164,913	\$142,523	\$169,124	\$106,627	\$117,762	\$112,445	\$103,016	\$79,165	\$106,561	\$59,188
50	\$202,296	\$182,358	\$157,583	\$179,756	\$127,250	\$121,500	\$121,971	\$107,192	\$90,680	\$111,731	\$61,096
75	\$222,609	\$206,073	\$184,325	\$193,714	\$131,188	\$130,417	\$128,233	\$121,019	\$104,366	\$135,970	\$64,714
90	\$236,077	\$229,252	\$213,088	\$209,757	\$141,930	\$137,000	\$134,692	\$123,347	\$118,639		

Table S11. Nine-month Salaries, 21 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	17	18	18	21	14	17	21	21	18	11	10
Indiv	130	118	145	423	81	113	213	198	205	90	137
10	\$163,814	\$149,525	\$131,787	\$141,825	\$105,213	\$111,010	\$109,726	\$97,581	\$80,075	\$77,125	\$43,833
25	\$194,252	\$166,972	\$144,951	\$171,993	\$115,881	\$115,954	\$113,201	\$101,924	\$88,317	\$106,561	\$55,610
50	\$205,975	\$183,714	\$165,875	\$184,355	\$126,932	\$129,022	\$128,333	\$112,049	\$98,963	\$127,872	\$64,100
75	\$231,717	\$217,333	\$189,238	\$204,342	\$135,020	\$138,898	\$140,160	\$121,430	\$106,402	\$151,713	\$66,415
90	\$242,085	\$223,302	\$212,790	\$216,882	\$139,531	\$153,875	\$147,014	\$124,967	\$114,601	\$158,991	\$67,219

Table S12. Nine-month Salaries, 40 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	35	35	37	40	34	38	40	39	28	14	14
Indiv	190	154	211	570	133	193	345	268	207	80	92
10	\$137,002	\$139,397	\$118,935	\$139,095	\$99,050	\$105,424	\$103,900	\$90,810	\$63,727	\$44,935	\$42,617
25	\$150,868	\$147,765	\$132,848	\$144,264	\$105,655	\$110,151	\$109,049	\$96,149	\$68,586	\$67,219	\$45,105
50	\$166,634	\$158,214	\$144,669	\$158,946	\$110,938	\$115,401	\$114,219	\$102,129	\$76,851	\$93,259	\$52,775
75	\$176,104	\$169,793	\$158,403	\$168,492	\$123,626	\$119,880	\$122,079	\$105,679	\$86,381	\$104,570	\$56,363
90	\$185,844	\$178,023	\$167,555	\$177,580	\$131,192	\$127,018	\$126,734	\$109,220	\$107,635	\$116,229	\$62,424

Table S13. Nine-month Salaries, 25 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	21	22	20	25	19	23	25	22	17	6	6
Indiv	131	107	141	386	74	108	185	161	114	28	22
10	\$130,718	\$114,804	\$128,662	\$124,676	\$98,282	\$102,867	\$99,356	\$91,115	\$54,156		
25	\$151,589	\$134,292	\$141,607	\$137,203	\$107,459	\$110,962	\$107,602	\$93,723	\$65,678		
50	\$164,895	\$153,965	\$150,787	\$156,874	\$111,647	\$116,000	\$113,110	\$100,457	\$72,019	\$79,373	\$55,976
75	\$185,093	\$167,430	\$162,338	\$171,912	\$117,500	\$128,467	\$122,896	\$106,251	\$80,997		
90	\$194,109	\$189,213	\$184,508	\$180,681	\$127,704	\$137,771	\$135,876	\$112,097	\$87,923		

Table S14. Nine-month Salaries, 40 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	27	33	36	40	33	34	37	39	26	11	16
Indiv	116	127	168	452	117	144	277	245	184	67	58
10	\$129,432	\$118,295	\$114,135	\$118,241	\$98,712	\$98,437	\$100,009	\$86,255	\$59,540	\$63,554	\$47,421
25	\$140,126	\$125,894	\$122,358	\$130,187	\$102,010	\$102,698	\$102,409	\$89,702	\$66,994	\$66,233	\$49,102
50	\$156,254	\$146,876	\$135,587	\$142,810	\$110,656	\$110,633	\$111,183	\$95,230	\$74,645	\$77,391	\$54,000
75	\$175,632	\$171,377	\$158,157	\$161,808	\$117,736	\$120,609	\$118,203	\$100,695	\$83,344	\$84,026	\$58,829
90	\$187,024	\$186,978	\$170,319	\$173,208	\$126,356	\$124,644	\$127,813	\$106,974	\$90,546	\$88,375	\$65,389

Table S15. Nine-month Salaries, 26 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	20	20	19	26	18	21	25	25	22	13	10
Indiv	111	108	129	387	96	116	233	187	225	103	113
10	\$129,922	\$132,161	\$130,496	\$134,129	\$105,572	\$106,357	\$105,344	\$97,376	\$73,479	\$72,950	\$43,833
25	\$160,267	\$146,673	\$136,336	\$156,392	\$109,265	\$113,409	\$112,842	\$101,924	\$79,693	\$105,653	\$54,063
50	\$194,698	\$187,517	\$157,583	\$175,606	\$126,842	\$126,200	\$122,441	\$110,764	\$90,047	\$127,872	\$58,377
75	\$207,425	\$213,272	\$189,145	\$198,453	\$130,950	\$139,507	\$138,360	\$121,430	\$100,660	\$158,991	\$61,517
90	\$236,112	\$224,526	\$213,506	\$216,836	\$136,444	\$152,340	\$144,944	\$124,617	\$106,809	\$190,671	\$64,351

Table S16. Nine-month Salaries, 12 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	6	11	7	9	12	11	7	4	5
Indiv	66	44	37	159	11	32	52	58	26	14	62
10				\$141,825			\$107,808	\$99,258			
25	\$187,258	\$167,667		\$159,693	\$111,465	\$118,615	\$112,445	\$101,082	\$86,154		
50	\$196,084	\$184,379	\$173,304	\$183,369	\$123,700	\$128,200	\$121,158	\$112,049	\$102,999	\$126,040	\$65,757
75	\$218,054	\$221,082		\$198,987	\$142,735	\$137,000	\$135,802	\$115,835	\$116,587		
90				\$214,206			\$139,911	\$122,813			

Table S17. Nine-month Salaries, 8 Responses of 34 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	5	6	6	8	5	6	8	7	6	2	2
Indiv	26	11	30	78	10	32	48	25	18		
10											
25				\$144,269			\$106,939	\$92,074			
50	\$185,000	\$141,825	\$131,063	\$161,993	\$116,265	\$111,059	\$116,876	\$101,000	\$81,421		
75				\$177,519			\$119,843	\$102,689			
90											

Table S18. Nine-month Salaries, 15 Responses of 20 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	12	14	13	15	12	15	15	15	12	10	7
Indiv	33	47	75	155	55	93	148	135	145	51	38
10	\$130,728	\$136,037	\$128,743	\$137,719	\$92,208	\$95,549	\$93,689	\$83,558	\$54,977	\$66,535	
25	\$139,639	\$155,332	\$135,829	\$147,118	\$108,244	\$98,574	\$103,962	\$89,274	\$80,413	\$67,436	\$47,950
50	\$165,568	\$173,153	\$143,305	\$161,167	\$111,863	\$113,780	\$115,067	\$98,250	\$91,306	\$75,758	\$59,333
75	\$180,172	\$191,903	\$157,438	\$168,134	\$120,296	\$125,344	\$123,013	\$104,765	\$100,051	\$93,390	\$61,722
90	\$191,591	\$211,035	\$174,234	\$183,408	\$135,124	\$137,964	\$137,341	\$110,323	\$118,636	\$99,487	

Table S19. Twelve-month Salaries, 9 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	9	9	9	9	9	8	9	9	7	3	5
Indiv	53	56	62	171	62	31	93	45	65		53
10											
25	\$166,443	\$158,430	\$141,655	\$153,031	\$136,771	\$121,156	\$134,026	\$102,328	\$104,106		
50	\$203,564	\$179,768	\$161,422	\$175,912	\$146,088	\$136,177	\$145,177	\$112,798	\$124,968		\$54,588
75	\$214,459	\$190,308	\$175,405	\$190,211	\$157,144	\$152,681	\$155,631	\$125,414	\$131,249		
90											

Table S20. Nine-month Salaries for New PhDs (Twelve-month for Canadian)

	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	72	27	9	25	2	0	0	3
Indiv	131	52	17	89	2			5
10	\$88,000	\$58,100	\$33,733	\$54,500				
25	\$91,000	\$62,750	\$33,733	\$59,108				
50	\$100,000	\$75,528	\$65,040	\$63,333				
75	\$105,600	\$82,357	\$88,000	\$67,714				
90	\$110,000	\$84,809	\$90,300	\$69,017				

Table S21. Change in Salary Median for Departments that Reported in Both 2015 and 2016

	U.S. CS	U.S. CE	U.S. I	Canadian
Departments	124	6	10	9
Full Profs	2.4%	7.2%	1.8%	0.2%
Assoc. Profs.	2.8%	4.2%	-0.3%	1.5%
Asst. Profs.	2.6%	3.6%	2.5%	-2.5%
Non-ten-track teaching faculty	4.0%	-1.4%	3.8%	12.5%
Research faculty	0.3%	0.0%	-14.2%	-36.3%
Post doctorates	4.4%		4.6%	5.2%

**Figure S1. US CS Department Average Salary, Full Professor in Rank 16+ Years
CRA Taulbee Survey 2016**

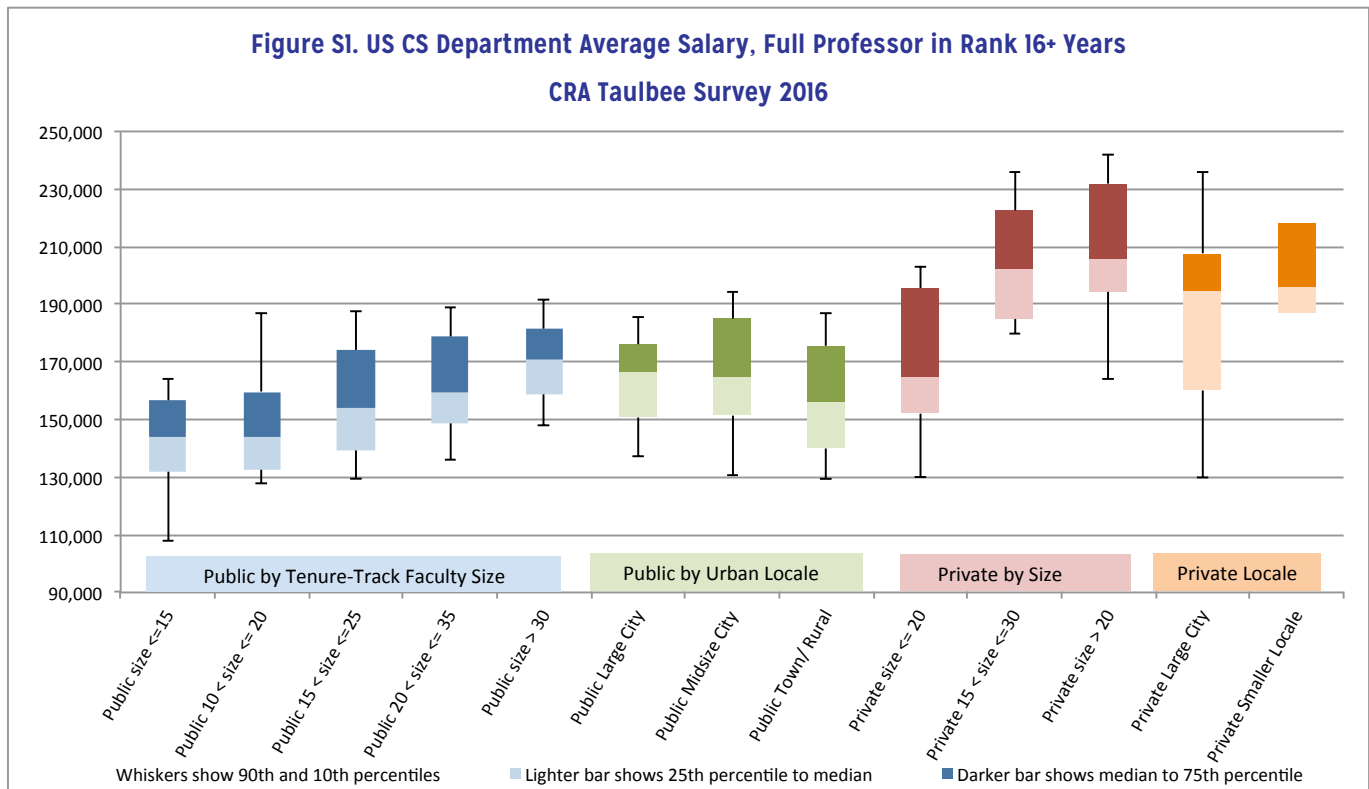


Figure S2. US CS Department Average Salary, Full Professor in Rank 8-15 Years

CRA Taulbee Survey 2016

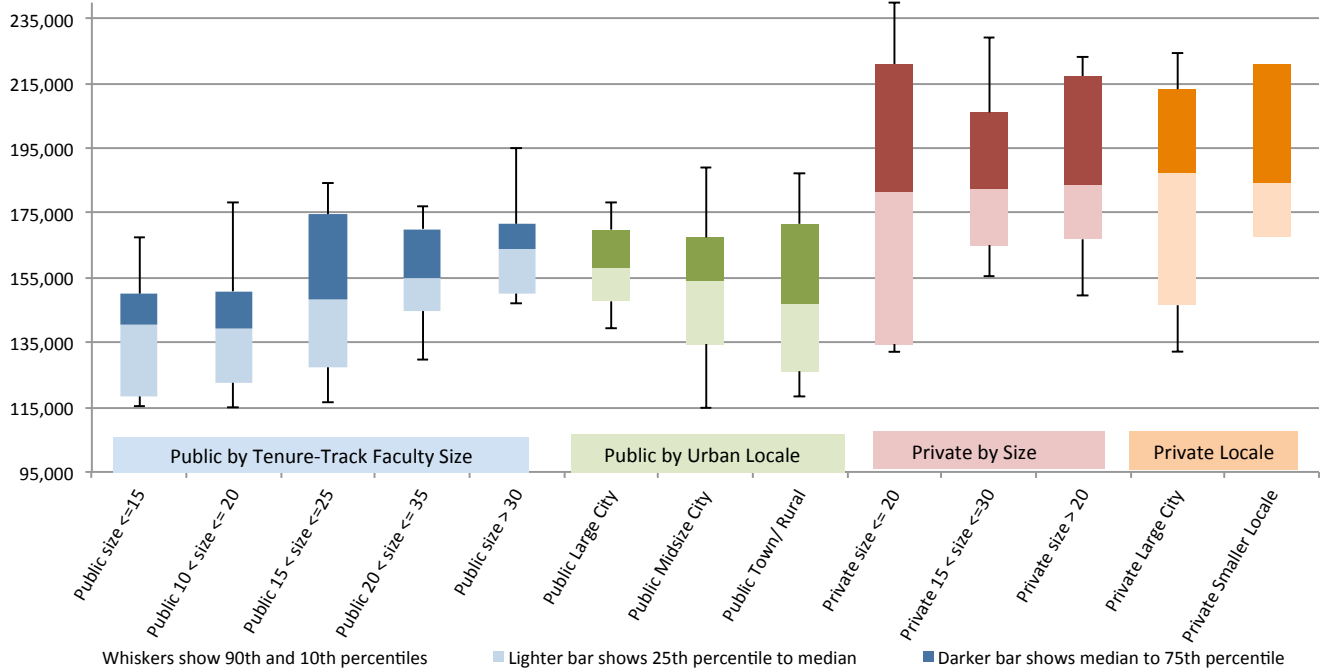


Figure S3. US CS Department Average Salary, Full Professor in Rank 0-7 Years

CRA Taulbee Survey 2016

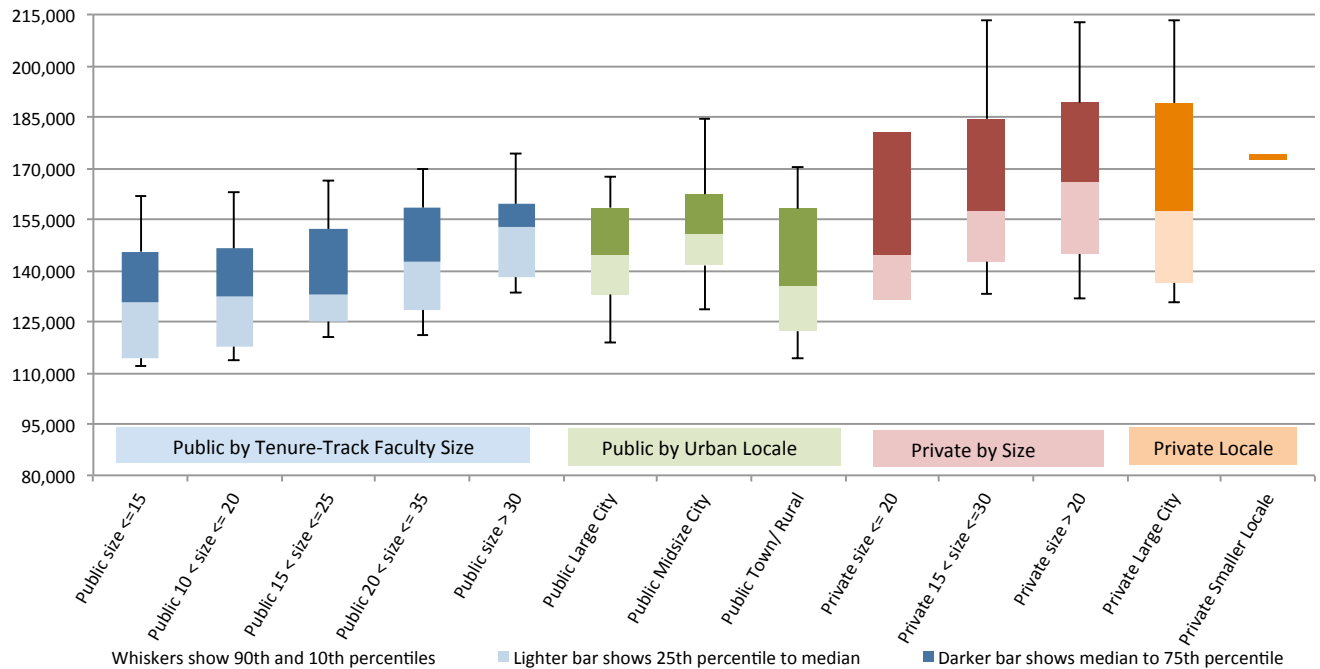


Figure S4. US CS Department Average Salary, Associate Professor in Rank 8+ Years
CRA Taulbee Survey 2016

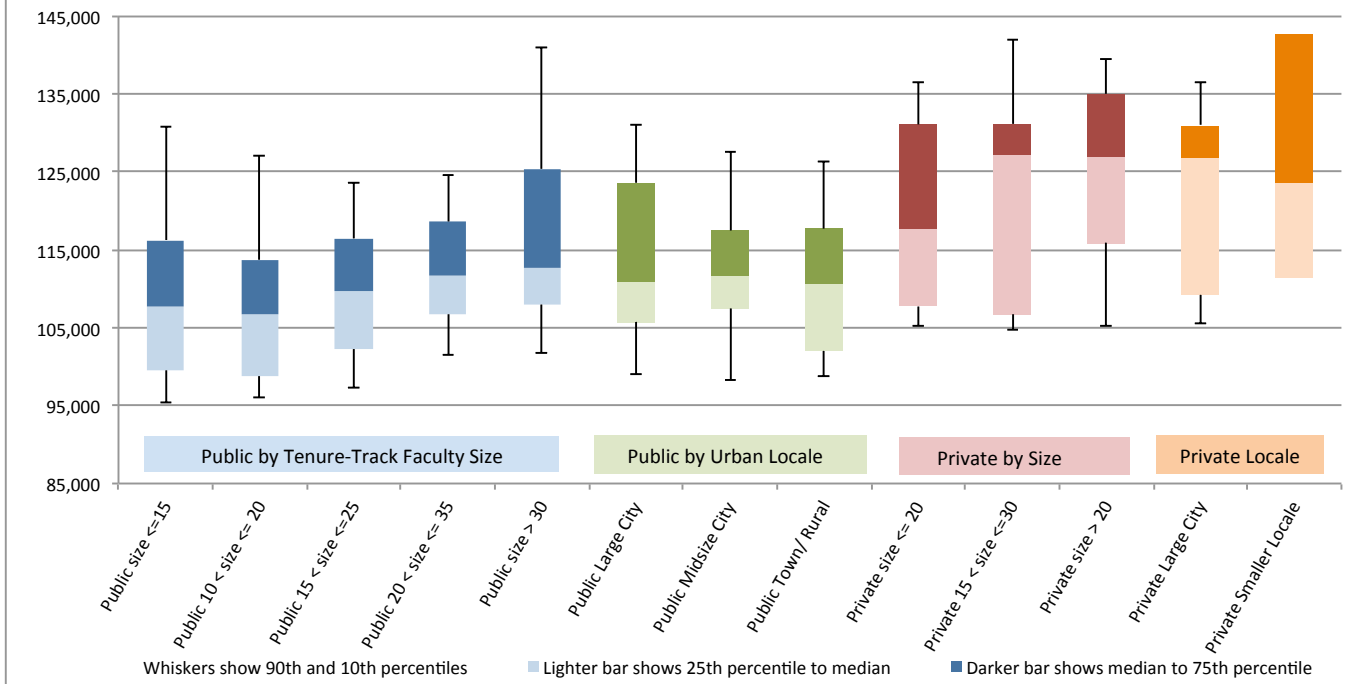


Figure S5. US CS Department Average Salary, Associate Professor in Rank 0-7 Years
CRA Taulbee Survey 2016

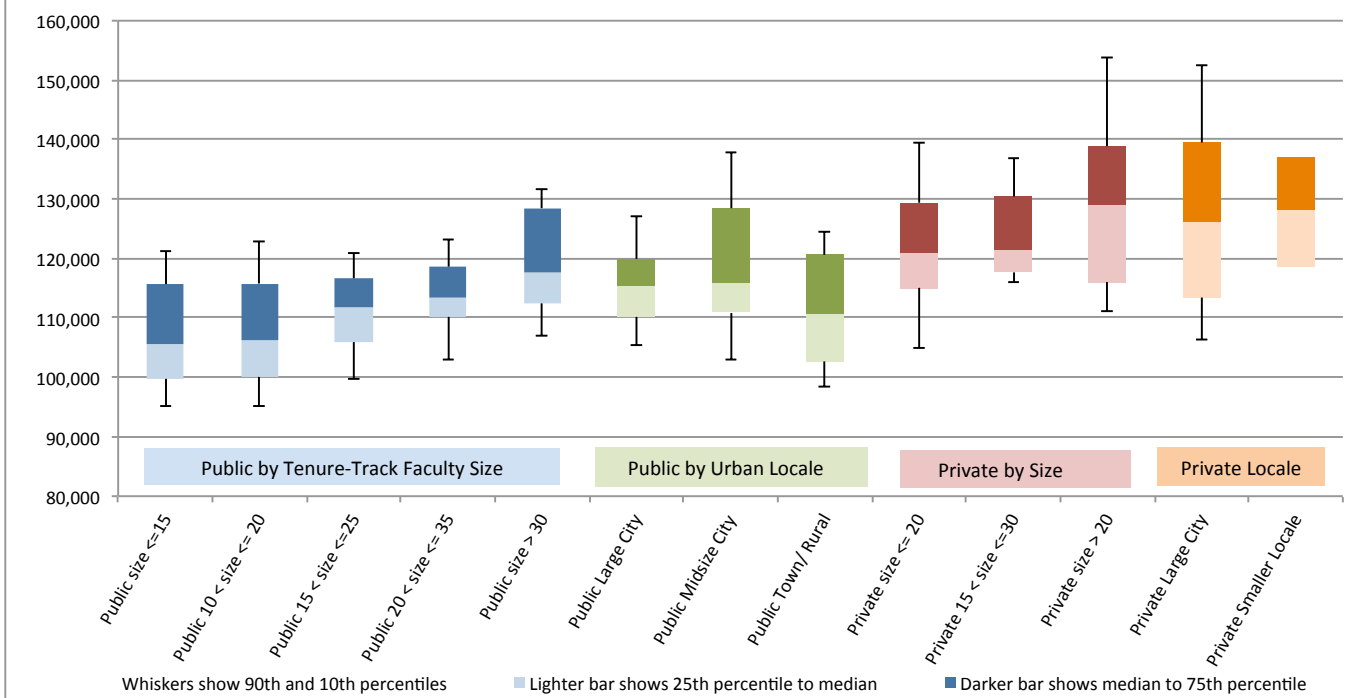


Figure S6. US CS Department Average Salary, Assistant Professor
CRA Taulbee Survey 2016

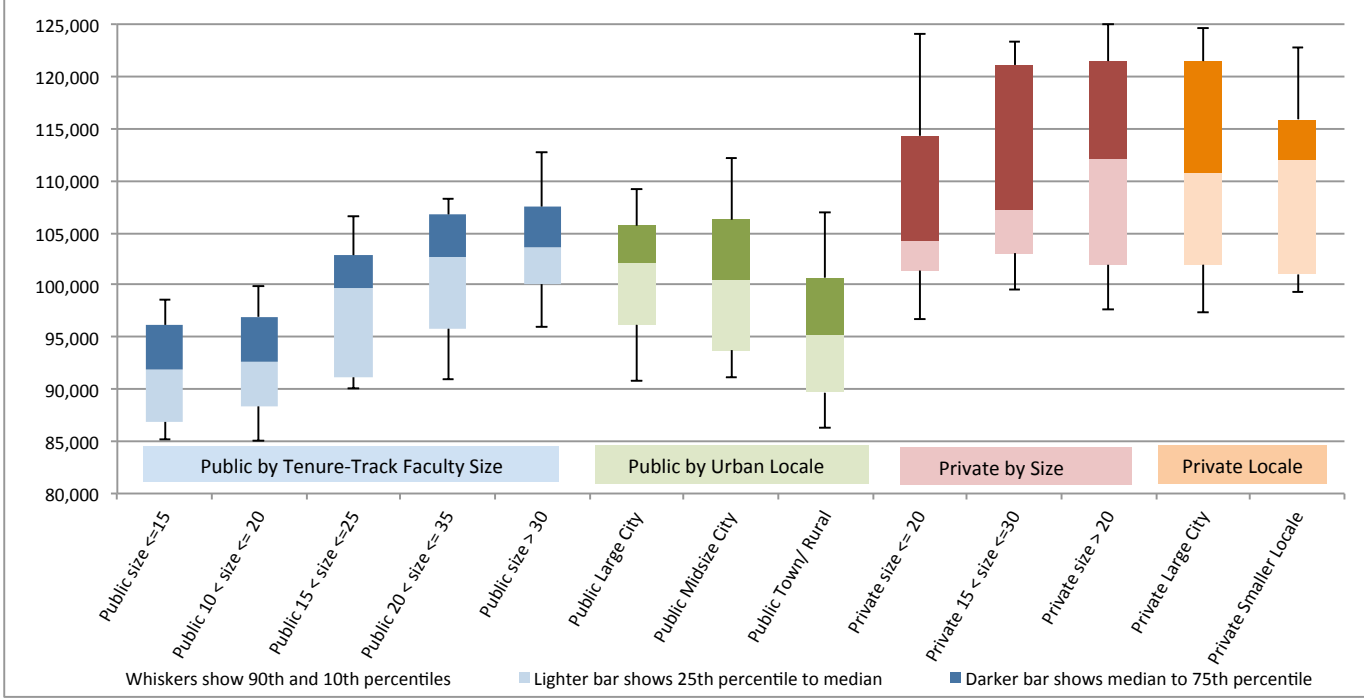


Figure S7. US CS Department Average Salary, Non-Tenure Track Teaching Faculty
CRA Taulbee Survey 2016

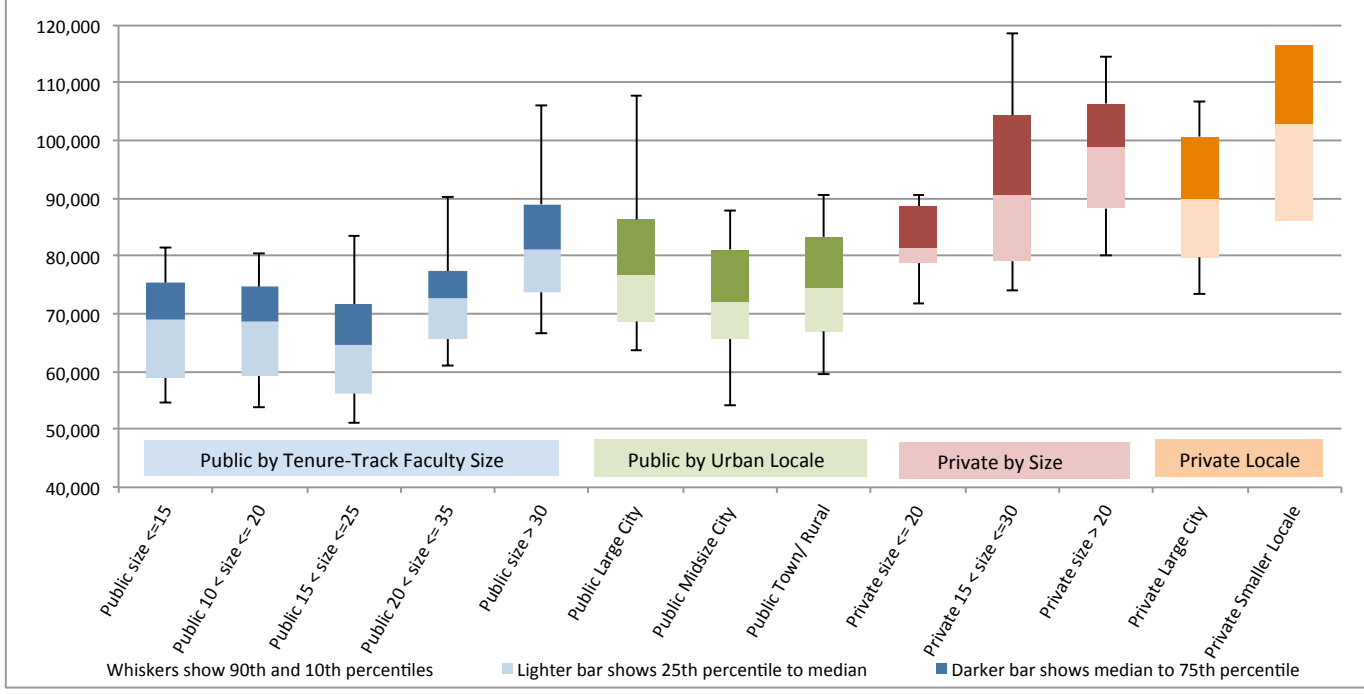


Figure S8. US CS Department Average Salary, Non-Tenure Track Research Faculty
CRA Taulbee Survey 2016

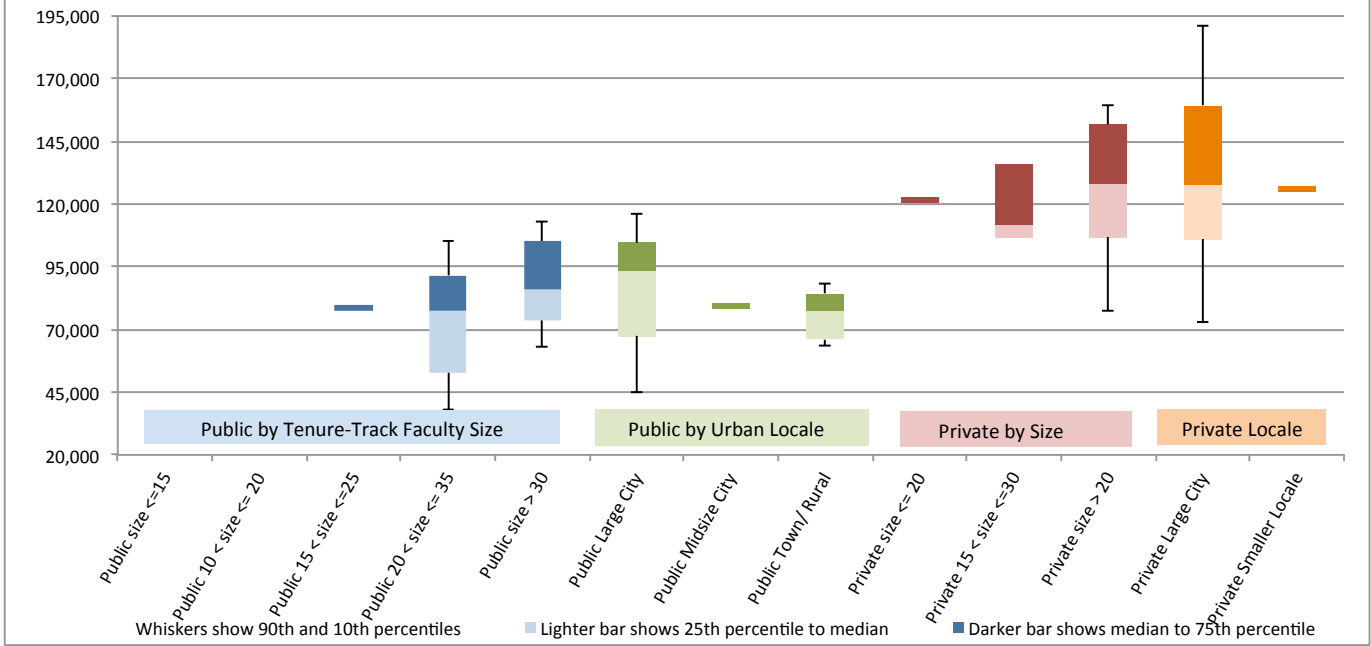
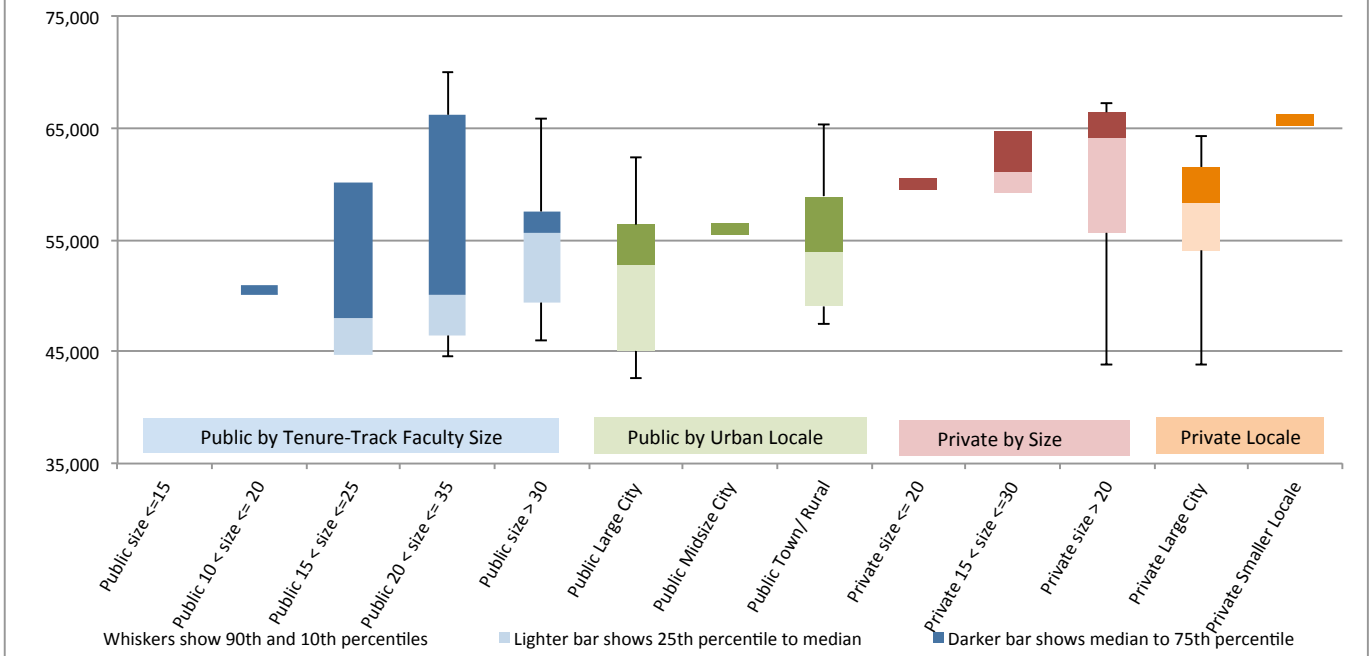


Figure S9. US CS Department Average Salary, Postdoctorates
CRA Taulbee Survey 2016



Concluding Observations

The undergraduate enrollment surge continues in U.S. doctoral-granting computer science programs. At the same time, master's and doctoral production rose and the number of new students in the departments' graduate programs rose. Increases in tenure-track and teaching faculty are not keeping pace with the increases in students, and there was a sharp increase this year in the number of faculty moving from academic to non-academic positions. Departments and their administrations need to find sustainable solutions to both the student surge and the workload pressures being placed on their faculty.

Participating CS, CE, I and Canadian Departments

U.S. CS Public (III): Arizona State, Auburn, Binghamton, Clemson, College of William & Mary, Colorado School of Mines, Colorado State, Florida International, George Mason, Georgia Tech, Georgia State, Indiana, Iowa State, Kansas State, Kent State, Michigan State, Michigan Technological University, Mississippi State, 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, Southern Illinois (Carbondale), Stony Brook (SUNY), Texas A&M, Texas Tech, Universities at Albany and Buffalo, 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, Illinois (Chicago and Urbana-Champaign), Iowa, Kansas, Kentucky, Louisiana at Lafayette, Maryland (College Park and Baltimore County), Massachusetts (Amherst, Boston, and Lowell), Memphis, Michigan, Minnesota,

Mississippi, Missouri (Columbia), Nebraska (Omaha and Lincoln), Nevada (Las Vegas and Reno), New Hampshire, New Mexico, North Carolina (Chapel Hill and Charlotte), North Texas, Oklahoma, Oregon, Pittsburgh, Rhode Island, South Carolina, South Florida, Southern Mississippi, Tennessee (Knoxville), Texas (Arlington, Austin, Dallas, and El Paso), Utah, Vermont, Virginia, Washington, Wisconsin (Madison and Milwaukee), Wyoming, Virginia Commonwealth, Virginia Tech, Washington State, Wayne State, Western Michigan, and Wright State.

U.S. CS Private (39): Boston University, Brandeis, Brown, Carnegie Mellon, Case Western Reserve, Clarkson, Columbia, Cornell, DePaul, Drexel, Duke, Emory, Florida Institute of Technology, George Washington, Georgetown, Harvard, Illinois Institute of Technology, Johns Hopkins, Lehigh, MIT, New York University, Northeastern, Northwestern, Polytechnic, Princeton, Rensselaer, Rice, Rochester Institute of Technology, Stanford, Stevens Institute of Technology, Toyota Technological Institute at Chicago, Tufts, Universities of: Chicago, Notre Dame, Pennsylvania, Rochester, Southern California, and Tulsa, Washington in St. Louis, Worcester Polytechnic Institute, and Yale.

U.S. CE (8): Iowa State, North Carolina State, Northeastern, Universities of: California (Santa Cruz), Central Florida, Illinois (Urbana-Champaign), New Mexico, and Southern California.

U.S. Information (14): Cornell, Drexel, Indiana, Penn State, Syracuse, Universities of: California (Berkeley), Illinois (Urbana-Champaign), Maryland (College Park CLIS and Baltimore County), Michigan, North Carolina (Chapel Hill), Pittsburgh, Texas (Austin), and Washington.

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

¹ The title of the survey honors 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 \geq 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.