Chapter 3

Mathematical Sciences Bachelors Degrees and Enrollments in Four-Year Colleges and Universities

Mathematics and statistics departments in the nation's four-year colleges and universities offer a wide spectrum of undergraduate mathematical sciences courses and majors, sometimes including mathematics education, actuarial science, operations research, and computer science, as well as mathematics and statistics. This chapter's eleven tables describe:

- the number of bachelors degrees awarded through the nation's mathematics and statistics departments (Table E.1.A-E.1.D),
- enrollments in mathematical sciences courses and the numbers of mathematical sciences course sections (Tables E.2-E.3)
- distance learning enrollments (Table E.4)
- the appointment type of instructors who teach undergraduate courses in mathematics and statistics departments (Table E.5-E.9), and
- average sizes of sections of categories of courses taught in mathematics and statistics departments, and average sizes of recitation sections used in lecture/recitation classes for calculus and introductory statistics courses (Tables E.10-E.11).

These tables are broken down by the level of department based on the highest degree offered. The tables in this chapter expand upon Tables S.1-S.8 from Chapter 1, while Chapter 5 provides additional detail about enrollments in first-year courses in mathematics and statistics. The enrollments in each course listed on the four-year mathematics and statistics questionnaires (both with, and without, distance learning enrollments) are given in Appendix I; in making comparisons to previous CBMS surveys, one should note that the Appendix enrollments in CBMS reports prior to 2010 include distance learning enrollments. Enrollment data from two-year colleges appear in Chapter 6.

In the text that follows, the standard error (SE) in many of the estimates is provided along with the estimate (e.g. enrollment of 255,000 (SE 23,000)); the standard errors for all CBMS2015 tables can be found in Appendix VIII. The change in an estimate from an estimate in a previous survey is often expressed both as percentage change, and as the number of SEs that change represents (e.g. "increased 21% (1.7 SEs)").

Highlights:

A. Number of bachelors degrees awarded

- The estimated total number of mathematical sciences bachelors degrees granted through four-year mathematics and statistics departments in the 2014-15 academic year was 26,234, up from 21,377 in 2009-10 (a 23% increase (1.9 SEs) over 2009-10), This estimate reverses a declining trend in estimated bachelors degrees awarded observed over the CBMS surveys from 1985-2010; the CBMS 1985 estimate was 27,928. See Table S.3 in Chapter 1.
- There was a 19% (1.5 SEs) increase in the estimated number of bachelors degrees awarded by mathematics departments from 2009-10 to 2014-15, and the estimated number of degrees awarded by statistics departments more than doubled in that time period. See Tables E.1.A. and E.1.B.
- In the 2014-15 academic year, all levels of mathematics departments combined awarded more bachelors degrees in mathematics, statistics, actuarial mathematics, other, and computer science, but fewer degrees in mathematics education than in 2009-10. See Table E.1.A and Table S.3 in Chapter 1.
- In the 2014-15 academic year, the estimated total number of bachelors degrees in the mathematical sciences awarded by each level of mathematics department increased. The bachelors-level departments awarded the greatest estimated number of bachelors degrees in the mathematical sciences, but when computer science degrees are removed, the doctoral-level departments awarded the greatest estimated number of bachelors degrees in the mathematical sciences. Doctoral-level statistics departments awarded an estimated 92% of the degrees awarded by statistics departments. See Tables E.1.A and E.1.B.
- The estimated percentage of bachelors degrees in the mathematical sciences awarded to women by mathematics and statistics departments combined in the 2014-15 academic year was 42% (compared

with 43% in both 2009-10 and 1999-2000); in 2014-15 this percentage was 43% in statistics departments and 42% in mathematics departments (in 2009-10 these estimated percentages were 40% and 43% for statistics and mathematics departments, respectively). See Table S.3 in Chapter 1 and Tables E.1.A and E.1.B.

B. Enrollments and number of sections

- Estimated total fall 2015 enrollments (including distance learning enrollments) in mathematics departments were up 12% (1.8 SE) over fall 2010, and up 41% over fall 2005; in statistics departments, the estimated total enrollments were up 32% (9 SEs) over fall 2010, and up 80% over fall 2005. Increases in estimated enrollments occurred at almost all levels of departments and category of courses, except computer science enrollments in mathematics departments (which were up 35% from fall 2005 to fall 2010, but down in 2015) and enrollments in masters-level statistics departments (where estimated enrollments in 2015 were almost half of estimated enrollments in 2010). Estimated enrollments in statistics courses in mathematics departments were up 19% (2.1 SEs) over fall 2010 and up 72% (5.5 SEs) over fall 2005. See Table E.2.
- Most of the growth in estimated enrollments in mathematics departments was due to growth in enrollments in doctoral-level mathematics departments, which were up 28% (2.4 SEs). See Table E.2 and Figure E.2.3.
- The largest increase in estimated enrollments in mathematics courses was at the lower levels of mathematics courses, as enrollments in pre-college-level mathematics were up 21% (1.7 SEs), and in introductory-level mathematics courses estimated enrollments were up 16% (1.7 SEs) in fall 2015 over fall 2010. See Table E.2.
- Estimated statistics enrollments made gains from fall 2010 to fall 2015, in both mathematics and statistics departments, particularly at the upper-level. as enrollments in upper-level statistics courses taught in mathematics and statistics departments combined were up 83%; estimated enrollments in upper-level statistics courses in doctoral-level statistics departments in fall 2015 were three times the estimated enrollments in fall 2010. Introductory statistics course enrollments showed slower growth from 2010 to 2015. See Table E.2.
- Estimated enrollments in calculus-level courses (which include courses in linear algebra, differential equations, and discrete mathematics, as well as calculus courses of various kinds) rose only 8% (0.95 SEs) in 2015 over 2010, but grew by 37% (3.5 SEs) in 2015 over 2005. See Table E.2.
- From fall 2010 to fall 2015, the estimated total number of course sections offered in mathematics departments grew by 11% (1.2 SEs). The number of sections of upper-level statistics courses in mathematics departments more than doubled from 2010 to 2015, and, at masters-level mathematics departments, more than tripled. In doctoral-level statistics departments the estimated number of sections of upper-level statistics courses increased by 73% (9.3 SEs) from 2010 to 2015. See Table E.3.

C. Distance learning enrollments

- Estimated enrollments in distance learning courses were up in 2015 over 2010 for most course categories reported in 2010, in four-year mathematics departments, with the estimated total distance learning enrollments in all course categories combined in fall 2015 more than double the estimate for fall 2010. In fall 2015, in mathematics departments of four-year departments, distance learning enrollments represented 3% of precollege level enrollments, 5% of College Algebra, Trigonometry and Pre-Calculus (combined) enrollments, 3% of both Calculus I and of Calculus II enrollments, and 8% of Introductory Statistics enrollments; all of these percentages, except for precollege level, are increases over 2010. In statistics departments, an estimated 5% of the introductory statistics enrollment was taught in distance learning format in both 2010 and 2015. See Table E.4

D. Appointment type of section instructor

- Over all levels of mathematics departments combined, there was a 48% (2.9 SEs) increase in the estimated number of sections of calculus-level courses taught by other full-time (OFT) faculty, and a 15% (2.6 SEs) decrease in the estimated number of sections taught by tenured or tenure-eligible (TTE) faculty. The trend of decreasing estimated number of sections taught by TTE faculty and increasing number of sections taught by OFT faculty held for each level of mathematics department. See Table E.5.
- Over all levels of mathematics departments combined, in fall 2015, an estimated 41% of the introductory-level statistics sections were taught by TTE faculty, 21% were taught by OFT faculty, 25% were taught by part-time (PT) faculty, and 4% were taught by graduate teaching assistants (GTAs); in all levels of statistics departments combined, an estimated 14% of the introductory statistics sections were taught by TTE faculty, 25% taught by OFT faculty, 10% taught by PT faculty, and 31% taught by GTAs. See Table E.6.
- The estimated percentage of sections of lower-level computer science courses in mathematics departments taught by PT instructors declined from

2010 to 2015, but the percentage of sections of middle-level computer science course taught by PT instructors increased. See Tables E.7 and E.8.

- In bachelors-level and in doctoral-level departments, the estimated percentage of sections of advanced-level mathematics courses taught by TTE faculty declined from 2010 to 2015. See Table E.9.

E. Average section size

- Over both levels of statistics departments combined, estimated average section size of statistics courses increased significantly. In introductory statistics classes, the estimated average section size rose from 45 in fall 2010 to 60 (with SE 2.4) in 2015, and in upper-level statistics course sections, the estimated average section size grew from 30 in fall 2010 to 52 (with SE 2.0) in fall 2015. See Table E.10.
- The estimated average recitation section size in Non-Mainstream Calculus I at doctoral-level departments increased, from 30 in fall 2010, to 36 (SE 1.7) in fall 2015. See Table E.11.

Terminology: The two preceding CBMS survey reports are called CBMS2005 and CBMS2010.

In the CBMS 2015 survey, the term "mathematics department" includes departments of mathematics, applied mathematics, mathematical sciences, and departments of mathematics and statistics. The term "statistics department" refers to departments of statistics that offer undergraduate statistics courses. The term "mathematical sciences courses" covers all courses that are taught in mathematics or statistics departments in the United States; it includes courses in mathematics education, actuarial sciences, and operations research taught in a mathematics or statistics department, as well as courses in mathematics, applied mathematics, and statistics. Computer science courses (and majors) are included in CBMS2015 totals when the courses (and majors) are taught (granted through) a mathematics department (previous CBMS surveys gathered data on computer science courses/majors offered through statistics departments, but this data were not collected beginning in 2010). CBMS2015 data do not include any courses or majors that are taught in, or granted through, separate departments of computer science, actuarial science, operations research, etc. Departments are classified by the highest degree offered. For example, the term "bachelors-level department" refers to one that does not offer masters or doctoral degrees.

Tables E.1.A and E.1.B: Bachelors degrees granted between July 1, 2014 and June 30, 2015

Total numbers of degrees awarded by mathematics and statistics departments

The CBMS 2015 survey (Table S.3 of Chapter 1) estimated that the total number of mathematical sciences bachelors degrees granted through the nation's four-year mathematics and statistics departments in the 2014-15 academic year was 26,234, up from 21,377 in 2009-10 (a 23% (1.9 SEs) increase over 2009-10), and up from the estimate of 21,437 in 2004-5. The six previous CBMS surveys (see Table S.3 in Chapter 1 for the estimates from the surveys of 1995, 2000, 2005, and 2010, and Table SE.4 in CBMS2000, p. 14, for the estimates from the surveys of 1985 and 1990) reported a declining trend in the total number of bachelors degrees awarded by the nation's mathematics and statistics departments in the preceding academic year, and, over the 25 years, 1985-2010, the estimated number of bachelors degrees awarded decreased by 31%. The 2015 estimate, while higher than any of the estimates in the last five CBMS surveys, is below the 1985 estimate of 27,928 (which included an estimated 8,691 degrees in computer science awarded by mathematical sciences departments), and, if the apparent increase is not due to statistical error, it indicates a reversal in the trend of decline in the number of bachelors degrees awarded the previous academic year, perhaps fueled by increases in estimated enrollments observed in the CBMS surveys of 2010 and 2015. When computer science degrees were removed from the count, the estimated number of degrees awarded by mathematics and statistics departments appeared relatively constant in past CBMS surveys: 19,237 in 1984-1985 (the first year computer science degrees were tabulated), 19,380 degrees in 1989-1990 and 19,241 degrees in 2009-10 (see Table S.3 and Table SE.4 in CBMS2000). However, first, the number of computer science degrees awarded by mathematics departments over the preceding academic year, 2014-2015, is the largest number recorded in the last five CBMS surveys (see Table S.1), and, second, when we remove the estimated 3,968 computer science degrees from the estimated CBMS2015 total number of bachelors degrees awarded, the estimated total is 22,266, seemingly an increase over the past surveys.

Table E.1.A presents the estimated number of bachelors degrees awarded by mathematics departments from July 1, 2014-June 30, 2015, broken down by the level of the department, and the type of degree awarded (the subcategories of degrees are: mathematics (including applied mathematics), mathematics education, statistics, actuarial science, computer science, joint majors, and other degrees).

TABLE E.1.A Bachelors degrees in mathematics, mathematics education, statistics, and computer science in mathematics departments awarded between July 1, 2014 and June 30, 2015, by gender of degree recipient and type of department. This table can be compared to Table E.1 in CBMS2010, p. 78.

	Mathematics Departments			
Bachelors degrees in Math Depts	Univ (PhD)	Univ (MA)	Coll (BA)	Total Math Depts
Mathematics Majors (including applied)				
Men	3431	1436	2529	7396
Women	1645	1365	2388	5398
Percentage of women	*32%*	*49%*	*49%*	*42%*
Total Math degrees	5076	2801	4917	12794
Mathematics Education Majors				
Men	235	412	497	1143
Women	401	480	851	1732
Percentage of women	*63%*	*54%*	*63%*	*60%*
Total Math Ed degrees	636	891	1348	2875
Statistics Majors				
Men	98	77	95	270
Women	28	56	62	147
Percentage of women	*22%*	*42%*	*40%*	*35%*
Total Stat degrees	126	133	157	416
Computer Science Majors				
Men	7	483	2177	2666
Women	3	217	1082	1302
Percentage of women	*33%*	*31%*	*33%*	*33%*
Total CS degrees	10	700	3259	3968
Actuarial Mathematics Majors				
Men	997	207	167	1371
Women	635	134	75	844
Percentage of women	*39%*	*39%*	*31%*	*38%*
Total Actuarial Math degrees	1632	341	243	2215
Joint Mathematics Majors				
Men	212	224	491	927
Women	109	168	156	433
Percentage of women	*34%*	*43%*	*24%*	*32%*
Total Joint degrees	321	393	646	1360
Other Mathematics Majors				
Men	357	87	16	460
Women	251	37	10	298
Percentage of women	*41%*	*30%*	*38%*	*39%*
Total other Math degrees	608	124	26	758
Total degrees - Men	5337	2925	5971	14233
Total degrees - Women	3072	2458	4624	10154
Percentage of women	*37%*	*46%*	*44%*	*42%*
Total all degrees	8409	5383	10595	24387

Note: Round-off may make row and column sums seem inaccurate.

TABLE E.1.B Bachelors degrees in statistics departments awarded between July 1, 2014 and June 30, 2015, by gender of degree recipient and type of department. This table can be compared to Table E.1 in CBMS2010, p. 78.

	Statistics Departments		
Bachelors degrees in Stat Depts	Univ (PhD)	Univ (MA)	Total Stat Depts
Statistics Majors			
Men	540	55	594
Women	418	42	460
Percentage of women	*44%*	*43%*	*44%*
Total Statistics degrees	958	97	1055
Biostatistics			
Men	17	0	17
Women	21	0	21
Percentage of women	*55%*	*NA*	*55%*
Total Biostatistics degrees	**38**	**0**	38
Actuarial Science			
Men	58	7	65
Women	73	1	74
Percentage of women	*56%*	*17%*	*53%*
Total Actuarial Science degrees	131	8	139
Joint Statistics and Computer Science			
Men	46	0	46
Women	18	0	18
Percentage of women	*28%*	*0%*	*28%*
Total Joint Statistics and Computer Science degrees	**64**	**0**	64
Joint Statistics and Mathematics			
Men	*124*	*0*	*124*
Women	*72*	*0*	*72*
Percentage of women	*37%*	*0%*	*37%*
Total Joint Statistics and Mathematics degrees	**196**	**0**	196
Joint Statistics and (Business or Economics)			
Men	*116*	*0*	*116*
Women	*84*	*0*	*84*
Percentage of women	*42%*	*0%*	*42%*
Total Joint Statistics and (Business or Ecoomics) degrees	**200**	**0**	200
Statistics Education			
Men	*2*	*0*	*2*
Women	*3*	*0*	*3*
Percentage of women	*60%*	*0%*	*60%*
Total Statistics Education degrees	**5**	**0**	5
Other			
Men	*62*	*29*	*90*
Women	*47*	*12*	*59*
Percentage of women	*43%*	*29%*	*39%*
Total other degrees	*109*	*41*	*149*
Total degrees - Men	965	90	1055
Total degrees - Women	737	55	792
Percentage of women	*43%*	*38%*	*43%*
Total all degrees	1702	145	1847

Note: Round-off may make row and column sums seem inaccurate.

Table E.1.C. Comparisons of NCES Tabulations of Bachelors Degrees awarded to Majors in Math & Stat during 2014-2015 survey cycle with estimates from 2015 CBMS Survey and 2015 Annual Survey Departmental Profile survey.

Institutions with a:	NCES	Annual Survey [1]	Annual Survey SEs	CBMS [2]
Doctoral Mathematics Departments	14256	13477	*70*	10256
Masters Mathematics Departments	4354	4701	*141*	5383
Bachelors Mathematics Departments	9058	12204	*270*	10595
Grand Total	27668	30382	*348*	26234

[1] Doctoral Math. Depts. includes degrees awarded by doctoral stat departments; Masters stat departments were not surveyed.

[2] Doctoral Math. Depts. includes degrees awarded by doctoral and masters stat departments; some masters stat departments are at institutions whose math department does not offer a doctorate. Computer science degrees included.

Table E.1.D. Comparisons of NCES Tabulations of Bachelors Degrees awarded to Majors in Math & Stat during 2014-2015 survey cycle with estimates from 2015 Annual Survey Departmental Profile survey adjusted to remove CS-only Bachelors. The CBMS estimates include CS majors.

Institutions with a:	NCES	Annual Survey with CS-only removed [1]	CBMS [2]
Doctoral Mathematics Department	14256	13334	10256
Masters Mathematics Department	4354	4457	5383
Bachelors Mathematics Department	9058	10666	10595
Grand Total	27668	28457	26234

[1] Doctoral Math. Depts. includes degrees awarded by doctoral stat departments; Masters stat departments were not surveyed.

[2] Doctoral Math. Depts. includes degrees awarded by doctoral and masters stat departments; some masters stat departments are at institutions whose math department does not offer a doctorate. Computer science degrees included.

Table E.1.B gives the estimated number of degrees awarded by statistics departments over that same time period. Mathematics departments award most of the degrees in the mathematical sciences, 93% in 2015, down from 96% in 2009-10, so the number of degrees awarded by mathematics departments is the major component in the number of undergraduate degrees awarded in the mathematical sciences. The estimated total number of degrees awarded by four-year mathematics departments in 2014-15 was 24,387 with an SE of 2,535, and the estimated total number awarded by statistics departments was 1,847 with an SE of 101; the corresponding estimates for 2009-10 were 20,540 (SE 1,180) degrees awarded by mathematics departments, and 838 (SE 83) degrees awarded by statistics departments [CBMS2010 Table E.1, p. 78]. Hence, there was a 19% (1.5 SEs) increase in the estimated number of degrees awarded by mathematics departments from 2009-10 to 2014-15, and the estimated number of degrees awarded by statistics departments more than doubled in that time period.

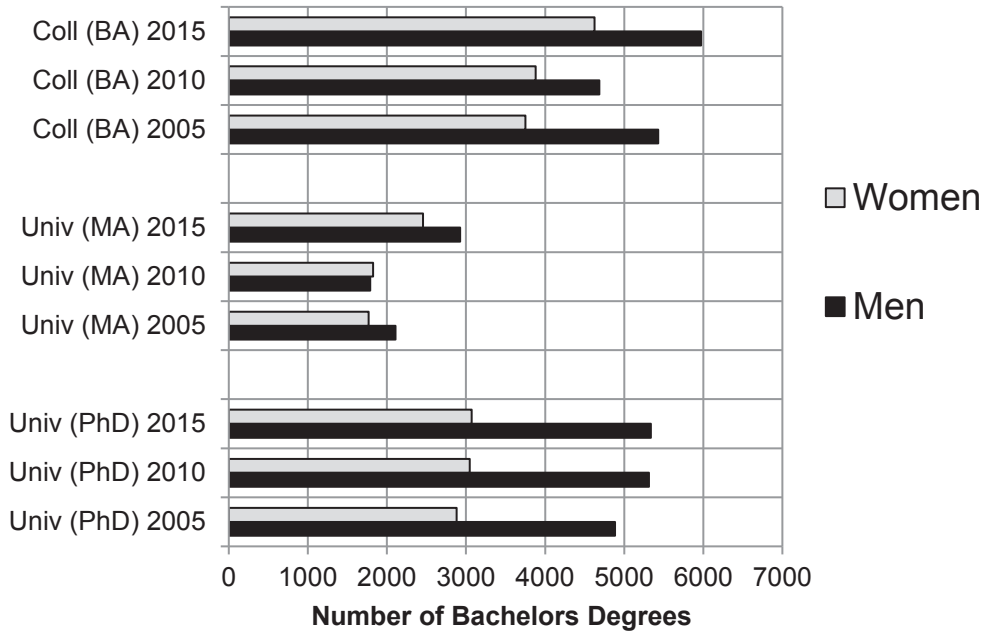

FIGURE E.1.1 Bachelors degrees in mathematics departments awarded between July 1 and June 30 in the academic years 2004-2005, 2009-2010, and 2014-2015, by gender and type of department.

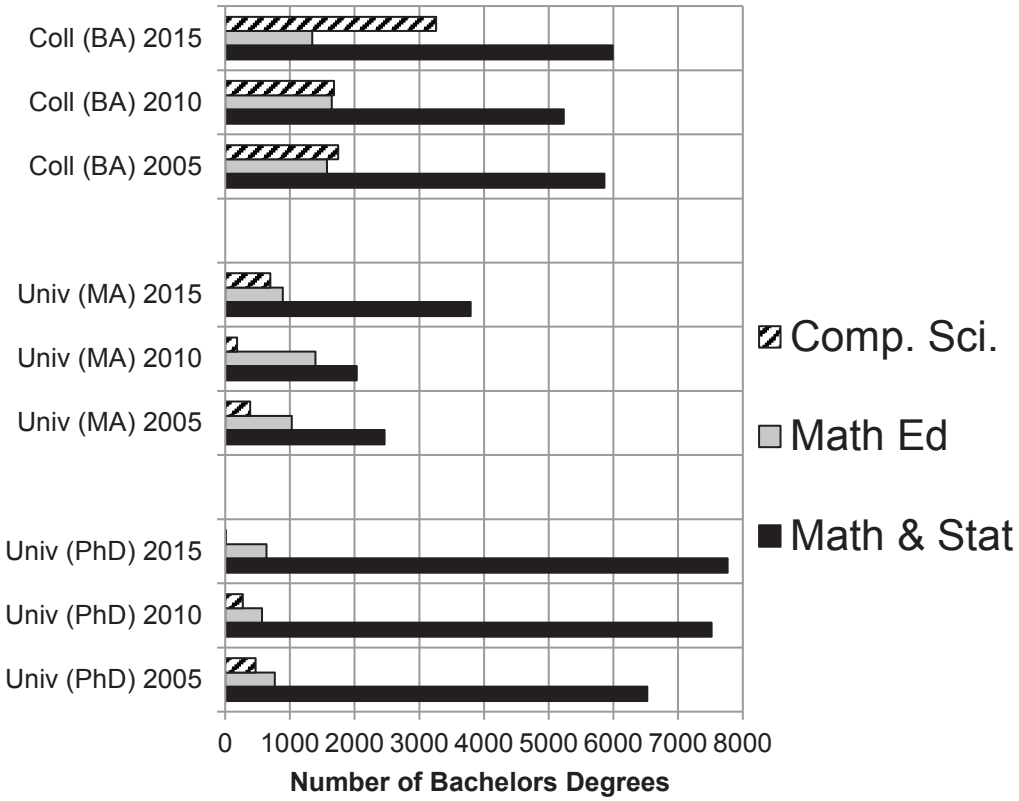

FIGURE E.1.2 Number of bachelors degrees granted by mathematics departments in academic years 2004-2005, 2009-2010, and 2014-2015 by type of major and type of department.

Degrees awarded by mathematics departments broken down by level of department

Table E.1.A breaks down the estimated numbers of degrees awarded in 2014-15 by the level of mathematics department awarding the degree. In the 2005 and 2010 CBMS surveys, most of the growth in the number of bachelors degrees awarded in mathematics occurred at the doctoral-level mathematics departments. In 2005, for the first time, the estimated number of bachelors degrees in mathematics granted by doctoral-level departments exceeded the number granted by bachelors-level departments. In 2015, the largest growth in estimated degrees awarded occurred in the masters and bachelors-level departments, with bachelors-level departments awarding more degrees total than doctoral-level departments, but when computer science degrees are removed, the situation is reversed. Figures E.1.1 and E.1.2 display the numbers of degrees awarded by each level of mathematics department in 2004-5, 2009-10 and 2014-15; Figures E.1.3, and E.1.4 display the percentage of mathematical science degrees awarded by each level of mathematics department, and by statistics departments, with, and without, degrees in computer science awarded by mathematics departments included. In 2014-15 doctoral-level departments awarded 34% of all the estimated total degrees awarded by mathematics departments, and bachelors-level departments awarded 43%; when computer science degrees awarded by mathematics departments are removed, doctoral-level departments awarded 41% of all the estimated degrees, and bachelors-level departments awarded 36% of the degrees.

Degrees awarded by mathematics departments broken down by category of degree

Table E.1.A breaks the estimated number of degrees awarded by mathematics departments in 2014-15 down by category of the major, and by level of the department; Figure E.1.2 displays this breakdown of degrees awarded in 2004-5, 2009-10, and 2014-15. Table E.1.A shows that the estimated number of bachelors degrees in the category "mathematics", awarded in 2014-15 by all levels of mathematics departments combined, was 12,794, and Table S.3 of Chapter 1 shows that this is an increase over both 2009-10 and 2004-05. Note that Table E.1 in CBMS2010 p. 78, includes actuarial mathematics, joint majors, and "other" in the category "mathematics", while the comparable Table E.1.A in CBMS2015 breaks out these categories separately; these categories are also broken out in Table S.3, which can be used to make comparisons between estimated number of degrees awarded in mathematics in 2014-15 to number awarded in 2009-10 over all levels of mathematics department combined. To make comparisons between the number of degrees awarded in 2009-10 and 2014-5, broken down by level of department, using Table E.1.A in CBMS2015 and Table E.1 in CBMS2010, we combine the numbers of degrees awarded in mathematics, actuarial mathematics, joint majors and "other" in 2014-15. Hence, the number of degrees awarded by doctoral-level departments in these categories in 2014-15 was 7,637 degrees, and the number of degrees awarded by bachelors-level departments was 5,832 degrees; in the CBMS 2010 survey the corresponding estimates were 7,303 degrees awarded by doctoral-level departments, and 5,167 degrees awarded by bachelors-level departments. If one considers the narrower category of only mathematics, the estimated numbers of degrees awarded in 2014-15 are closer: 5,076 by doctoral-level departments, and 4,917 by bachelors-level departments.

The estimated number of degrees awarded by all levels of mathematics departments combined in 2014-15 in mathematics education was estimated at 2,875 degrees (SE 333), down from 3,614 in 2009-10, 3,369 in 2004-5, 4,991 in 1999-2000, and 4,829 in 1994-95 (see Table S.3 in Chapter 1). In 2014-15, the estimated number of mathematics education degrees awarded was down from 2009-10 in all three levels of departments, but the largest decline was at the masters-level mathematics departments, where the estimated number of mathematics education degrees awarded dropped from an estimated 1,396 degrees awarded in 2009-10 to an estimated 891 degrees awarded in 2014-15. See Figure E.1.2.

Table E.1.A, shows that the estimated number of bachelors degrees in statistics awarded by mathematics departments increased from 241 degrees in 2004-5, to 354 degrees in 2009-10, to 416 degrees (SE 96) in 2014-15, almost doubling in the past 10 years, but still a relatively small number, and, in mathematics departments, the estimated number of degrees awarded in statistics was only about 20% of the estimated number of actuarial mathematics degrees. The degrees awarded in statistics by mathematics departments were spread pretty evenly across the three levels of mathematics departments, unlike in 2009-10, when more than half of the statistics degrees awarded by mathematics departments were awarded by the doctoral-level mathematics departments. As we will see later in this chapter, mathematics departments have a relative large enrollment in both lower and upper level statistics courses, but, apparently, offer few degrees classified by the survey responders as statistics degrees.

As was already observed, there was an increase in the estimated number of bachelors degrees awarded in computer science by mathematics departments. In 1994-5 the CBMS study estimated that mathematics departments awarded 2,741 bachelors degrees in computer science (Table S.3 of Chapter 1), while Table E.1.A shows that in 2014-15 this number

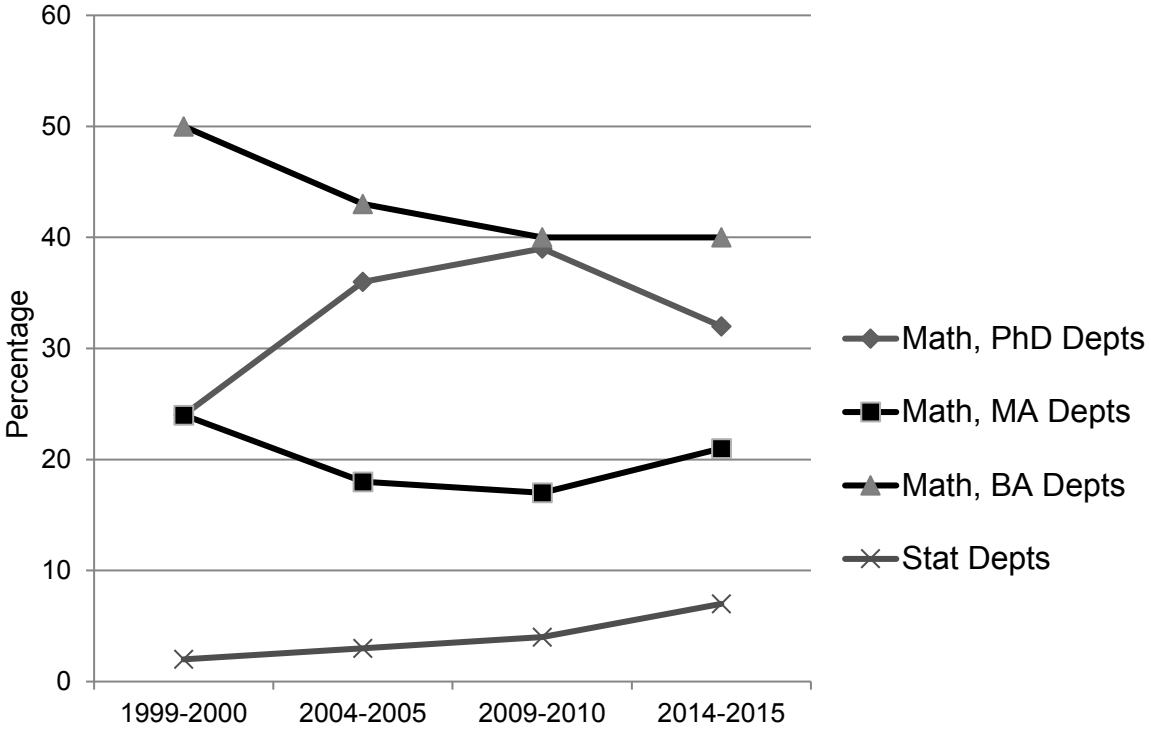

FIGURE E.1.3 Percentage of mathematical sciences bachelors degrees (including computer science) awarded through mathematics and statistics departments of various kinds in academic years 1999-2000, 2004-2005, 2009-2010, and 2014-2015.

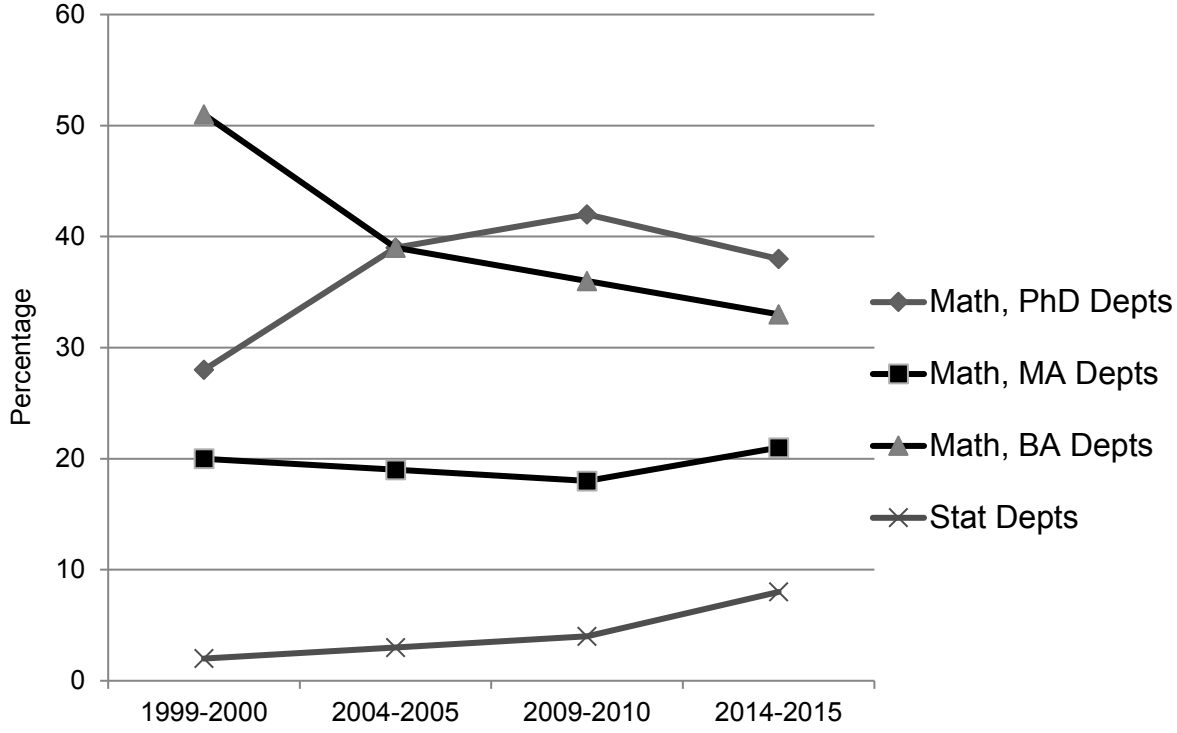

FIGURE E.1.4 Percentage of mathematical sciences bachelors degrees (excluding computer science) awarded through mathematics and statistics departments of various kinds in academic years 1999-2000, 2004-2005, 2009-2010, and 2014-2015.

TABLE E.2 Enrollment (in thousands) in undergraduate mathematics, statistics, and computer science courses (including distance-learning enrollments) in mathematics and statistics departments by level of course and type of department in fall 2015. Numbers in parentheses are (2005, 2010) enrollments.

	Fall 2015 (2005, 2010) enrollments (in 1000s)						
	Mathematics Departments				Statistics Departments		
	Univ (PhD)	Univ (MA)	Coll (BA)	Total Math Depts	Univ (PhD)	Univ (MA)	Total Stat Depts
Mathematics Courses							
Precollege	80 (55,57)	48 (60,64)	125 (87,88)	253 (201,209)			
Introductory (incl. Precalc)	408 (269,299)	226 (190,214)	365 (248,350)	1000 (706,863)			
Calculus level	474 (345,383)	157 (88,145)	176 (154,221)	807 (587,748)			
Advanced Mathematics	81 (52,64)	30 (24,39)	43 (36,47)	154 (112,150)			
Total Math courses	1043 (720,803)	461 (362,462)	709 (525,706)	2213 (1607,1971)			
Statistics Courses							
Introductory Statistics	57 (30,51)	62 (32,40)	134 (86,140)	253 (148,231)	78 (42,54)	16 (13,27)	94 (54,81)
Upper Statistics	17 (15,15)	24 (9,6)	20 (10,11)	60 (34,32)	45 (20,15)	5 (3,12)	50 (24,28)
Total Stat Courses	74 (44,66)	85 (42,45)	154 (96,151)	313 (182,262)	124 (62,70)	20 (16,39)	144 (78,109)
Computer Science Courses							
Lower Computer Science	4 (3,3)	5 (11,3)	36 (30,50)	45 (44,56)			
Middle Computer Science	1 (1,1)	2 (1,1)	14 (6,9)	16 (8,12)			
Upper Computer Science	0 (1,1)	2 (1,1)	5 (3,8)	6 (5,10)			
Total CS courses	5 (5,5)	8 (13,6)	55 (39,67)	68 (57,77)			
Total all courses	1122 (769,874)	554 (417,513)	918 (659,924)	2594 (1845,2310)	124 (62,70)	20 (18,39)	144 (80,109)

Note: Beginning in 2010, the CBMS Survey did not include computer science courses taught in statistics departments

Note: Due to round-off, row and column sums may appear inaccurate.

was 3,968. Most of the bachelors degrees awarded in computer science in 2014-15 by mathematics departments were given by the bachelors-level departments. The CBMS2010 study showed an increase in estimated computer science enrollments in mathematics departments for fall 2010 over the computer science enrollments for fall 2005 that were reported in CBMS2005 (see Table E.2 of CBMS2010), but, as we will see later in this chapter, the 2015 report on enrollments shows a decline in computer science enrollments over 2010 in mathematics departments.

Degrees awarded by statistics departments

Table E.1.B shows that in 2014-15 the estimated number of bachelors degrees awarded by statistics departments was 1,847, compared with 838 bachelors degrees awarded in 2009-10, and compared with 416 degrees awarded by mathematics departments in 2014-15 in statistics. The number of degrees awarded by doctoral-level statistics programs in 2014-15 was 1,702, compared with 481 in 2009-10. In the 2015 CBMS survey the degrees awarded by statistics departments were broken down into the categories of statistics, biostatistics, actuarial science, joint statistics and computer science, joint statistics and mathematics, and joint statistics and business/economics. Statistics was the category with the largest estimated number of degrees awarded (1,055) in 2014-15, followed by joint statistics and business/economics (200), and joint statistics and mathematics (196). There were an estimated 139 degrees awarded by statistics departments in actuarial science, and an estimated 2,215 degrees awarded by mathematics departments in actuarial mathematics.

Degrees awarded broken down by gender

Table E.1.A (respectively, Table E.1.B) breaks down the estimated number of bachelors degrees awarded by mathematics departments (respectively, statistics departments) by gender, and Figure E.1.1 displays the numbers of degrees awarded by mathematics departments, broken down by level of department and gender, for 2004-5, 2009-10, and 2014-15. Tables E.1.A and E.1.B show that the estimated total numbers of mathematical sciences degrees awarded to women increased from 2009-10 to 2014-15 at each level of mathematics and statistics department, except at masters-level statistics departments; however, over the course of the last 25 years the estimated percentage of bachelors degrees awarded to women has decreased slightly in mathematics departments and increased in statistics departments. Comparisons to previous CBMS surveys can be found at [CBMS1990 Table E.6, p. 30], [CBMS1995 Table E.1, p. 42], [CBMS2000 Table E.1, p. 71], [CBMS2005 Table E.1, p. 78], and [CBMS2010 Table E.1, p.78]. The total estimated percentage of undergraduate degrees awarded to women by all levels of mathematics departments combined in 2014-15 was 42% (SE 2) women, comparable to the percentage that in 2009-10 was 43% women, and in 2004-5 was 40% women; in 1989-90 the estimated percentage of women was 46%. The estimated percentage of bachelors degrees awarded to women by statistics departments in 2014-2015 was estimated at 43% (SE 0.5) (Table E.1.B), up from 40% in 2009-2010; in 2004-5 it was 40%, in 1999-2000 it was 43%, and in both 1989-90 and 1994-95 it was 38%. The percentage of degrees awarded to women varies by the level of department. The estimated percentage of all bachelors degrees awarded to women by doctoral-level mathematics departments in 1989-90 was 37%, in 1994-5 was 43%, in 1999-2000 was 40%, in 2004-5 was 37%, in 2009-10 was 36%, and in 2014-15 it was 37% (SE 1.2) by Table E.1.A. In 2014-15, the estimated percentage of bachelors degrees awarded by masters-level mathematics departments to women decreased from 50% in 2009-10 to 46% (SE 3.3) in 2014-15 by Table E.1.A (it was 50% in 1989-90), and in the bachelors-level departments it decreased from 45% in 2009-10, to 44% (SE 4.3) in 2014-15; it was 52% in 1989-90. See Figure E.1.1, which shows the estimated number of bachelors degrees awarded, broken down by gender in 2004-5, 2009-10, and 2014-15.

Table E.1.A shows that the percentage of degrees awarded to women also varies by category of mathematics degree. it is highest in mathematics education (in 2014-15 it was 60% (SE 2.9), in 2009-10 it was 63%, and in 2004-5 it was 60%). The percentage of degrees awarded to women by mathematics departments made the biggest changes in the number of computer science degrees awarded; in all levels of mathematics departments combined, women were 33% of the degrees awarded in 2014-15 and 16% of degrees awarded in 2009-10.

Table E.1.B breaks down the number of bachelors degrees awarded by statistics departments into more categories than in previous CBMS surveys. Though the numbers are small, the table shows that the percentage of bachelors degrees in biostatistics awarded to women was 55% (SE 2).

Tables E.1.C and E.1.D: Comparison: Annual Survey, NCES, and CBMS Survey Estimates of Numbers of Degrees Awarded

Next we compare the estimates of the number of degrees awarded that were obtained from the CBMS survey, to the estimates of these numbers obtained from the Annual Survey, and from data available through NCES. In both the 2010 and the 2015 CBMS surveys, the estimated number of bachelors degrees awarded was less than the estimate in the Annual Survey. NCES data is entered by college and university offices of institutional research, rather than by the department chair; at one time these offices were not

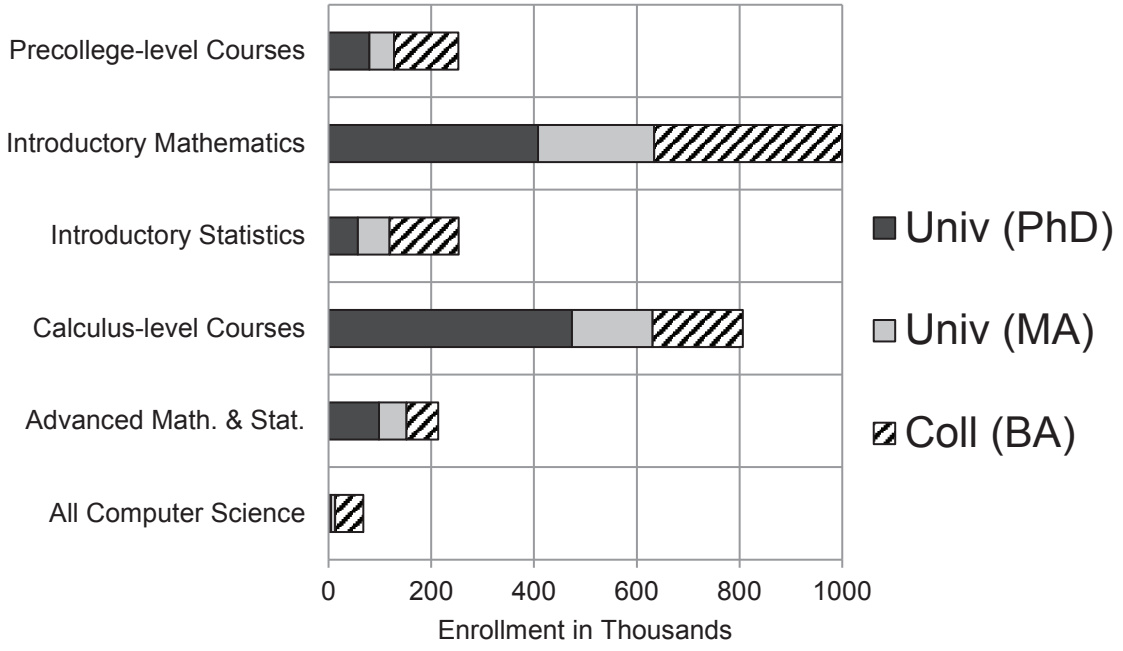

FIGURE E.2.1 Enrollment (in thousands) in undergraduate mathematics, statistics, and computer science courses in four-year college and university mathematics departments by type of course and type of department in fall 2015.

allowed to enter more than one major for a student, and, for this reason, the NCES estimates did not seem to be an accurate estimate of numbers of degrees awarded by mathematical sciences departments. In the data institutions give NCES, it now is possible for a degree to be counted under more than one major, but whether that is done depends upon how the local institution implements that policy. If counting the same things, the NCES data should be more accurate than both the Annual Survey and the CBMS survey, as NCES data is a census, rather than a survey. The Annual Survey and the CBMS survey use basically the same methodology to count the same quantities, but they are conducted at different times of the year (the CBMS survey in the fall, and the Annual Survey in January). The CBMS estimates of degrees awarded by four-year mathematics and statistics department are less than the numbers reported by NCES, and the NCES numbers are less than the Annual survey estimates.

Tables E.1.C and E.1.D consolidate the estimates of bachelors degrees awarded by mathematics and statistics departments during 2014-15 from the Annual Survey and from the CBMS 2015 survey so as to try to make them roughly comparable with the total bachelors degrees awarded as reported by NCES, given the differences in the three surveys. In creating these tables using NCES institutional data, the data are combined according to the highest degree awarded (doctoral, masters, or bachelors) by the mathematics department at the institution (the level of a possible statistics department is not used, and we make the assumption that if an institution has a statistics department, it also has a mathematics department). To make the NCES data comparable to the CBMS data, in Tables E.1.C and E.1.D the CBMS total number of bachelors degrees awarded in mathematics and statistics for "Doctoral Mathematics Departments" includes CBMS estimated degrees awarded by masters and doctoral-level statistics departments, since these degrees would likely be combined in the institutional total number of bachelors degrees awarded in mathematics and statistics. The Annual Survey total shown for "Doctoral Mathematics Departments" includes the degrees reported separately for departments in the Annual Survey that are labelled Applied Mathematics Departments and Doctoral Statistics Departments (the CBMS labelled masters-level statistics departments are not part of the Annual Survey).

The NCES totals in Table E.1.C include only one type of Computer Science Degree, those submitted to NCES under the label Mathematics and Computer Science, CIP code 30.08. Since computer science degree programs are sometimes housed within the mathematics departments, the Annual Survey bachelors degree totals certainly include degrees viewed within the department as falling within Computer Science broadly, and certainly include Joint Mathematics and

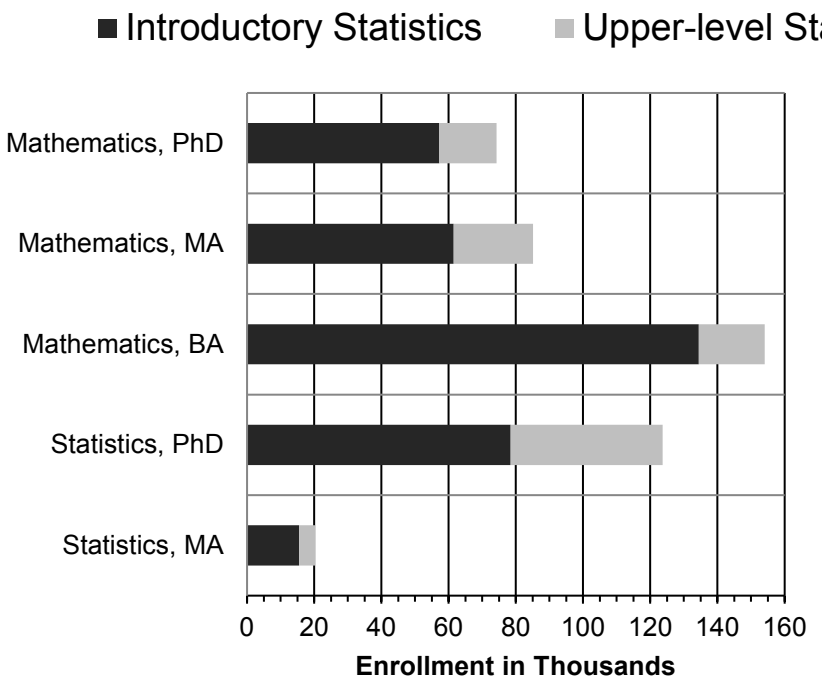

FIGURE E.2.2 Enrollment (in thousands) in undergraduate statistics courses by level of course and type of department in fall 2015.

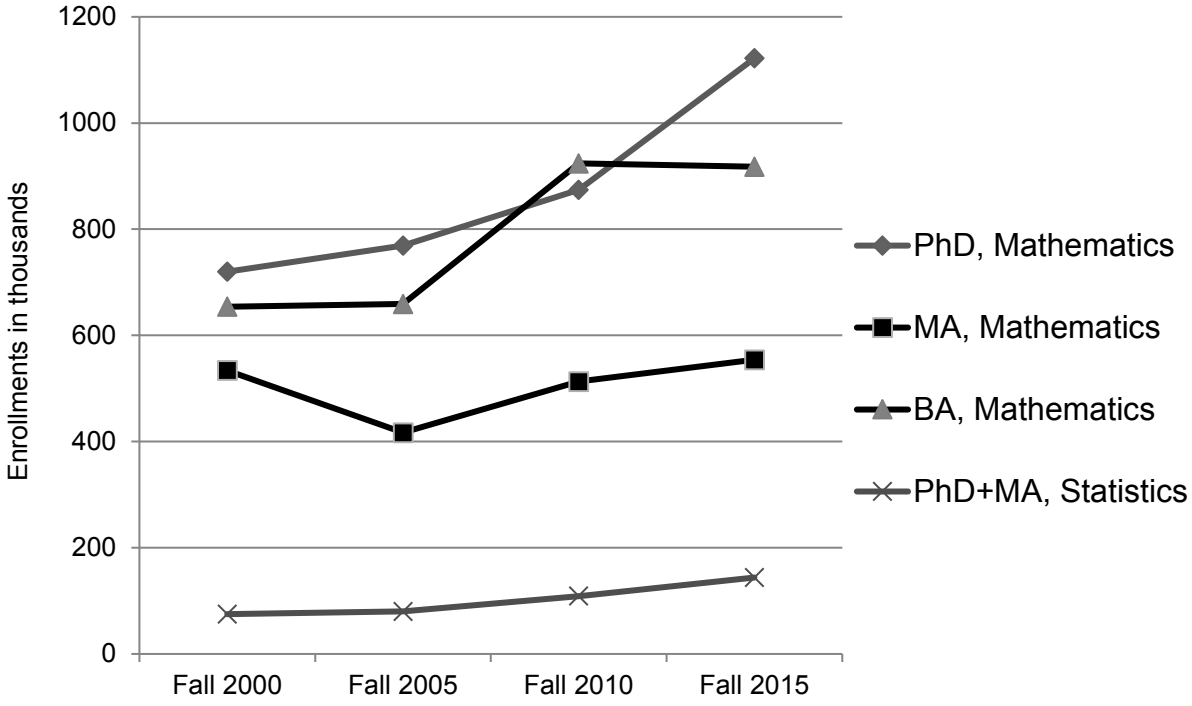

FIGURE E.2.3 Undergraduate enrollment (in thousands) by type of department in fall 2000, fall 2005, fall 2010, and fall 2015.

Computer Science bachelors degrees. The Annual Survey asks departments to report separately on how many Computer Science only degrees were included in the number they reported in their department degrees awarded total. No doubt some (and perhaps even most) of these Computer Science-only degrees are reported to NCES under a program total other than CIP code 30.08, the one used to produce the NCES totals shown in Table E.1.C. The NCES uses the label Computer Science, CIP code 11.07, which is one code that could easily be assigned by the institutional research unit at the institution for the degrees reported to Annual Survey as Computer Science only degrees. This difference in the NCES and Annual Survey data might explain why the Annual Survey estimate is higher than the NCES total in Table E.1.C.

In order to try to make the Annual Survey estimate closer to the NCES data, in Table E.1.D the Annual Survey data with the Computer Science only degrees reported by departments are removed from the Annual Survey estimates. For the CBMS survey, departments can report computer science degrees in the CBMS survey under the label "Computer Science majors", and they can report degrees that might have NCES CIP code 30.08 under the label "Joint Mathematics Majors", or they might decide to place then under the label "Other Mathematics Majors"; all these degrees are included in both Tables E.1.C and E.1.D in the CBMS survey column. It is interesting to note that the 2015 CBMS survey total bachelors degree awarded estimate for "Computer Science majors" is 3,968, whereas the Annual Survey's estimate for "Computer Science only" majors is 1,925. In addition, the NCES total tally of Mathematics and Computer Science degrees awarded is just 300.

Tables E.2 and E.3: Undergraduate enrollments and number of sections offered in mathematics and statistics departments

The CBMS2015 data show that estimated enrollments in mathematical sciences courses were larger in fall 2015 than in fall 2010, but perhaps not always significantly higher, and these enrollments were up in almost every category. The 2010 CBMS survey showed large growths in enrollments over 2005, and the 2015 survey generally maintains those high levels, suggesting that there has been real enrollment growth since 2005 (see Figure S.2.1 in Chapter 1 for growth in mathematics enrollments since fall 1990, and Figure S.2.3 in Chapter 1 for growth in statistics enrollments over that 25-year time period). Table E.2 shows that estimated total fall 2015 enrollments (including distance learning enrollments) in mathematics departments were up 12% (1.8 SE) over fall 2010, and up 41% over fall 2005; in statistics departments, the total estimated enrollments were up 32% (8.8 SEs) over fall 2010 and 80% over fall 2005. Table E.2 breaks enrollments down by broad categories of courses (mathematics courses, statistics courses, and computer science courses) and by levels of department. The enrollments of individual courses are given in Appendix I (where enrollments both with, and without, distance learning enrollments can be found; in CBMS survey reports prior to 2010, Appendix I gives enrollments with distance learning enrollments included). Enrollments in introductory-level mathematics, calculus, and introductory-level statistics are considered in more detail in Chapter 5 (where tables generally do not include distance learning enrollments). When a table in this report concerns sections of a course, the corresponding enrollments do not contain distance-learning enrollments; otherwise, distance learning enrollments generally are included.

Table E.2 shows that increases in estimated enrollments occurred at almost all levels of departments and types of courses, except computer science enrollments in mathematics departments (which were up 35% from fall 2005 to fall 2010, but down in 2015) – including enrollments in mathematics courses, and mathematics department enrollments in statistics courses, which were up 19% (2.1 SEs) over fall 2010 and 72% over fall 2005.

Enrollments in mathematics courses

Considering, first, the enrollments in mathematics courses, Table E.2 shows that the estimated total national enrollment in mathematics courses taught at four-year mathematics departments in fall 2015 was roughly 2,213,000 (with an SE of 140,000), up 12% (1.7 SEs) from the estimated 1,971,000 in 2010, and up 38% from the estimated 1,607,000 in fall 2005. Mathematics course enrollments are broken down into enrollments in precollege courses, introductory courses (including Precalculus), calculus-level courses (including Linear Algebra, Differential Equations, Discrete Mathematics, as well as various kinds of Calculus), and advanced mathematics; each of these course grouping enrollments is broken down further by the level of the department. Figure E.2.1 shows that the largest estimated total mathematics enrollments are in the introductory-level courses, as was seen, also, in the two previous CBMS surveys. The biggest percentage growth in estimated mathematics course enrollment was in precollege-level courses, which increased 21% (1.7 SEs), from an estimated enrollment of roughly 209,000 in 2010 to an estimated enrollment of 253,000 (with SE 26,000) in 2015. The next largest growth in estimated enrollment in fall 2015 over fall 2010 occurred in introductory-level courses, up 16% (1.7 SEs), followed by an 8% (1 SE) growth in enrollment in calculus-level courses (which rose 37% in 2015 over 2005), and only a 3% (0.3 SE) increase in enrollment in advanced-level mathematics courses (which rose 38% in 2015 over 2005). In the

TABLE E.3 Number of sections (not including distance learning) of undergraduate mathematics, statistics, and computer science courses in mathematics and statistics departments by level of course and type of department in fall 2015 with fall 2010 figures in parentheses.

	Number of sections: Fall 2015 (Fall 2010)						
	Mathematics Departments				Statistics Departments		
	Univ (PhD)	Univ (MA)	Coll (BA)	Total Math Depts	Univ (PhD)	Univ (MA)	Total Stat Depts
Mathematics Courses							
Precollege level	2235	1578	4206	8020			
	(1578)	(2075)	(3699)	(7352)			
Introductory (incl. Precalc)	8245	6999	16948	32192			
	(6268)	(6556)	(12525)	(25349)			
Calculus	8323	4579	8285	21186			
	(7976)	(4559)	(9575)	(22110)			
Advanced Mathematics	3676	2633	4461	10771			
	(3266)	(3304)	(3913)	(10483)			
Total Math courses	22479	15788	33901	72168			
	(19088)	(16494)	(29712)	(65294)			
Statistics Courses							
Introductory Statistics	1319	1493	4562	7374	1256	238	1494
	(969)	(1208)	(5014)	(7191)	(1113)	(638)	(1751)
Upper Statistics	752	1432	1776	3960	796	174	970
	(561)	(420)	(929)	(1910)	(461)	(447)	(907)
Total Stat Courses	2072	2925	6338	11334	2052	412	2464
	(1530)	(1628)	(5943)	(9102)	(1573)	(1085)	(2658)
Computer Science Courses							
Lower Computer Science	109	186	1987	2282			
	(101)	(146)	(2230)	(2477)			
Middle Computer Science	31	69	1128	1227			
	(51)	(92)	(769)	(912)			
Upper Computer Science	0	84	375	460			
	(49)	(69)	(741)	(859)			
Total CS courses	140	339	3490	3970			
	(201)	(307)	(3740)	(4248)			
Total all courses	24692	19053	43728	87472	2052	412	2464
	(20820)	(18428)	(39396)	(78644)	(1573)	(1085)	(2658)

Note: Due to round-off, row and column sums may appear inaccurate.

2010 CBMS survey data, the advanced-level courses showed the largest growth from 2005 to 2010, while the precollege-level courses showed the smallest growth, so at least some of the variation we see from 2010 to 2015 may be explained by standard error, though the general trend seems to be increasing enrollments (see Figure E.2.3). Growth in estimated enrollments occurred in all levels of departments, except precollege-level in masters-level departments, calculus-level in bachelors-level departments, and advanced-level in both masters and bachelors-level departments. Estimated total enrollments in mathematics courses grew 30% (2.5 SEs) at the doctoral-level departments, and were almost identical in the masters and bachelors-levels to the enrollments observed in fall 2010 (in the 2010 CBMS survey, the doctoral-level estimate showed the smallest growth over 2005). In 2015, total estimated enrollment in doctoral-level mathematics departments exceeded that in bachelors-level departments; see Figure E.2.3.

Enrollments in statistics courses

Statistics enrollments showed large gains in both mathematics and statistics departments, particularly in upper-level courses; Table E.2 shows that the estimated total enrollments in statistics departments were 144,000 (SE 4,000) in fall 2015 and 109,000 in fall 2010, a 32% (9 SEs) increase over fall 2010. In fall 2015, the estimated total enrollments in statistics courses in mathematics departments were 313,000 (SE 24,000), and, hence, roughly 2/3 of the estimated undergraduate statistics enrollments were in mathematics departments. It should also be noted (see Figure S.2.3 in Chapter 1) that, in fall 2015, for the first time, two-year college enrollments in introductory statistics courses surpassed four-year mathematics department enrollments in introductory statistics. The estimated number of enrollments in upper-level statistics courses were closer, but mathematics department enrollments in upper-level statistics courses were 20% more than statistics department enrollments at the upper-level in fall 2015. In mathematics departments, Table E.2 shows that the estimated introductory statistics enrollments in fall 2015 were 253,000, up 10% (1.1 SEs) from fall 2010, and the estimated upper-level statistics enrollments were up 88% (4.7 SEs). In statistics departments, the estimated introductory statistics enrollments in fall 2015 were up 16% (4.3 SEs) over fall 2010, and upper-level statistics enrollments were up 79% (11 SEs). The 2010 CBMS survey showed large gains from 2005 to 2010 in introductory enrollments, and modest gains in upper-level enrollments; perhaps the increased interest in beginning statistics courses in 2010 has matured to interest in the upper-level statistics courses in 2015.

Most of the introductory statistics that is taught in four-year mathematics departments occurs in bachelors-level departments, where the fall 2015 enrollment in introductory statistics was roughly 134,000 with an SE of 14,000; this estimate was slightly lower than the 2010 estimate. In masters-level departments, estimated upper-level statistics enrollments in 2015 were four times the 2010 estimate. Enrollment growth in statistics department occurred at the doctoral-level departments, as estimated enrollments in both lower-level and upper-level courses in masters-level statistics departments declined from 2010 to 2015. In doctoral-level statistics departments, estimated introductory statistics enrollments were up 44% (12 SEs) over fall 2010, and estimated upper-level enrollments were three times the 2010 estimate, and more than twice the 2005 estimate. Figure E.2.2 presents a bar graph of statistics course enrollments in the three levels of mathematics departments and two levels of statistics departments.

Enrollments in computer science courses in mathematics departments

Computer science enrollments in mathematics departments are now confined largely to bachelors-level departments. The estimated computer science enrollments in mathematics departments were down to 68,000 (SE 11,000) in fall 2015, below the 2010 estimate of 77,000, but above the 2005 estimate of 57,000, but well below the 2000 estimate of 123,000 enrollments. The long-run trend is declining computer science enrollments in mathematics departments, as more computer science courses are taught in computer science departments. The computer science enrollments in mathematics departments, though small, are still significant in mathematics department enrollments; as one example, according to Table E.2, in fall 2015 (as in fall 2010), the bachelors-level mathematics departments had more total estimated enrollments in computer science courses than in advanced-level mathematics courses.

Enrollments: numbers of sections

Another way to measure changes in enrollment is to track the number of course sections that are offered. Table E.3 shows that, from fall 2010 to fall 2015, the estimated total number of course sections offered in mathematics departments grew 11% (1.2 SEs), and the estimated total number of sections of mathematics courses grew 11% (1 SE); these data provide an estimate similar to the estimated growth observed in enrollments. The number of sections of precollege-level mathematics courses grew by an estimated 9% (0.9 SEs) from fall 2010 to fall 2015, and the number of sections of introductory-level courses grew by an estimated 27% (1.4 SEs). The estimated number of sections of calculus-level courses was smaller in 2015 than in 2010, due to a smaller number of sections in the bachelors-level departments. The estimated number of sections of mathematics courses in

TABLE E.4 Enrollments in distance-learning courses (meaning courses in which the majority of the instruction occurs with the instructor and the students separated by time and/or space [e.g. courses in which the majority of the course is taught online, or by computer software, or by other technologies], including MOOCs that are offered for credit) and other sections for various freshman and sophomore courses, by type of department, in fall 2015. (A MOOC is a "massive open online course.") (Fall 2010 data in parentheses.)

	Four-year Mathematics Departments		Two-year Mathematics Departments		Statistics Departments	
	Distance-learning Enrollments	Other Enrollments	Distance-learning Enrollments	Other Enrollments	Distance-learning Enrollments	Other Enrollments
Precollege Level	8405	244475	89035	693252		
	(8106)	(201089)	(87073)	(1062667)		
College Algebra, Trigonometry, & Pre-Calculus	45226	954356	55227	390066		
	(12021)	(431420)	(40898)	(309272)		
Calculus I (mainstream and non-mainstream)	8968	346343	7455	84537		
	(2159)	(332632)	(3504)	(82192)		
Calculus II (mainstream and non-mainstream)	3410	125126	1813	32523		
	(782)	(128104)	(285)	(30827)		
Differential Equations & Linear Algebra	1492	137567	480	13559		
	(862)	(115837)	(298)	(10473)		
Introductory Statistics	18696	234558	30608	220671	4291	89620
	(12368)	(218385)	(23363)	(110910)	(4171)	(77153)

Note: For some distance-learning enrollments in this table, the Standard Error (SE) was very large. See Appendix VIII.

doctoral-level departments showed a growth of 18% (1.4 SEs), the largest growth of the three levels of mathematics departments. There were an estimated 548 more sections of advanced-level mathematics courses in fall 2015 over fall 2010 at bachelors-level departments, an increase of 14% (0.8 SEs); however, we noted that estimated total enrollments in these courses were slightly lower in 2015 than in 2010 by Table E.2.

Table E.3 also supports the general pattern of growth in estimated enrollments observed in statistics courses noted already. From fall 2010 to fall 2105, the estimated total number of sections of statistics courses offered in mathematics departments increased 25% (2 SEs), while the estimated number of sections in statistics departments decreased, due to the fact that the estimated number of sections in masters-level statistics departments in fall 2015 was less than half the 2010 estimate (and Table E.2 showed enrollments decreased as well). The estimated number of sections of upper-level statistics courses in all levels of mathematics departments combined more than doubled from 2010 to 2015, and, at masters-level mathematics departments, more than tripled. In doctoral-level statistics departments Table E.3 shows the estimated number of sections of upper-level statistics courses increased by 73% (9.3 SEs) from 2010 to 2015.

The issue of what constitutes a course "section" has become more problematic, as courses now are taught in many different formats, and some departments list courses in different sections even though they are taught in the same room at the same time. The issue of enrollment in course sections is addressed further in Chapter 5, where enrollment tables are broken down by the format of section.

Table E.4: Distance education in four-year colleges and universities

The 2015 CBMS survey defined distance learning courses as "those courses offered by your institution for credit, in which the majority of the instruction occurs with the instructor and the students separated in time and/or place (e.g. courses in which the majority of the course is taught online, or by computer software, or by other technologies) including MOOCs that are offered for credit. (A MOOC is a 'massive open online course')". Various practices in distance learning courses were discussed in Chapter 2 (see Tables SP.8-SP.11B). While at four-year departments these enrollments are still a small percentage of total enrollments, yet these enrollments appear to be growing. Distance learning enrollments are a larger percentage of two-year college enrollments than of four-year college enrollments, and data on distance learning enrollment at two-year colleges is included here for comparison (more information regarding distance learning enrollments at two year-colleges is contained in Chapter 6).

Table E.4 shows that enrollments in distance learning courses were up in fall 2015 over fall 2010, for every category of courses in the table, with the total distance learning enrollments in Table E.4 for four-year mathematics departments (combined), in fall 2015 estimated at 86,197, more than double the fall 2010 estimate of 36,798. In fall 2015, at two-year colleges, estimated distance learning enrollments represented 11% of estimated precollege (distance learning + other) enrollments, 12% of College Algebra, Trigonometry and Pre-Calculus (combined) enrollments, 8% of Calculus I enrollments, and 12% of introductory statistics enrollments (all of these percentages, with the exception of introductory statistics, are up over 2010). At four-year mathematics departments, these estimated percentages in fall 2015 were 3%, 9%, 3%, and 7%, respectively, (all larger than in 2010), and in four-year statistics departments, 5% of the introductory statistics enrollment was taught in distance learning sections (same estimated percentage as in 2010). Distance learning estimated enrollments for individual courses (except for advanced-level courses) are contained in Appendix I; Chapter 2, Tables SP.11(A) and SP.11(B), present data on the advanced-level mathematics and statistics courses that were reported to be available in a distance learning format in 2015.

Table E.4 shows that the largest estimated distance learning course category enrollment in mathematics departments at four-year institutions in fall 2015 occurred in the category of College Algebra, Trigonometry and Pre-Calculus courses combined, where the estimated distance learning enrollment in fall 2015 was almost four times the fall 2010 estimate, increasing from 12,021 in fall 2010 to 45,226 (SE 9,043) in fall 2015. The next largest category of the distance learning enrollments in four-year mathematics departments was introductory statistics, where estimated distance learning enrollments increased 51% (1.6 SEs). Distance learning enrollments in both Calculus I and in Calculus II were more than 4 times the 2010 estimates, and Differential Equations and Linear Algebra combined distance learning enrollments were up 73% (1.1 SEs) from 2010. Many of the SEs for the data in Table E.4 are large, so these percentages of increase, as large as they appear, may be somewhat misleading; however, it does appear that distance learning enrollments are increasing in four-year mathematics departments and in two-year colleges. The estimated distance-learning enrollment in introductory statistics courses offered in statistics departments was almost identical in 2010 and 2015.

TABLE E.5 Number of sections (excluding distance learning) of calculus-level courses in mathematics departments taught by various types of instructor, by type of department in fall 2015, with fall 2010 figures in parentheses. This table can be compared to Table E.8 in CBMS2010, p. 92.

	Number of calculus-level sections taught by					
	Tenured/ tenure-eligible [1]	Other full-time	Part-time	Graduate Teaching Assistant	Unknown	Total Sections
Mathematics Departments						
Univ (PhD)	2803	2962	733	1370	454	8323
	(3120)	(2057)	(789)	(1289)	(721)	(7976)
Univ (MA)	2365	994	797	84	339	4579
	(3080)	(495)	(611)	(160)	(213)	(4559)
Coll (BA)	5896	1078	585	0	727	8285
	(6743)	(839)	(1223)	(0)	(771)	(9575)
Total	11064	5034	2115	1454	1520	21186
	(12943)	(3391)	(2622)	(1448)	(1705)	(22110)

[1] In 2010, the CBMS survey added the word "permanent" to the description "tenured/tenure eligible" that was used previously. In 2015 the word "permanent" was deleted.

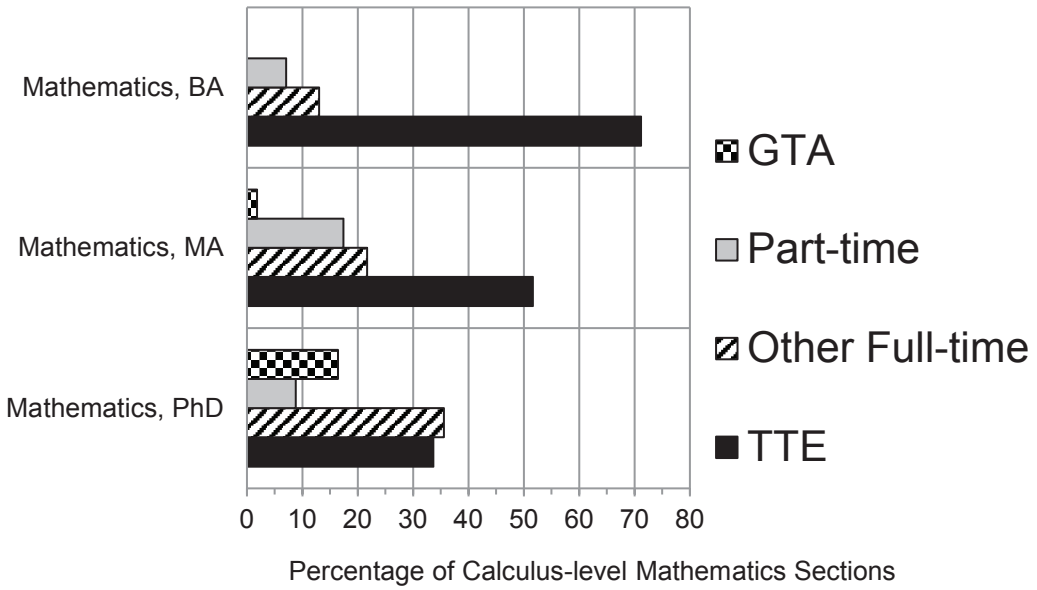

FIGURE E.5.1 Percentage of calculus-level mathematics sections in mathematics departments whose instructors were tenure/tenure-eligible (TTE), other full-time faculty, part-time faculty, and graduate teaching assistants (GTA), by type of department in fall 2015. (Percentages may not sum to 100 due to "unknown" instructor percentages.) (Note: Figure E.5.1 in CBMS2010, p. 98, included data on all mathematics courses offered.)

TABLE E.6 Number of sections (excluding distance learning) of introductory statistics courses taught in mathematics departments and statistics departments by type of instructor and type of department in fall 2015 with fall 2010 figures in parentheses. This table can be compared to Table E.9 in CBMS2010, p. 93.

	Number of introductory statistics sections taught by					
	Tenured/ tenure-eligible [1]	Other full-time	Part-time	Graduate Teaching Assistant	Unknown	Total Sections
Mathematics Departments						
Univ (PhD)	268 (251)	392 (243)	239 (124)	245 (274)	175 (77)	1319 (969)
Univ (MA)	781 (641)	467 (185)	216 (293)	0 (19)	29 (70)	1493 (1208)
Coll (BA)	2006 (2564)	725 (601)	1389 (1130)	30 (28)	411 (691)	4562 (5014)
Total	3055 (3456)	1584 (1029)	1844 (1547)	275 (320)	615 (838)	7374 (7191)
Statistics Departments						
Univ (PhD)	136 (262)	281 (202)	111 (103)	466 (243)	263 (302)	1256 (1113)
Univ (MA)	75 (318)	97 (93)	33 (113)	3 (17)	31 (96)	238 (638)
Total	210 (581)	378 (295)	144 (217)	468 (260)	295 (399)	1494 (1751)

Note: Round-off may make row and column sums seem inaccurate.

[1] In 2010, the CBMS survey added the word "permanent" to the description "tenured/tenure eligible" that was used previously. In 2015 the word "permanent" was deleted.

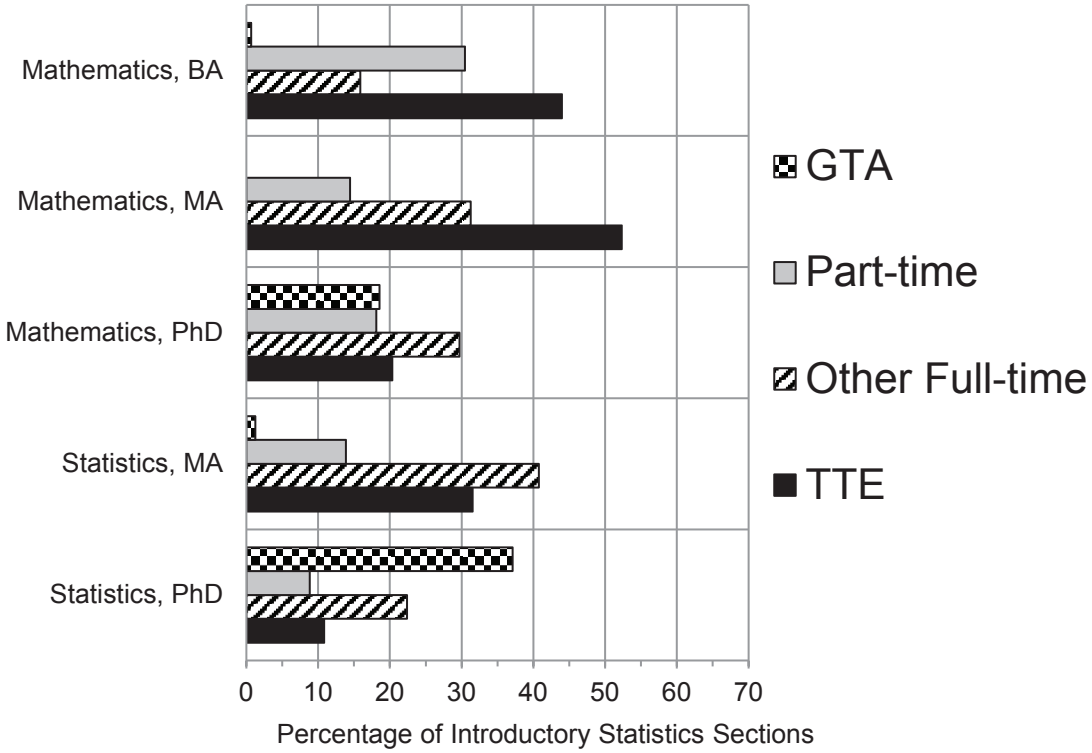

FIGURE E.6.1 Percentage of introductory statistics sections in mathematics and in statistics departments whose instructors were tenure/tenure-eligible (TTE), other full-time faculty, part-time faculty, and graduate teaching assistants (GTA), by type of department in fall 2015. (Percentages may not sum to 100 due to "unknown" instructor percentages.) (Note: Figure E.5.2. in CBMS 2010, p. 90, included data on all statistics courses offered.)

Tables E.5-E.9: Appointment type of instructors in mathematics and statistics courses at four-year mathematics and statistics departments in fall 2015

Past CBMS surveys have analyzed the appointment type of the instructors teaching mathematics and statistics courses at four-year departments. The 2000 survey generally tabulated percentages of enrollments taught by various rank instructors, while the 2005 survey switched to percentages of sections taught by instructors of various ranks. The 2015 survey continues the practice begun in 2005 of considering percentages of sections. In 2015, instructors were broken into the appointment type categories: tenured or tenure eligible (TTE), other full time (OFT) (a category that includes, for example, postdocs, faculty with appointments that are renewable (but not tenure-eligible), and academic visitors), part-time (PT), graduate teaching assistant (GTA), and unknown (a category that was used when the response did not account for all sections of a course). In the 2010 survey the label "permanent" was added to the description of the TTE category on the questionnaire (to include the small percentage of cases where an institution does not recognize tenure), and this change, unintentionally, may have added to the number of instructors in the TTE category instructors who have teaching positions that are regarded as permanent, although these faculty do not have tenure and are not eligible for tenure, at institutions that recognize tenure; these latter faculty should have been counted as OFT faculty. The 2015 survey instructions tried to make it more clear that such faculty should be counted as OFT faculty. To shorten the questionnaire, in 2015 the survey instrument asked for this breakdown of who is teaching the section only in calculus-level mathematics courses (including Calculus (in all flavors and levels), Differential Equations, Linear Algebra, and Discrete Mathematics), introductory statistics courses, and computer science courses taught in mathematics departments; for advanced-level courses, the survey asked for only the number of sections taught by TTE faculty. A similar scheme was used on the 2015 statistics department questionnaire. In the 2010 survey, this breakdown of the appointment type of the instructor was also sought for precollege-level and college algebra-level mathematics courses, but these questions were deleted from the 2015 survey instrument. In both 2010 and 2015 there were unknown rank instruc-

tors reported; the numbers of these unknown seem roughly comparable in the two surveys.

Appointment type of calculus-level instructors

Table E.5 and Figure E.5.1 summarize the appointment types of the calculus-level instructors in mathematics departments at four-year institutions in fall 2015. The estimated percentage of calculus-level sections taught by faculty at each rank, for each level of department, is presented. The total number of sections (excluding distance learning sections) is also given, and the numbers in parentheses are from the 2010 CBMS survey [CBMS2010, Table E.8, p 92]. Table E.6 and Figure E.6.1 give these appointment types for introductory statistics courses in mathematics and statistics departments, by level of department (compare with CBMS2010, Table E.8, p 92), Table E.7 gives these appointment types for advanced-level courses in mathematics and statistics departments, by level of department (compare with CBMS2010, Table E.12, p. 96), Tables E.8 and E.9, and Figure E.9.1, gives these ranks for computer science courses taught in mathematics departments, by level of department (compare with CBMS2010, Tables E.10 and E.11, p. 94).

Although by Table E.3 the estimated number of calculus-level sections decreased by 4% (0.6 SEs) from 2010 to 2015, Table E.5 shows that, over all levels of mathematics departments combined, there was a 48% (2.9 SEs) increase in the estimated number of calculus-level sections taught by OFT faculty, and a 15% (2.6 SEs) decrease in the estimated number of sections taught by TTE faculty. This trend occurred across all levels of mathematics departments: from fall 2010 to fall 2015, the estimated number of sections of calculus-level courses taught by OFT faculty increased 44% (2 SEs) at doctoral-level departments, were double (2.2 SEs) in masters-level departments, and increased 28% (1 SE) in bachelors-level departments. Figure E.5.1 presents a bar graph, displaying, at each level of department, the estimated percentage of sections taught by each appointment type of faculty, and it shows that, in doctoral-level departments, in fall 2015, slightly larger percentage of sections of calculus-level courses were taught by OFT faculty than by TTE faculty, in contrast to the situation in the other two levels of mathematics departments, and different from fall 2010, when a larger percentage of sections were taught by TTE faculty. GTAs taught an estimated 16% of sections of calculus-level courses offered at doctoral-level mathematics departments in fall 2015, the same estimate as in 2010. Over all levels of mathematics departments combined, the estimated percentage of calculus-level sections taught by TTE faculty has been decreasing; it was estimated at 61% in 2005, 59% in 2010, and 52% in 2015. The estimated number of sections taught by PT faculty declined, most dramatically at the bachelors-level departments, where the estimated number of sections of calculus-level courses taught by PT faculty in fall 2015 was less than half the 2010 estimate. We note that bachelors-level departments were the only level where the estimated number of sections of calculus-level courses declined from fall 2010 to fall 2015 (Table E.3) and, also, where estimated calculus enrollments declined (Table E.2), so, perhaps, these declines led to fewer PT faculty. For further discussion of the decline in TTE faculty teaching Calculus classes, see Chapter 5, and also David Bressoud's Launchings blog http://launchings.blogspot.com/ for October 2017.

Appointment type of statistics instructors

Table E.6 breaks down the estimated number of sections of introductory statistics courses taught in mathematics departments, and in statistics departments, by the appointment type of the instructor; the table invites comparison of the percentages of the appointment types of the instructors in mathematics and statistics departments, which differ over the two kinds of departments, and over the different levels of departments (see Figure E.6.1). The estimated total number of sections of introductory statistics courses was slightly larger in fall 2015 than in fall 2010, in mathematics departments, but slightly smaller in fall 2015 in statistics departments, due to a decreased number of sections in masters-level statistics departments. Over all levels of mathematics departments combined, in fall 2015, an estimated 41% of the introductory-level statistics sections were taught by TTE faculty, 21% were taught by OFT faculty, 25% were taught by PT faculty, and 4% were taught by GTAs; in all levels of statistics departments combined, an estimated 14% of the introductory-level sections were taught by TTE faculty, 25% were taught by OFT faculty, 10% were taught by PT faculty, and 31% were taught by GTAs. Comparing these percentages to the estimates obtained in 2010, we see in mathematics departments, from 2010 to 2015, a slight shift toward OFT faculty, and, in statistics departments, from 2010 to 2015, there was roughly a reversal of the percentage of sections taught by TTE faculty and those taught by GTAs. In doctoral-level statistics departments, the estimated number of introductory statistics sections taught by TTE faculty decreased 48% (11.5 SEs) and the number of sections taught by GTAs increased 92% (5 SEs).

Appointment type of advanced-level course instructors

Table E.7 presents the appointment types of instructors in advanced-level mathematics and statistics courses, in mathematics and statistics departments. For advanced-level courses, the survey instruments asked for only the numbers of sections taught by TTE faculty. In fall 2015 (respectively, fall 2010), in

TABLE E.7 Number of sections of advanced mathematics (including operations research) and statistics courses in mathematics departments, and number of sections of advanced statistics courses in statistics departments, taught by tenured/tenure-eligible[1] (TTE) faculty, and total number of advanced level sections, by type of department in fall 2015 with fall 2010 data in parentheses. This table can be compared to Table E.12 in CBMS2010, p. 95.

Mathematics Departments	Sections taught by TTE [1]	Total sections	Statistics Departments	Sections taught by TTE [1]	Total sections
Advanced Mathematics courses					
Univ (PhD)	2519 (2500)	3676 (3266)			
Univ (MA)	1769 (2098)	2633 (3304)			
Coll (BA)	3236 (3548)	4461 (3913)			
Total advanced mathematics	7525 (8146)	10771 (10483)			
Advanced Statistics courses			Advanced Statistics courses		
Univ (PhD)	452 (438)	752 (561)	Univ (PhD)	394 (324)	796 (452)
Univ (MA)	656 (308)	1432 (420)	Univ (MA)	140 (382)	174 (442)
Coll (BA)	1010 (721)	1776 (929)			
Total advanced statistics	2118 (1467)	3960 (1910)	Total advanced statistics	533 (706)	970 (894)
Total all advanced courses	9643 (9613)	14731 (12394)	Total all advanced courses	533 (706)	970 (894)

Note: Round-off may make row and column sums seem inaccurate.

[1] In 2010, the CBMS survey added the word "permanent" to the description "tenured/tenure eligible" that was used previously. In 2015, the word "permanent" was deleted.

TABLE E.8 Number of sections (excluding distance learning) of lower-level computer science taught in mathematics departments, by type of instructor and type of department in fall 2015, with fall 2010 figures in parentheses. This table can be compared to Table E.10 in CBMS2010, p. 94.

	Number of lower-level computer science sections taught by					
	Tenured/ tenure-eligible/ permanent [1]	Other full-time	Part-time	Graduate Teaching Assistant	Unknown	Total Sections
Mathematics Departments						
Univ (PhD)	30 (25)	71 (29)	8 (29)	0 (15)	0 (4)	109 (101)
Univ (MA)	112 (116)	48 (0)	26 (30)	0 (0)	0 (0)	186 (146)
Coll (BA)	899 (1089)	339 (397)	277 (656)	0 (14)	472 (73)	1987 (2230)
Total	1042 (1229)	458 (426)	311 (715)	0 (30)	472 (77)	2282 (2477)

Note: Round-off may make row and column sums seem inaccurate.

[1] In 2010, the CBMS survey added the word "permanent" to the description "tenured/tenure eligible" that was used previously. In 2015 the word "permanent" was deleted.

doctoral-level mathematics departments, an estimated 69% (respectively, 77%) of sections of advanced-level mathematics courses were taught by TTE faculty, in masters-level departments, an estimated 67% (respectively, 63%) of sections of advanced-level mathematics courses were taught by TTE faculty, and in bachelors-level departments, an estimated 73% (respectively, 91%) of sections of advanced-level mathematics courses were taught by TTE faculty. The estimated percentage of sections of advanced-level statistics courses taught by TTE faculty, in all levels of mathematics departments combined, dropped from 78% in fall 2010, to 53% in fall 2015; in statistics departments, the corresponding estimated percentages dropped from 79% to 55%. These changes in the percentages are another indication of the apparently decreasing role in undergraduate teaching played by TTE faculty.

Appointment type of computer science instructors

Tables E.8 and E.9 give the estimated number of sections of lower-level and middle-level computer sciences courses taught by faculty at the various appointment types; the estimated number of sections of lower-level computer science taught by PT faculty decreased, while the estimated number of sections of upper-level computer science courses taught by PT faculty increased. Figure E.8.1 displays the percentages of faculty at each rank, for all levels of computer science courses taught in mathematics departments combined.

Tables E.10 and E.11: Average section size

Table E.10 summarizes data on the average section size for each of the course categories, broken down by the level of department in fall 2015 (and fall 2010), and the overall averages over the last four CBMS surveys. The Mathematical Association of America has recommended 30 students as the appropriate maximum class size for undergraduate mathematics courses [MAAGuidelines], and the CBMS surveys have shown that this maximum is not always maintained. In particular, section sizes at the doctoral-level departments often substantially exceed the MAA Guidelines. As we have noted, the definition of a section caused some problems with responses in 2010, particularly with calculus sections.

Table E.10 shows that the largest changes from 2010 in the estimated average section size in 2015

TABLE E.9 Number of sections (excluding distance learning) of middle-level computer science taught in mathematics departments, by type of instructor and type of department in fall 2015, with fall 2010 figures in parentheses. This table can be compared to Table E.11 in CBMS2010, p. 94.

	Number of middle-level computer science sections taught by					
	Tenured/ tenure-eligible/ permanent [1]	Other full-time	Part-time	Graduate Teaching Assistant	Unknown	Total Sections
Mathematics Departments						
Univ (PhD)	17 (31)	0 (11)	5 (2)	0 (7)	9 (0)	31 (51)
Univ (MA)	55 (92)	4 (0)	9 (0)	0 (0)	0 (0)	69 (92)
Coll (BA)	549 (521)	311 (156)	161 (95)	0 (0)	107 (0)	1128 (769)
Total	621 (644)	316 (168)	174 (97)	0 (7)	116 (0)	1227 (912)

Note: Round-off may make row and column sums seem inaccurate.

[1] In 2010, the CBMS survey added the word "permanent" to the description "tenured/tenure eligible" that was used previously. In 2015 the word "permanent" was deleted.

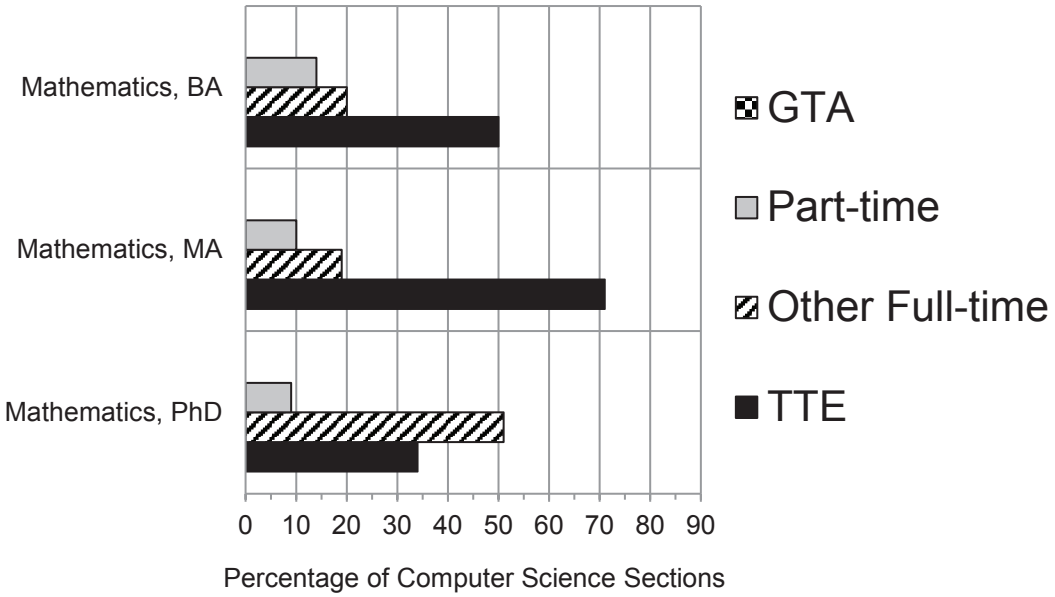

FIGURE E.9.1 Percentage of computer science sections (all levels) in mathematics departments whose instructors were tenure/tenure-eligible faculty (TTE), other full-time faculty, part-time faculty, and graduate teaching assistants (GTA), by type of department in fall 2015. (Percentages may not sum to 100 due to "unknown" instructor percentages.) This figure can be compared to Figure E.5.3 in CBMS2010, p. 91.

TABLE E.10 Average section size (excluding distance learning) for undergraduate mathematics, statistics, and computer science courses in mathematics and statistics departments, by level of course and type of department in fall 2015, with fall 2010 data, when available, in parentheses. Also, all departments' average section sizes from previous CBMS surveys. This table can be compared to Table E.13 in CBMS2010, p. 96.

	Average section size Fall 2015 (2010)										
	Mathematics Depts				Statistics Depts			All Departments			
	Univ (PhD)	Univ (MA)	Coll (BA)	Overall Math	Univ (PhD)	Univ (MA)	Overall Stat	2000	2005	2010	2015
Mathematics courses											
Precollege	34 (36)	30 (30)	29 (23)	30 (27)				29	28	27	30
Introductory (incl. Precalc)	47 (47)	31 (31)	20 (27)	30 (33)				35	33	33	30
Calculus level	55 (48)	34 (31)	21 (24)	37 (34)				32	32	34	37
Advanced Mathematics	22 (20)	11 (12)	10 (12)	14 (14)				13	14	14	14
Statistics courses											
Introductory Statistics	40 (52)	39 (32)	27 (26)	32 (30)	59 (49)	65 (38)	60 (45)	37	35	33	37
Upper Statistics	23 (27)	16 (13)	11 (12)	15 (17)	57 (33)	27 (27)	52 (30)	22	19	21	22
CS courses											
Lower CS	38 (29)	24 (22)	18 (20)	19 (21)				22	19	21	19
Middle CS	20 (18)	22 (15)	13 (12)	13 (12)				22	9	12	13
Upper CS	NA (15)	19 (16)	13 (11)	14 (11)				11	8	11	14

NA = Not applicable (there were no upper division computer science courses at doctorate-granting institutions).

TABLE E.11 Average recitation size in Mainstream Calculus I and II and other Calculus I courses and in introductory statistics courses that are taught using lecture/recitation method, by type of department in fall 2015, with fall 2010 data in parentheses. Distance-learning sections are not included. (A calculus course is "mainstream" if it leads to the usual upper-division mathematical sciences courses.)

	Average recitation section size		
For Lecture/Recitation Courses	Univ (PhD)	Univ (MA)	College (BA)
Calculus Courses			
Mainstream Calculus I	31	34	17
	(29)	(30)	(30)
Mainstream Calculus II	29	14	9
	(29)	(25)	(33)
Other Calculus I	36	16	9
	(30)	(19)	(15)
Introductory Statistics			
in Mathematics Depts	33	19	26
	(28)	(29)	(32)
in Statistics Depts	25	28	na
	(30)	(34)	na

occurred in sections of courses in statistics departments and in sections of calculus-level courses in doctoral-level mathematics departments. In both levels of statistics departments combined (as well as in each individually) there was an increase in the estimated average section size; over both levels of statistics departments combined, in introductory-level classes, estimated average section size rose from 45 in fall 2010 to 60 (with SE 2.4) in 2015, a significant change, and in sections of upper-level statistics courses, estimated average section size grew from 30 in fall 2010 to 52 (with SE 2.0) in fall 2015, again a significant change. In doctoral-level mathematics departments, average section size rose from 48 in fall 2010 to 55 (SE 3) in fall 2015, an increase of more than 2 SEs.

Table E.11 presents the estimated average size of recitation sections in Calculus and introductory statistics courses in mathematics and statistics departments that were taught in a lecture/recitation format. The SEs in the masters-level departments were generally large. The bachelors-level estimated average recitation section size decreased significantly from fall 2010 to fall 2015, but the fall 2010 estimates were double the 2005 estimates. Perhaps the most interesting change in estimated average size of recitation sections is the increase in Non-Mainstream Calculus I estimated average recitation section size in doctoral-level departments, from 30 in fall 2010, to 36 (SE 1.7) in fall 2015. Table FY.2 in Chapter 5 will show large estimated average section size in “other” formats than lecture/recitation for Non-Mainstream Calculus I at doctoral-level mathematics departments.