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 fourteen tables describe

- the number of bachelors degrees awarded through the nation's mathematics and statistics departments (Table E.1),
- enrollments in mathematical sciences courses (Tables E.2–E.4),
- the kinds of instructors who teach undergraduate courses in mathematics and statistics departments (Tables E.5–E.12), and
- average class sizes and average sizes of recitation sections used in lecture/recitation classes (Tables E.13–E.14).

Because there is considerable variation among departmental practices based on highest degree offered, we present the data by type of department as well as by level and type of course.

The tables in this chapter expand upon Tables S.2 and S.4 of Chapter 1, and Chapter 5 provides additional detail about first-year courses. Mathematics and statistics courses and enrollments in two-year colleges are discussed in Chapter 6.

Highlights

- The total number of mathematical sciences bachelors degrees granted through the nation's mathematics and statistics departments in the 2004–2005 academic year was about five percent below the number granted five years earlier. This was caused by sharp declines in bachelors degrees in mathematics education and computer science that were granted through mathematics and statistics departments, declines that more than offset increases in the numbers of mathematics and statistics majors. See Table E.1.
- Hidden within the five percent decrease in overall mathematical sciences bachelors degrees was a major shift in the source of mathematical sciences bachelors degrees. In the 2004–2005 academic year, the number of bachelors degrees granted through doctoral mathematics departments was 41% larger than the number granted during 1999–2000, while the number granted through masters- and bachelors-level departments declined by 27% and 19% respectively from the levels of 1999–2000. However, bachelors-only departments continued to grant the largest number of mathematical sciences bachelors degrees. See Table E.1.
- The percentage of mathematical sciences bachelors degrees granted to women declined from 43% in academic year 1999–2000 to 40% in 2004–2005. See Table E.1.
- Total 2005 fall enrollments in the nation's mathematics and statistics departments declined by about 3% from the levels of fall 2000 and yet remained 8% above the levels of fall 1995. That 3% decline resulted from substantial enrollment losses in masters-level departments that more than offset enrollment gains in doctoral departments. Enrollments in bachelors-level departments remained essentially unchanged from fall 2000. If only mathematics and statistics courses are considered, i.e., if computer science courses are excluded, then enrollments in fall 2005 were essentially the same as in fall 2000 and were about 11% above the levels of fall 1995. See Table E.2.
- Total enrollments in calculus-level courses (which include courses in linear algebra and differential equations as well as calculus courses of various kinds) rose by about 3% from the levels of fall 2000 and were about 9% above the levels of fall 1995. See Table E.2.
- Combined enrollments in advanced mathematics and advanced statistics courses rose by about 8% over the levels of fall 2000 and by about 21% over the levels of fall 1995. That 8% increase over fall 2000 included a remarkable 22% increase in advanced mathematics and advanced statistics enrollments in doctoral mathematics departments and a roughly 31% increase over corresponding doctoral department enrollment levels in fall 1995. See Table E.2.
- In fall 2005, distance education, also called distance learning, was used much more widely in

two-year colleges than in four-year colleges and universities. (CBMS studies, including CBMS2005, have defined distance education as any teaching method in which at least half of the students in a course receive the majority of their instruction in situations where the instructor is not physically present.) About two-tenths of one percent of enrollments in Calculus I courses in four-year colleges and universities in fall 2005 were taught using distance education techniques, compared to about 5% of Calculus I enrollments in two-year colleges. In elementary statistics courses, about two percent of enrollments in the mathematics and statistics departments of four-year colleges and universities were taught using distance learning, compared to over 8% of corresponding enrollments in two-year colleges. See Table E.4.

- The decline in the percentage of mathematical science courses taught by tenured and tenure-eligible faculty that was observed in CBMS2000 continued, coupled with an increase in the percentage of courses taught by "other full-time faculty," a category that includes postdocs, visiting faculty, and a large cohort of non-doctoral full-time faculty. See Tables E.5 through E.12.
- Except in advanced-level courses, average section sizes in mathematical science courses declined slightly from the levels recorded in CBMS2000 but remained above the size recommended by Mathematical Association of America guidelines [MAAGuidelines]. See Table E.13.
- CBMS2005 presents data on the size of recitation sections used in calculus and elementary statistics courses taught in the lecture/recitation format (see Table E.14), and distinguishes between doctoral and non-doctoral faculty in a study of who teaches freshman and sophomore courses. See Tables E.6 through E.12.

Terminology: The two preceding CBMS survey reports are called CBMS1995 and CBMS2000.

Recall that in CBMS2005, 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 by the nation's mathematics and statistics departments and 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 CBMS2005 totals when the courses (and majors) are taught in (granted through) a mathematics or statistics department. CBMS2005 data does 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 on the basis of highest degree offered. For example, the term "bachelors-level department" refers to one that does not offer masters or doctoral degrees.

Table E.1: Bachelors degrees granted between July 1, 2004 and June 30, 2005

CBMS2000 revealed a one percent decrease in the number of bachelors degrees awarded through the nation's mathematics and statistics departments between the 1994–1995 academic year and the 1999–2000 academic year. CBMS2005 found a continuation of that trend, with the total number of bachelors degrees granted through the nation's mathematics and statistics departments dropping from 22,614 in the 1999–2000 academic year to 21,440 in the 2004–2005 academic year, a decline of about 5%.

If one looks only at the nation's mathematics departments (which granted about 97% of the 21,440 U.S. bachelors degrees in mathematics and statistics), one sees a variety of bachelors degree programs in a broad range of mathematical sciences—mathematics, applied mathematics, statistics, actuarial science, mathematics education, and (particularly among departments in four-year colleges) also computer science. The total number of bachelors degrees granted through the nation's mathematics departments declined slightly (about one-half of 1%) between the 1995 and 2000 CBMS surveys and fell by another 6% between 2000 and 2005, with the result that the total number of bachelors degrees granted through mathematics departments in the 2004–2005 academic year was about 94% of the number granted in the 1994–1995 academic year.

The number of statistics majors receiving their bachelors degrees through statistics departments in the 2004–2005 academic year rose by about 56% from the levels reported in CBMS2000 for 1999–2000 and was about 9% above the 1994–1995 level. Although this growth rate is impressive, it does not have a major impact on the total number of mathematical sciences bachelors degrees produced in the U.S. because bachelors degrees awarded through statistics departments make up less than 3% of the nation's total number of mathematics and statistics majors.

Table E.1 presents data on several subcategories of the broad mathematical sciences major within mathematics departments. Mathematics education, statistics, and computer science are listed separately, with all other majors granted through mathematics departments lumped into the mathematics category. The number of majors in that remainder category rose by about 7% over CBMS2000 levels and was about 2% higher in 2004–2005 than in 1994–1995. That 7% increase was counterbalanced by decreases in each of the other surveyed bachelors-degree categories (statistics, mathematics education, and computer science) in mathematics departments. For example, the number of mathematics education majors in mathematics departments decreased from 4,991 reported in CBMS2000 to 3,370 in CBMS2005, a decline of about 32%, and the number of computer science majors graduating from mathematics departments fell from 3,315 in the 1999–2000 academic year to 2,604 in the 2004–2005 year, a decline of about 21%. See Figure E.1.2.

Table E.1 in CBMS1995, CBMS2000, and CBMS2005 can be used to study the gender distribution of mathematical sciences bachelors degrees. In the 1994–1995 academic year, about 42% of the mathematical sciences bachelors degrees granted through mathematics and statistics departments were awarded to women, about 43% in 1999–2000, and about 40% in the 2004–2005 academic year. There is some variation based on type of department. For example, the percentage of bachelors degrees awarded to women by doctoral mathematics departments declined from 43% in 1994–1995 to 40% in 1999–2000, and to 37% in 2004–2005. The corresponding percentages in masters-only and bachelors-only mathematics departments bounced around between 1994–1995 and 2004–2005 and do not reveal a steady trend. The percentage of mathematics education degrees awarded to women through mathematics departments rose from 49% in 1994–1995 to about 60% in 2004–2005 (with most of the increase occurring between 1994–1995 and 1999–2000). Among computer science bachelors degrees granted through mathematics departments in 2004–2005, only 18% went to women, down from 24% in 1999–2000. In the nation's statistics departments, about 38% of bachelors degrees were awarded to women in 1994–1995, about 43% in 1999–2000, and about 42% in 2004–2005. In mathematics departments, women accounted for about 48% of all bachelors degrees awarded in 2004–2005, down from 59% in 1999–2000. See also Figure E.1.2.

Table E.1 reveals a potentially important shift in the kinds of mathematics departments through which mathematical sciences majors earned their bachelors degrees. Figure E.1.3 shows a jump in the percentage of all bachelors degrees from mathematics departments that were awarded through doctoral mathematics departments, with a corresponding drop in the percentage of bachelors degrees awarded by non-doctoral departments between 1999–2000 and 2004–2005. The declines for masters-level mathematics departments are particularly large; the number of majors produced by those departments dropped 27% from levels reported in CBMS2000. Some of that decline may have been a consequence of changes between 2000 and 2005 in the American Mathematical Society (AMS) departmental classification that was the basis for CBMS studies in 2000 and 2005. However, CBMS2005 is not the first CBMS survey to report a major decline in the number of bachelors degrees granted through masters-level mathematics departments; CBMS2000 reported a 17% decline in bachelors degrees granted through masters-level departments between the academic years 1994–1995 and 1999–2000.

As separate departments of computer science are created, mathematics departments lose computer science enrollments and majors. Consequently, it makes sense to track the number of bachelors degrees awarded through mathematics departments, excluding computer science degrees, in order to study bachelors degree productivity of mathematics departments. CBMS1995 showed that in the 1994–1995 academic year, 19,593 non-computer-science bachelors degrees were awarded through the nation's mathematics departments. CBMS2000 and CBMS2005 show that total dropped by about 4% between the 1994–1995 and 1999–2000 academic years, and by another 4% between the 1999–2000 and 2004–2005 academic years, reaching 18,222 in academic year 2004–2005 for a total decline of about 7% from ten years earlier.

Data from CBMS1995, CBMS2000, and CBMS2005 show that bachelors-level mathematics departments consistently produced at least 40% of the non-computer-science bachelors degrees granted through mathematics departments, with doctoral departments' percentage rising from 31% in 1995 to 40% in 2005. The percentage of non-computer-science bachelors degrees granted through masters-level mathematics departments dropped from 30% in 1995, to 20% in 2000, to 19% in 2005. A graph of these percentages closely resembles the graph in Figure E.1.3.

TABLE E.1 Bachelors degrees in mathematics, mathematics education, statistics, and computer science in mathematics departments and in statistics departments awarded between July 1, 2004 and June 30, 2005, by gender of degree recipient and type of department.

	Mathematics Departments				Statistics Departments			
Bachelors degrees in Math and Stat Depts	Univ (PhD)	Univ (MA)	Coll (BA)	**Total Math Depts**	Univ (PhD)	Univ (MA)	**Total Stat Depts**	**Total Math & Stat Depts**
Mathematics majors (including Act Sci, Oper Res, and joint degrees)								
Men	4112	1350	3358	**8820**				**8820**
Women	2282	1027	2482	**5791**				**5791**
(Percentage of women)	(36%)	(43%)	(43%)	**(40%)**				**(40%)**
Total Math degrees	**6393**	**2377**	**5839**	**14610**				**14610**
Mathematics Education majors								
Men	296	401	645	**1341**				**1341**
Women	470	628	930	**2028**				**2028**
	(61%)	(61%)	(59%)	**(60%)**				**(60%)**
Total Math Ed degrees	**766**	**1029**	**1575**	**3369**				**3369**
Statistics majors								
Men	64	44	17	**125**	237	120	**357**	**482**
Women	69	41	6	**116**	184	73	**257**	**373**
	(52%)	(48%)	(26%)	**(48%)**	(44%)	(38%)	**(42%)**	**(44%)**
Total Stat degrees	**133**	**85**	**23**	**241**	**421**	**193**	**614**	**855**
Computer Science majors								
Men	413	314	1412	**2139**				**2139**
Women	58	72	335	**465**				**465**
	(12%)	(19%)	(19%)	**(18%)**				**(18%)**
Total CS degrees	**471**	**386**	**1747**	**2603**				**2603**
Total degrees - Men	**4884**	**2109**	**5431**	**12424**	**237**	**120**	**357**	**12780**
Total degrees - Women	**2879**	**1768**	**3752**	**8399**	**184**	**73**	**257**	**8656**
	(37%)	**(46%)**	**(41%)**	**(40%)**	**(44%)**	**(38%)**	**(42%)**	**(40%)**
Total all degrees	**7763**	**3877**	**9183**	**20823**	**421**	**193**	**614**	**21437**

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

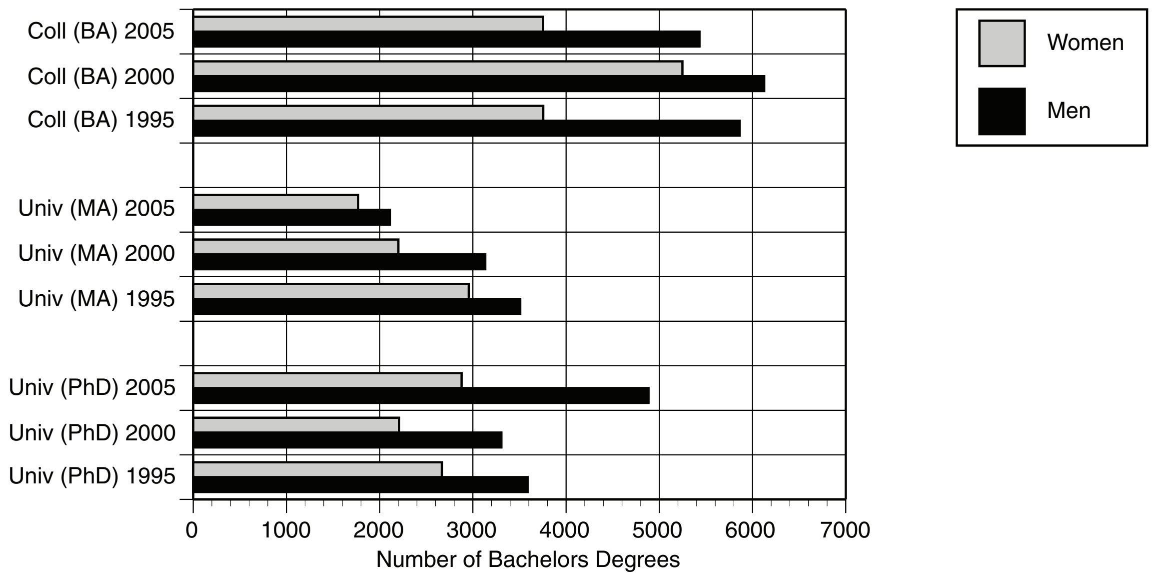

FIGURE E.1.1 Bachelors degrees in mathematics departments awarded between July 1 and June 30 in the academic years 1994-1995, 1999-2000, and 2004-2005, by gender and type of department.

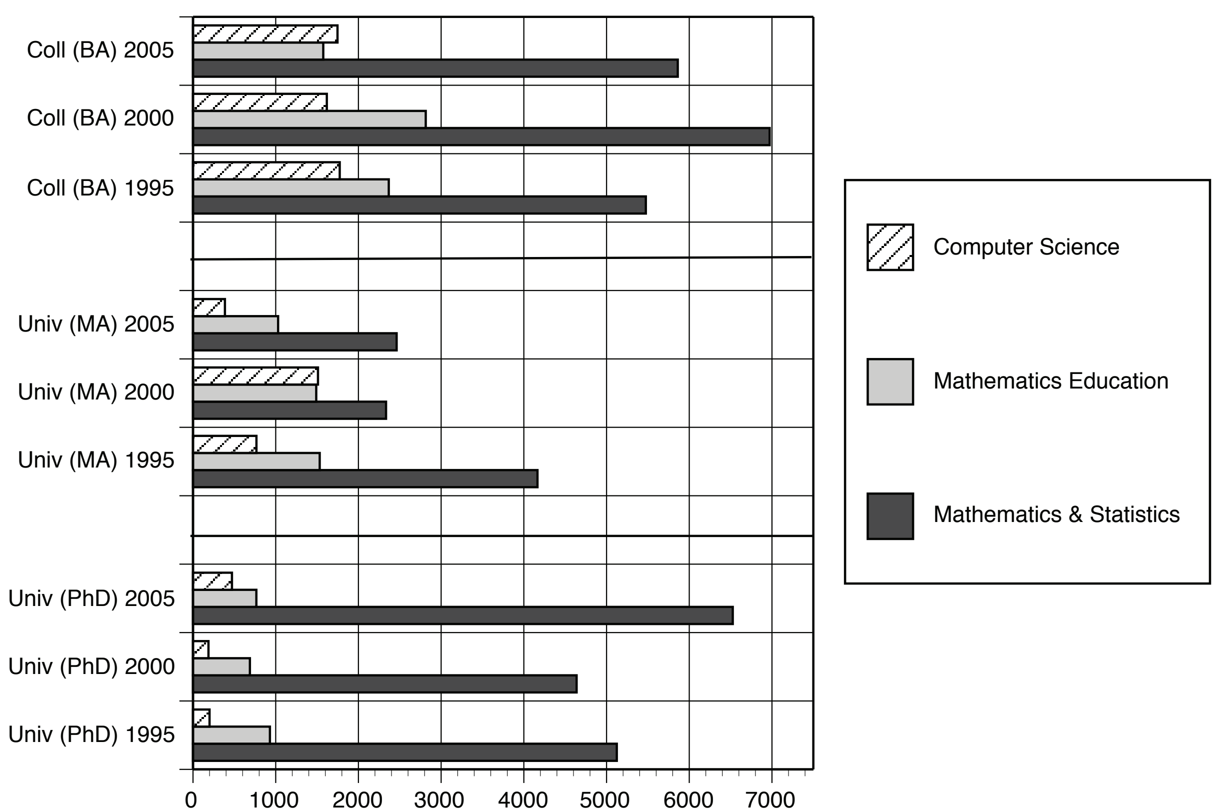

FIGURE E.1.2 Number of bachelors degrees granted in academic years 1994-1995, 1999-2000, and 2004-2005 by type of major and type of department.

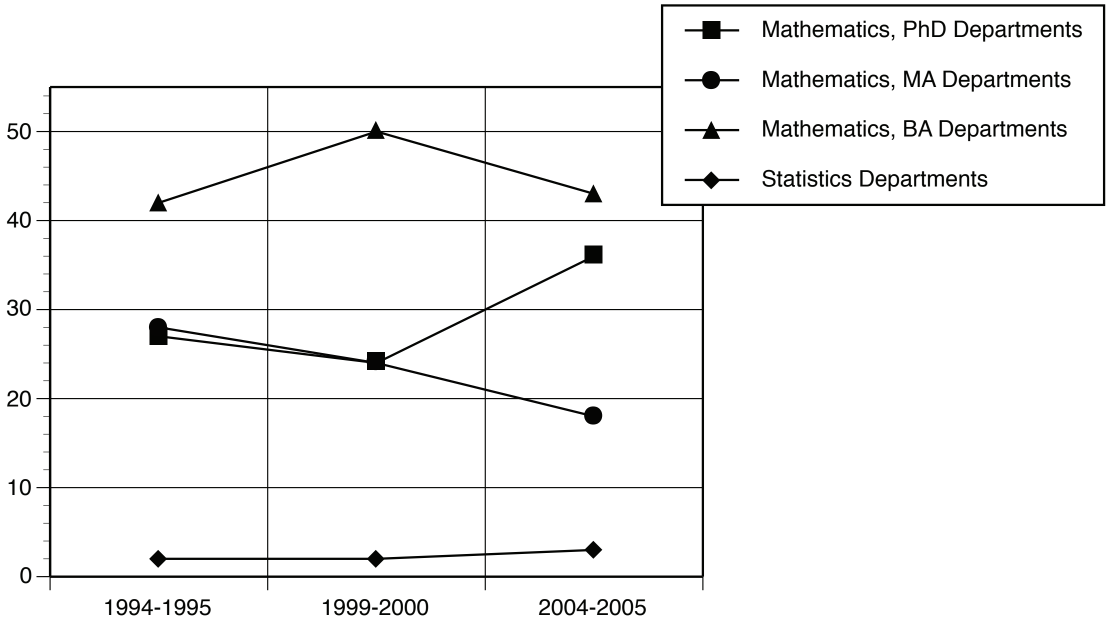

FIGURE E.1.3 Percentage of mathematical sciences bachelors degrees (including computer science) awarded through mathematics and statistics departments of various kinds in academic years 1994-1995, 1999-2000, and 2004-2005.

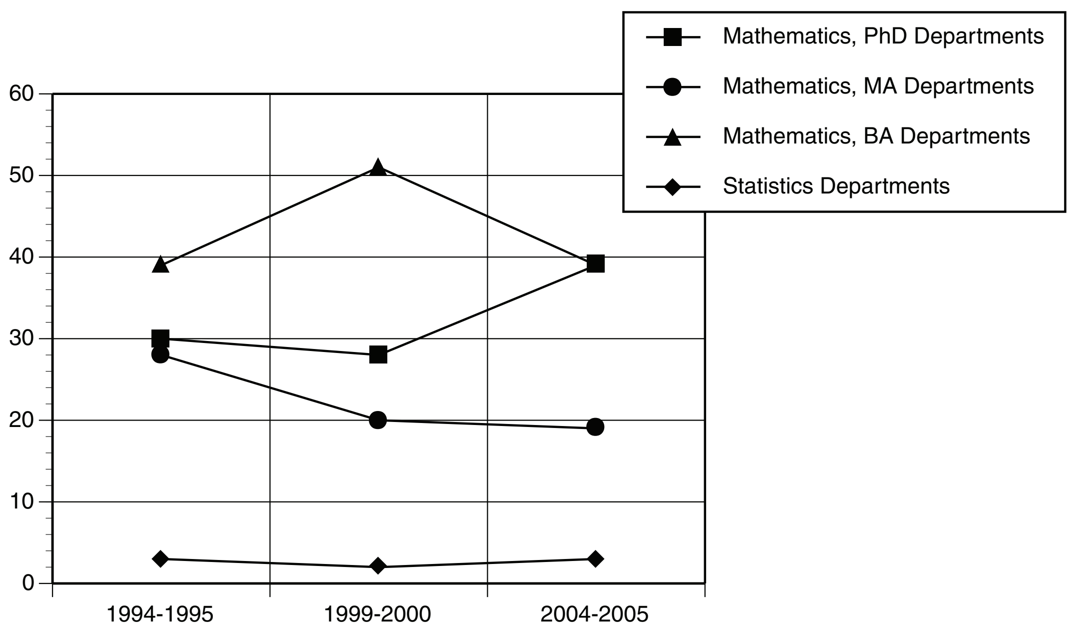

FIGURE E.1.4 Percentage of mathematics and statistics bachelors degrees (excluding computer science) awarded through mathematics and statistics departments of various kinds in academic years 1994-1995, 1999-2000, and 2004-2005.

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

CBMS2005 Table E.2 divides mathematical sciences department enrollments into three broad categories: mathematics courses, statistics courses, and computer science courses. Total enrollments in all fall-term courses in mathematics and statistics departments at four-year colleges and universities declined by about 3% from levels recorded in CBMS2000. This was due to a pronounced decline in the number of computer science enrollments in mathematics departments, from 123,000 in fall 2000 to 57,000 in fall 2005. Statistics enrollments in mathematics and statistics departments increased by about 6%, and mathematics enrollments held essentially steady at fall 2000 levels. The decline in computer science enrollments more than offset slight enrollment increases in the combination of all mathematics and statistics courses. Even though total enrollments dropped from fall 2000 levels, they were about 8% above the levels of fall 1995.

Table E.2 reveals that the change in total enrollments varied considerably among departments of different kinds. Figure E.2.3 shows that enrollment growth in doctoral mathematics departments outstripped enrollment growth in bachelors-level mathematics departments, while in masters-level departments, there was a decline. Between fall 2000 and fall 2005, for example, enrollment in doctoral mathematics departments grew by about 7% (from 720,000 to 769,000), while total enrollments in masters-level departments dropped by over 20% (from 534,000 to 417,000), and total enrollment in bachelors-level departments increased marginally (from 654,000 to 659,000) . The reported 22% enrollment decline in masters-level departments may be misleading. As noted above, some of the decrease was due to changes made in the American Mathematical Society departmental classification system between 2000 and 2005.

Combined fall-term statistics enrollments in mathematics and statistics departments grew by about 6% between 2000 and 2005, compared to an 18% increase between 1995 and 2000. The majority (about 70%) of all statistics course enrollments were in mathematics departments, and the majority of statistics enrollments in mathematics departments were in bachelors-level departments. (See Figure E.2.2.) Statistics course enrollments in mathematics departments grew by 20% between fall 1995 and fall 2000, and by 6% between fall 2000 and fall 2005.

Total enrollments in calculus-level courses are sometimes used as a predictor for growth in the number of science, technology, engineering, and mathematics (STEM) professionals. Previous CBMS studies included linear algebra and differential equations courses as calculus-level courses, and CBMS2005 continued that practice. (Separate enrollment totals for individual calculus courses are given in Appendix I of this report.) The nation's combined calculus-level enrollments grew by about 6% between fall 1995 and fall 2000, and grew by another 3% between fall 2000 and fall 2005. That growth was concentrated primarily in doctoral-level mathematics departments. In fall 2005, calculus-level enrollments in doctoral departments were up 14% from the level of fall 2000, and up almost 30% from the level of fall 1995. By contrast, calculus-level enrollments in masters departments dropped by almost a third between CBMS2000 and CBMS2005, and in fall 2005 were about 29% below the levels of fall 1995. Once again we note that some of this decrease may have been an artifact of changes in the AMS departmental classification system. Bachelors-level departments saw their calculus-level enrollments rebound to 1995 levels, after a marked decrease between fall 1995 and fall 2000.

The combination of all advanced mathematics and upper-level statistics enrollments in mathematics and statistics departments is another predictor for the number of future STEM professionals, and is also a predictor for the number of mathematics and statistics majors. Combined upper-level enrollments rose to 169,000 in fall 2005, an almost 8% increase over figures reported in CBMS2000 and an almost 21% increase over corresponding figures in CBMS1995. The largest gains were in doctoral mathematics departments, where the combination of advanced mathematics and upper-level statistics enrollments rose by about 22% from the levels of fall 2000 and by about 31% when compared with fall 1995. Masters-level mathematics departments saw an 8% decline in the number of upper-division mathematics and statistics enrollments between 2000 and 2005, and a roughly 9% decline from the levels of fall 1995. In bachelors-level mathematics departments, advanced mathematics and upper-level statistics enrollments were essentially unchanged from fall 2000 levels, and were up by about 12% compared to fall 1995. In statistics departments, upper-level enrollments grew by about 15% between fall 2000 and fall 2005, with almost all of the growth occurring in doctoral statistics departments. Compared to fall 1995, upper-level enrollment in statistics departments in fall 2005 rose by almost 44%.

Table E.3 reflects departmental teaching effort in fall 2005 in a different way, by showing the number of sections offered rather than the total enrollment. The total number of sections offered by the nation's mathematics and statistics departments dropped by about 2% (as did total enrollments). The number of sections offered by doctoral mathematics departments rose by about 9% between fall 2000 and fall 2005, while the number of sections offered by masters-level mathematics departments dropped by about 23%. The number of sections offered by bachelors-level mathematics departments rose by more than 3% between fall 2000 and fall 2005, as did the number of sections offered by statistics departments. The number of sections of calculus-level courses grew by about 14% between fall 2000 and fall 2005 in the nation's doctoral and bachelors-level mathematics departments, and there was a 29% drop in the number of calculus-level sections offered by masters-level mathematics departments (compared to

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 2005. (Numbers in parentheses are (1995,2000) enrollments.)

	Fall 2005 (1995,2000) enrollments (1000s)						
	Mathematics Departments				Statistics Departments		
	Univ (PhD)	Univ (MA)	Coll (BA)	**Total Math Depts**	Univ (PhD)	Univ (MA)	**Total Stat Depts**
Mathematics courses							
Precollege	55 (60,59)	60 (84,59)	87 (78,101)	**201** **(222,219)**			
Introductory (incl. Precalc)	269 (222,258)	190 (193,227)	248 (198,238)	**706** **(613,723)**			
Calculus	345 (264,302)	88 (124,131)	154 (150,137)	**587** **(538,570)**			
Advanced Mathematics	52 (41,43)	24 (25,24)	36 (30,35)	**112** **(96,102)**			
Total Math courses	**720** **(587,662)**	**362** **(426,441)**	**525** **(456,511)**	**1607** **(1469,1614)**			
Statistics courses							
Elementary Statistics	30 (23,38)	32 (35,35)	86 (57,63)	**148** **(115,136)**	42 (46,46)	13 (3,8)	**54** **(49,54)**
Upper Statistics	15 (10,12)	9 (7,12)	10 (11,11)	**34** **(28,35)**	20 (16,17)	3 (0,3)	**24** **(16,20)**
Total Stat courses	**44** **(33,50)**	**42** **(42,47)**	**96** **(68,74)**	**182** **(143,171)**	**62** **(62,63)**	**16** **(3,11)**	**78** **(65,74)**
CS courses							
Lower CS	3 (4,5)	11 (18,33)	30 (52,52)	44 (74,90)	0 (0,0)	1 (1,1)	**2** **(1,1)**
Middle CS	1 (0,1)	1 (3,7)	6 (10,9)	**8** **(13,17)**	0 (0,0)	0 (0,0)	**0** **(0,0)**
Upper CS	1 (2,2)	1 (4,6)	3 (6,8)	**5** **(12,16)**	0 (0,0)	0 (0,0)	**0** **(0,0)**
Total CS courses	**5** **(6,8)**	**13** **(25,46)**	**39** **(68,69)**	**57** **(99,123)**	**0** **(0,0)**	**2** **(1,1)**	**2** **(1,1)**
Total all courses	**769** **(626,720)**	**417** **(493,534)**	**659** **(592,654)**	**1845** **(1711,1908)**	**62** **(62,63)**	**18** **(4,12)**	**80** **(66,75)**

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

a 23% enrollment decline in calculus-level courses in such departments). The number of advanced mathematics and statistics sections in doctoral mathematics departments grew by about 18% (compared with a 22% enrollment increase). The number of advanced sections in masters-level departments dropped by about 9% (compared to an 8% enrollment decrease), and the number of advanced sections offered by bachelors-level mathematics departments grew by about 3% even though enrollment was unchanged from fall 2000.

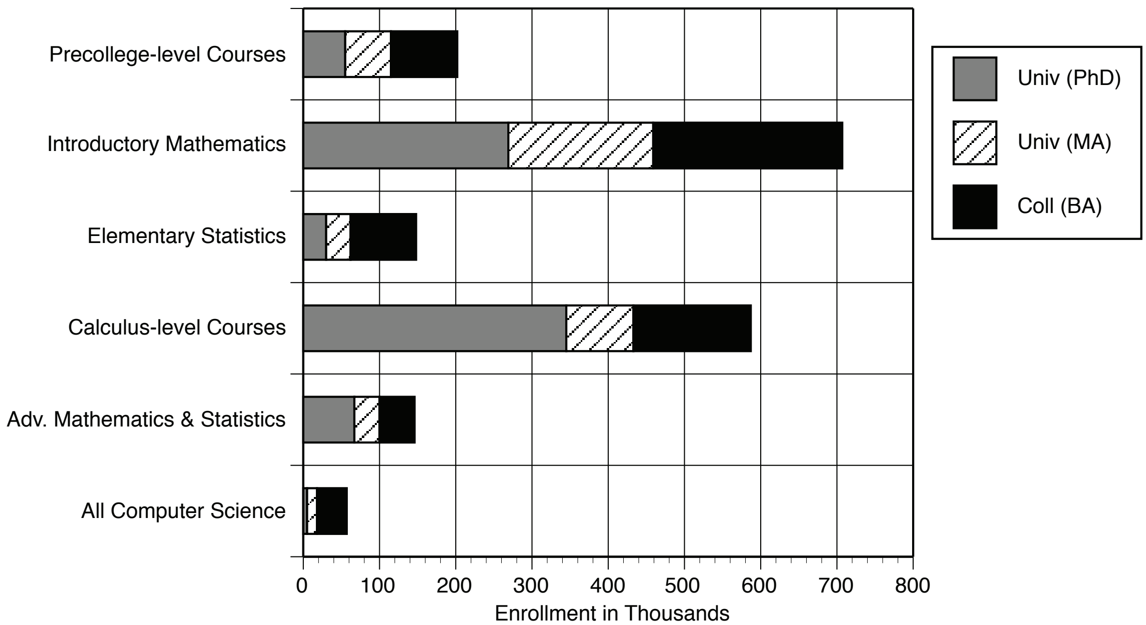

FIGURE E.2.1 Enrollment (thousands) in undergraduate mathematics, statistics, and computer science courses in four-year college and university mathematics departments by type of course and type of department in fall 2005.

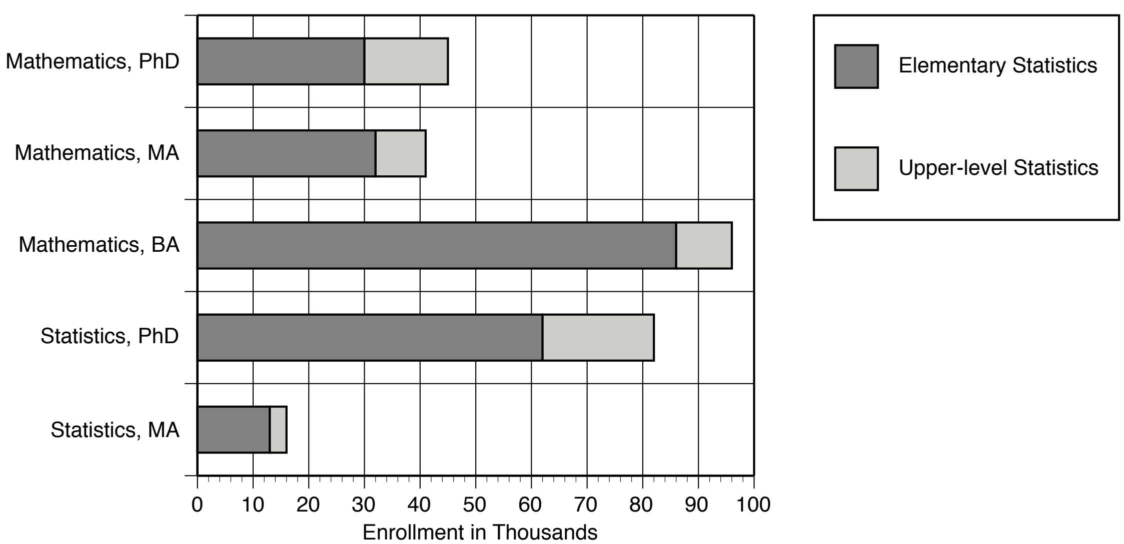

FIGURE E.2.2 Enrollment (thousands) in undergraduate statistics courses by level of course and type of department in fall 2005.

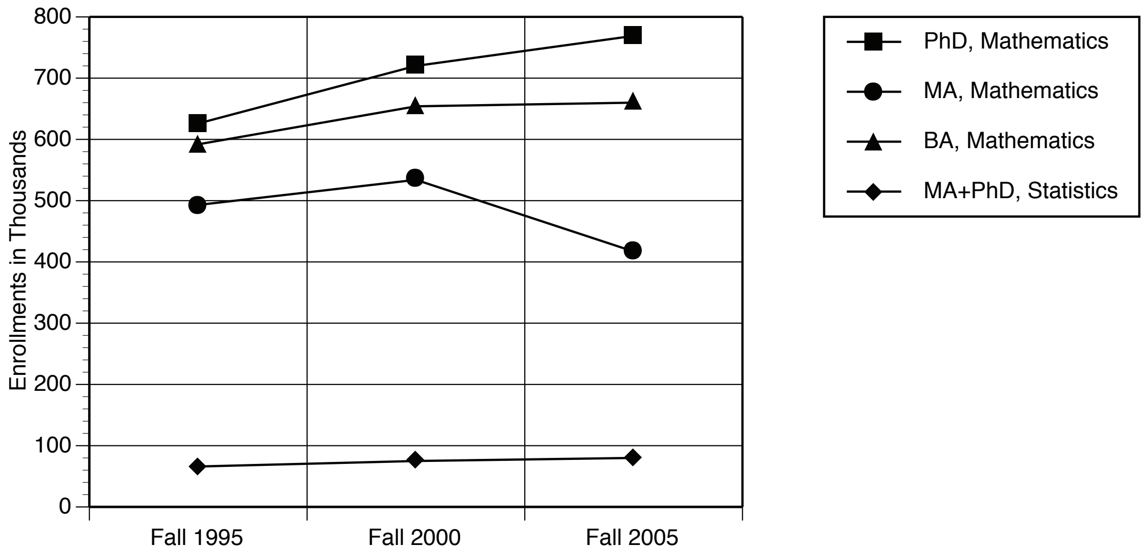

FIGURE E.2.3 Undergraduate enrollment (in thousands) in doctoral, masters, and bachelors mathematics departments, and in a combination of all masters and doctoral-level statistics departments, in fall 1995, fall 2000, and fall 2005.

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 2005 with fall 2000 figures in parentheses. (CBMS2000 data from Table E.10.)

	Number of sections: Fall 2005 (Fall 2000)						
	Mathematics Departments				Statistics Departments		
Mathematics courses	Univ (Phd)	Univ (MA)	Coll (BA)	**Total Math Depts**	Univ (PhD)	Univ (MA)	**Total Stat Depts**
Precollege level	1363 (1493)	1902 (1772)	3862 (4388)	**7126** **(7653)**			
Introductory (incl. Precalc)	5518 (5032)	5543 (6506)	9895 (8987)	**20955** **(20525)**			
Calculus	7696 (6768)	3237 (4551)	7388 (6438)	**18321** **(17757)**			
Advanced Mathematics	2625 (2392)	1622 (1936)	3507 (3415)	**7754** **(7743)**			
Total Math courses	17202 (15685)	12303 (14765)	24652 (23228)	**54157** **(53678)**			
Statistics courses							
Elementary Statistics	629 (827)	924 (1064)	3191 (2372)	**4744** **(4263)**	696 (786)	186 (123)	**882** **(909)**
Upper Statistics	869 (580)	714 (638)	771 (728)	**2354** **(1946)**	499 (476)	156 (122)	**654** **(598)**
Total Stat courses	1498 (1407)	1638 (1702)	3962 (3100)	**7098** **(6209)**	1195 (1262)	342 (245)	**1537** **(1507)**
CS courses							
Lower CS	114 (92)	512 (1553)	1629 (2557)	**2254** **(4202)**	11 (4)	22 (12)	**33** **(16)**
Middle CS	61 (24)	121 (465)	739 (590)	**921** **(1079)**	2 (0)	14 (2)	**16** **(2)**
Upper CS	61 (98)	83 (527)	444 (868)	**587** **(1493)**	0 (0)	0 (8)	**0** **(8)**
Total CS courses	236 (214)	715 (2545)	2811 (4015)	**3762** **(6774)**	13 (4)	36 (22)	**49** **(26)**
Total all courses	**18935** **(17306)**	**14656** **(19012)**	**31425** **(30343)**	65017 (66661)	**1208** **(1266)**	**378** **(267)**	1586 (1533)

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

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

The terms "distance education" and "distance learning" have been broadly defined in recent CBMS studies to mean any learning format in which the majority of students receive at least half of their instruction in situations where the instructor is not physically present. This includes, for example, correspondence courses (electronic or paper), courses that use broadcast lectures, and courses taught via the internet. Some universities have experimented with teaching their calculus courses in large computer labs, where students interact with sophisticated tutorial programs in lieu of interacting with an instructor.

CBMS2000 asked about the number of sections of a given course taught using distance-learning methods, and follow-up calls in fall 2000 revealed that to be the wrong question. In some cases, all distance-learning students were enrolled in a single section of a course, with the result that average section size estimates may have been inflated in the CBMS2000 report. With that in mind, CBMS2005 asked departments to report separately the number of students enrolled in distance-learning sections of a given course and the number of students enrolled in non-distance-learning sections. Table E.4 summarizes the results for the types of courses most frequently taught using distance education in fall 2005 and shows that, in fall 2005, distance education was not widely used in four-year colleges and universities. Among four-year mathematics departments, only in elementary statistics courses did distance enrollments exceed 2% of total enrollments, and in Calculus I courses the percentage was insignificant. The middle column of Table E.4 allows comparisons with the situation in two-year colleges, where distance education is more common. For example, at two-year colleges, distance-education enrollments were about five percent of total enrollment in certain precalculus and Calculus I courses, and accounted for more than 8% of total enrollments in elementary statistics courses. For more details on the use of distance education in two-year colleges, see Chapter 6.

TABLE E.4 Enrollments in distance-learning courses (meaning at least half of the students receive the majority of their instruction in situations where the instructor is not physically present) and in other sections for various freshman and sophomore courses, by type of department, in fall 2005.

	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	2489	198760	37036	927697	--	--
College Algebra. Triginometry, & Precalculus	5856	352591	15721	298081	--	--
Calculus I	593	308518	3620	68919	--	--
Calculus II	577	94858	270	20003	--	--
Differential Equations & Linear Algebra	238	82034	83	7423	--	--
Elementary Statistics	3075	140077	9894	107304	990	44303

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

Tables E.5 to E.12: Who taught undergraduate mathematics and statistics in fall 2005?

Chapter 3 of the CBMS2000 report contained several sets of tables, all produced from the same data set. CBMS2000 Tables E.4 to E.9 presented results as percentages of *enrollments*, e.g., the percentage of introductory-level enrollments taught by tenured or tenure-eligible faculty. Tables E.12 through E.18 of that report presented the same information in terms of the *number of sections*. Because the data transformation needed to produce percentage-of-enrollment tables from responses to CBMS2000 questionnaires made certain problematic assumptions, standard error (SE) values for Tables E.4 to E.9 were not calculated. This concern led the CBMS2005 project directors to present 2005 data in terms of numbers and percentages of sections of various kinds. As long as one is careful to compare the percentage-of-sections tables in CBMS2005 with percentage-of-sections tables from CBMS2000, historical trends can be studied, and the heading of Tables E.5 to E.12 in CBMS2005 contains a reference to the proper comparison table from CBMS2000. For example, Table E.5 of CBMS2005 should be compared with Table E.12 of CBMS2000.

The faculty categories used in CBMS2005 Tables E.5 to E.12 are tenured and tenure-eligible (TTE) faculty, other full-time faculty (OFT), which is the set of all full-time faculty who are not in the TTE category, part-time (PT) faculty, and graduate teaching assistants (GTAs). In cases where departmental responses did not account for all sections of a given type of course, there is also an "unknown" column. For example, postdoctoral faculty and scholarly visitors who teach courses would be included in the OFT category.

Table E.12 of the CBMS2000 study reported marked changes between fall 1995 and fall 2000 in the percentage of sections taught by various types of faculty in mathematics and statistics departments. CBMS2000 reported that, when compared with fall 1995 data, the percentage of sections taught in fall 2000 by tenured and tenure-eligible (TTE) faculty had dropped, sometimes by a large amount, with a corresponding increase in the percentage of sections taught by other full-time (OFT) faculty, a category that includes scholarly visitors, postdocs, full-time instructors and lecturers, and an increase in the number of sections taught by part-time faculty. CBMS2000 also found a pronounced drop in the number of sections taught by graduate teaching assistants (GTAs) between fall 1995 and fall 2000. (See also [LM].) (In CBMS surveys, to say that a GTA teaches a section means that she or he is the instructor of record for that section. Teaching assistants who supervise recitation sections for a larger lecture course are not counted as teaching their own section of the course.)

Table E.5 in the current report shows that between fall 2000 and fall 2005, the decline in the percentage of sections taught by TTE faculty continued, except among sections of computer science courses. For mathematics courses as a whole, the percentage taught by TTE faculty dropped by six percentage points, from 52% in fall 2000 to 46% in fall 2005. At the same time, the percentage of mathematics sections taught by OFT faculty rose by six points, and the percentage of mathematics sections taught by GTAs rose by two percentage points, from 7% to 9%. The percentage of statistics courses taught by TTE faculty dropped by eleven and ten percentage points in mathematics and statistics departments respectively, with a corresponding rise in teaching by OFT faculty. Only in computer science sections was there a marked increase in the percentage of sections taught by TTE faculty.

In some cases the change in the percentage of sections taught by TTE faculty was surprisingly large. For example, between fall 2000 and fall 2005, the percentage of statistics sections taught by TTE faculty in doctoral mathematics departments dropped from 63% to 39%, and the analogous percentage in masters-level mathematics departments dropped from 72% to 49%. Figures E.4.1, E.4.2, and E.4.3 show the percentages of various types of courses taught by different kinds of instructors in fall 2005.

CBMS2005 Tables E.6 through E.12 examine the fine structure of the global data in Table E.5, presenting data on courses at various levels of the curriculum (pre-college-level, introductory-level, and calculus-level, elementary statistics, introductory-level computer science, middle-level computer science, and advanced-level mathematics and statistics courses). The tables show the numbers of sections taught by different types of instructors, and they include important new data: the category of OFT faculty is subdivided into those who had a doctoral degree and those who did not. In order to allow comparisons with previous CBMS studies, one column of the tables presents the number of sections taught by all OFT faculty, independent of degree earned, and a second column shows the number of sections taught by doctoral OFT faculty. This refinement was introduced to make a distinction between sections taught by postdocs and scholarly visitors on the one hand, and by non-doctoral full-time instructors on the other. For example, Table E.6 shows that of the 7,126 sections of pre-college-level courses offered in mathematics departments in fall 2005, about 9% were taught by TTE faculty, 4% by doctoral OFT faculty, 21% by non-doctoral OFT faculty, etc. (It is also of interest to note that the number of pre-college sections dropped between fall 2000 and fall 2005, from 7,653 to 7,126.) By contrast, Table E.8 shows that of the 18,321 sections of calculus-level courses taught in mathematics departments, about 61% were taught by TTE faculty, about 10% by doctoral OFT faculty, and about 7% by non-doctoral OFT faculty.

CBMS2000 reported that between fall 1995 and fall 2000, the percentage of mathematics department sections taught by graduate teaching assistants (GTAs) declined, often to a pronounced degree. CBMS2005 data suggests a reversal of that trend. For example, in fall 2000, about 9.5% of precollege sections were taught by GTAs, while in fall 2005 the percentage was 14.6%. In introductory-level courses (including College Algebra, Precalculus, Mathematics for Liberal Arts, etc.), the percentage of sections taught by GTAs was essentially unchanged from fall 2000 levels. In calculus-level sections, the percentage rose from 6.4% to 7.6%. Only in elementary statistics and lower-level computer science was there a decline in the percentage of sections taught by GTAs. In elementary statistics, the percentage dropped from about 9% of all elementary statistics sections taught in mathematics and statistics departments combined to about 6% (Table E.9).

Tables E.5 and E.6 contain what appears to be anomalous data; they report that some mathematics sections in bachelors-only departments are taught by GTAs. Follow-up telephone calls to various bachelors-level mathematics departments revealed that some departments "borrow" GTAs from graduate departments at their own universities, and some departments classified as bachelors-level when the CBMS2005 sample frame was set up subsequently created masters programs, often Master of Arts in Teaching programs, and were using their new GTAs to teach courses in fall 2005. This anomaly will reappear in Chapter 5, which looks at first-year courses in considerable detail.

Table E.12 in CBMS2005 is new. Earlier CBMS studies made the assumption that all upper-division sections were taught by tenured and tenure-eligible (TTE) faculty. To test that assumption, CBMS2005 asked departments to specify how many of their upper-division sections were taught by TTE faculty. In mathematics departments, about 78% of all upper-division mathematics and statistics courses were taught by TTE faculty. Looking at mathematics and statistics courses in these departments separately, one sees that TTE faculty taught about 84% of all upper-division mathematics courses offered in fall 2005 and about 59% of all upper-level statistics courses. In statistics departments, 74% of all upper-level courses were taught by TTE faculty in fall 2005. CBMS2005 has no data on who taught the remaining upper-division courses.

TABLE E.5 Percentage of sections, excluding distance learning, of mathematics, statistics, and computer science courses taught by tenured/tenure-eligible (TTE), other full-time (OFT), part-time (PT), graduate teaching assistants (GTAs), and unknown (Ukn) in mathematics departments and statistics departments by type of department in fall 2005, with fall 2000 figures in parentheses. (CBMS2000 data from Table E.12.)

	Percentage of mathematics sections taught by						Percentage of statistics sections taught by						Percentage of CS sections taught by					
	TTE %	OFT %	PT %	GTAs %	Ukn %	**No. of Math sections**	TTE %	OFT %	PT %	GTAs %	Ukn %	**No. of Stat sections**	TTE %	OFT %	PT %	GTAs %	Ukn %	**No. of CS sections**
Math Depts																		
Univ (PhD)	35	24	14	21	6	**17202**	39	44	7	9	2	**1498**	39	38	9	7	6	**236**
	(42)	(16)	(17)	(21)	(4)	**(15685)**	(63)	(9)	(11)	(14)	(3)	**(1407)**	(59)	(17)	(6)	(3)	(15)	**(214)**
Univ (MA)	45	20	22	8	6	**12303**	49	33	15	1	2	**1639**	43	8	18	0	30	**715**
	(48)	(19)	(22)	(5)	(6)	**(14765)**	(72)	(9)	(11)	(1)	(7)	**(1702)**	(47)	(11)	(35)	(0)	(7)	**(2545)**
Coll (BA)	54	20	23	1	3	**24652**	59	13	25	0	3	**3962**	80	9	9	0	1	**2811**
	(60)	(13)	(21)	(0)	(6)	**(23228)**	(59)	(13)	(22)	(0)	(6)	**(3100)**	(56)	(18)	(15)	(0)	(11)	**(4015)**
Total Math Depts	**46**	**21**	**20**	**9**	**5**	**54157**	**52**	**24**	**19**	**2**	**2**	**7099**	**70**	**11**	**11**	**0**	**7**	**3762**
	(52)	**(15)**	**(20)**	**(7)**	**(6)**	**(53678)**	**(63)**	**(11)**	**(17)**	**(4)**	**(5)**	**(6209)**	**(53)**	**(15)**	**(22)**	**(0)**	**(10)**	**(6774)**
Stat Depts																		
Univ (PhD)	Too few cases in the sample to make reliable estimates						41	22	7	14	15	**1195**	Too few cases in the sample to make reliable estimates					**13**
							(53)	(8)	(14)	(20)	(5)	**(1262)**						**(4)**
Univ (MA)							64	27	7	0	2	**342**						**36**
							(71)	(9)	(5)	(4)	(12)	**(245)**						**(22)**
Total Stat Depts							**46**	**23**	**7**	**11**	**12**	**1537**						**49**
							(56)	**(8)**	**(12)**	**(18)**	**(6)**	**(1507)**						**(26)**

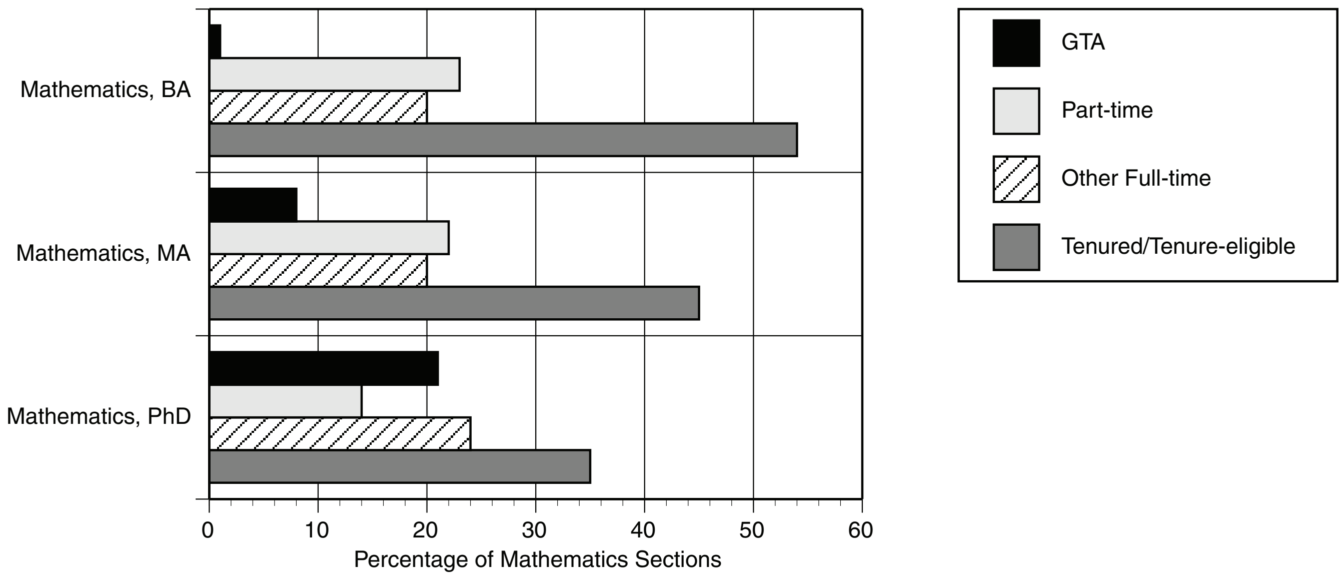

FIGURE E.5.1 Percentage of mathematics sections in mathematics departments whose instructors were tenured/tenure-eligible faculty, other full-time faculty, part-time faculty, and graduate teaching assistants (GTA), by type of department in fall 2005.

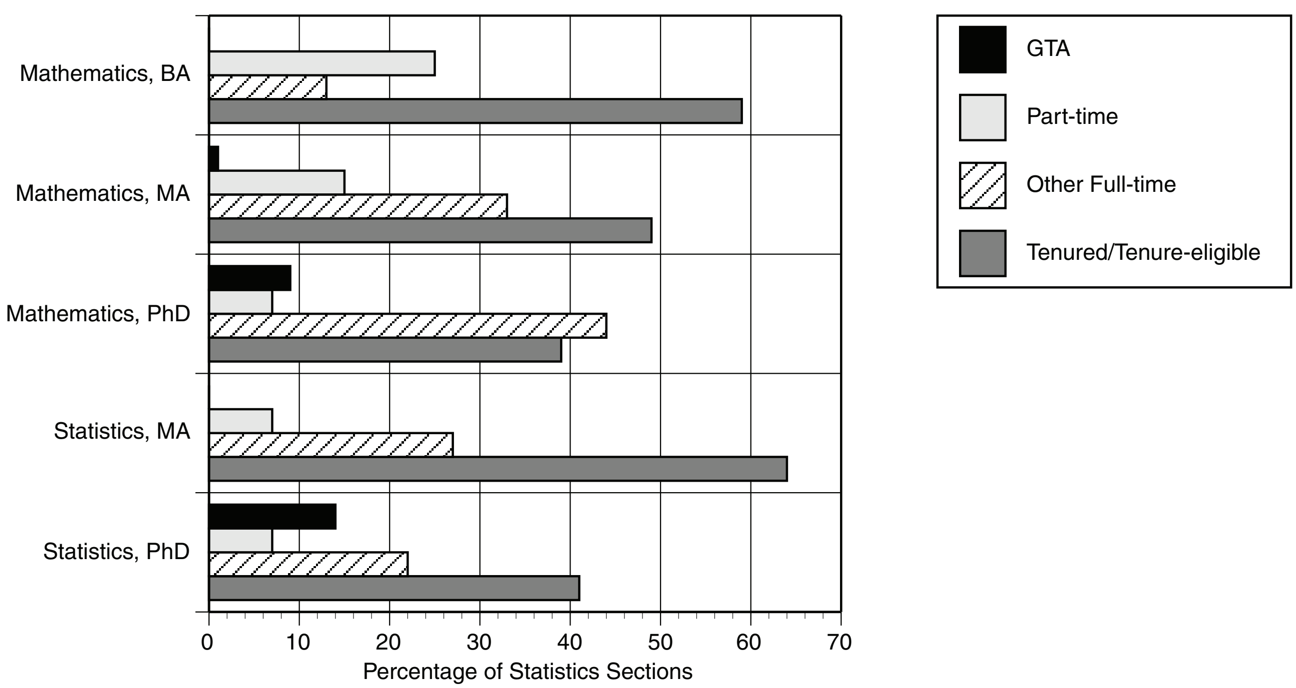

FIGURE E.5.2 Percentage of statistics sections whose instructors were tenured/tenure-eligible faculty, other full-time faculty, part-time faculty, and graduate teaching assistants (GTA), by type of mathematics or statistics department in fall 2005.

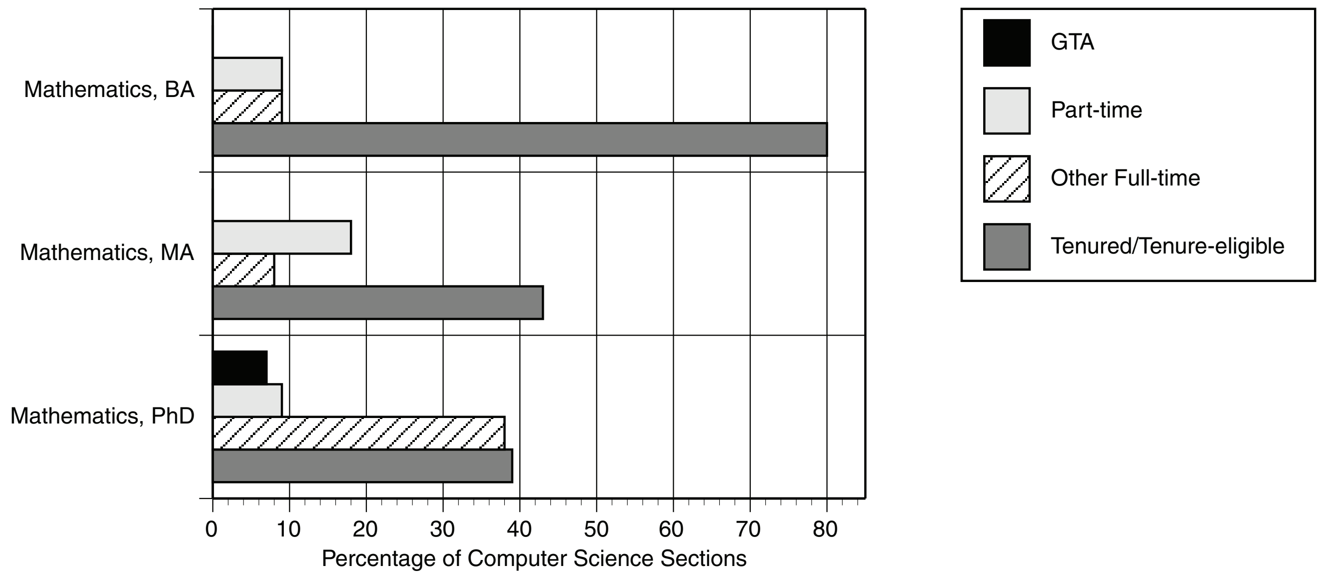

FIGURE E.5.3 Percentage of computer science sections taught in mathematics departments whose instructors were tenured/tenure-eligible faculty, other full-time faculty, part-time faculty, and graduate teaching assistants (GTA), by type of mathematics department in fall 2005. (Percentages do not sum to 100% due to "unknown" instructor percentages.)

TABLE E.6 Number of sections, not including distance learning, of precollege-level courses in mathematics departments taught by various types of instructor, by type of department in fall 2005, with fall 2000 figures in parentheses. (CBMS2000 data from Table E.13.)

	Number of precollege-level sections taught by						
	Tenured/ tenure-eligible	Other full-time (total)	Other full-time (doctoral)	Part-time	GTA	Ukn	**Total sections**
Mathematics Departments							
Univ (PhD)	29 (25)	312 (216)	34 (na)	579 (618)	376 (482)	66 (152)	**1363 (1493)**
Univ (MA)	55 (120)	491 (475)	43 (na)	616 (807)	641 (221)	99 (149)	**1902 (1772)**
Coll (BA)	576 (1387)	980 (698)	209 (na)	2091 (1829)	23 (26)	192 (448)	**3862 (4388)**
Total	**660 (1532)**	**1783 (1389)**	**286 (na)**	**3286 (3254)**	**1040 (729)**	**357 (749)**	**7126 (7653)**

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

TABLE E.7 Number of sections (excluding distance learning) of introductory-level courses (including precalculus) in mathematics departments taught by various types of instructors, by type of department in fall 2005, with fall 2000 figures in parentheses. (CBMS2000 data from Table E.14.)

	Number of introductory-level sections taught by						
	Tenured/ tenure-eligible	Other full-time (total)	Other full-time (doctoral)	Part-time	GTA	Ukn	**Total sections**
Mathematics Departments							
Univ (PhD)	588 (683)	1457 (1159)	341 (na)	1176 (1261)	1902 (1714)	394 (215)	**5517** **(5032)**
Univ (MA)	1849 (2007)	1373 (1747)	197 (na)	1657 (1760)	295 (419)	369 (573)	**5543** **(6506)**
Coll (BA)	4079 (4397)	2385 (1407)	423 (na)	2998 (2676)	0 (0)	432 (507)	**9895** **(8987)**
Total	**6517** **(7087)**	**5215** **(4313)**	**960** **(na)**	**5831** **(5697)**	**2196** **(2133)**	**1196** **(1295)**	**20955** **(20525)**

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

TABLE E.8 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 2005, with fall 2000 figures in parentheses. (CBMS2000 data from Table E.15.)

	Number of calculus-level sections taught by						
	Tenured/ tenure-eligible	Other full-time (total)	Other full-time (doctoral)	Part-time	GTA	Ukn	**Total sections**
Mathematics Departments							
Univ (PhD)	3199 (3522)	1860 (1134)	1155 (na)	726 (762)	1261 (1087)	650 (263)	**7696** **(6768)**
Univ (MA)	2196 (3053)	375 (614)	159 (na)	402 (652)	16 (42)	249 (190)	**3237** **(4551)**
Coll (BA)	5754 (4854)	900 (820)	526 (na)	520 (409)	107 (0)	108 (355)	**7388** **(6438)**
Total	**11149** **(11429)**	**3135** **(2568)**	**1841** **(na)**	**1648** **(1823)**	**1384** **(1129)**	**1006** **(808)**	**18321** **(17757)**

TABLE E.9 Number of sections (excluding distance learning) of elementary level statistics taught in mathematics departments and statistics departments, by type of instructor and type of department in fall 2005 with fall 2000 figures in parentheses. (CBMS2000 data from Table E.16.)

Elementary Statistics	Number of elementary-level statistics sections taught by						**Total sections**
	Tenured/ tenure-eligible	Other full-time (total)	Other full-time (doctoral)	Part-time	GTA	Ukn	
Mathematics Departments							
Univ (PhD)	145 (307)	219 (130)	73 (na)	104 (157)	136 (198)	25 (35)	**629 (827)**
Univ (MA)	441 (589)	185 (146)	34 (na)	250 (195)	15 (20)	34 (114)	**924 (1064)**
Coll (BA)	1738 (1087)	366 (402)	90 (na)	987 (691)	0 (0)	100 (192)	**3191 (2372)**
Total Math Depts	**2324 (1983)**	**770 (678)**	**197 (na)**	**1341 (1043)**	**151 (218)**	**159 (341)**	**4744 (4263)**
Statistics Departments							
Univ (PhD)	144 (196)	111 (104)	60 (na)	88 (174)	172 (254)	180 (58)	**696 (786)**
Univ (MA)	80 (51)	75 (23)	22 (na)	24 (9)	0 (11)	7 (29)	**186 (123)**
Total Stat Depts	**224 (247)**	**186 (127)**	**82 (na)**	**112 (183)**	**172 (265)**	**187 (87)**	**882 (909)**

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

TABLE E.10 Number of sections (excluding distance learning) of lower-level computer science taught in mathematics departments, by type instructor and type of department in fall 2005, with fall 2000 figures in parentheses. (CBMS2000 data from Table E.17.)

	Number of lower-level computer science sections taught by						
	Tenured/ tenure-eligible	Other full-time (total)	Other full-time (doctoral)	Part-time	GTA	Ukn	**Total sections**
Mathematics Departments							
Univ (PhD)	31 (41)	44 (26)	24 (na)	10 (8)	14 (6)	15 (11)	**114** **(92)**
Univ (MA)	187 (559)	50 (204)	0 (na)	127 (677)	0 (0)	149 (113)	**512** **(1553)**
Coll (BA)	1199 (1162)	168 (549)	55 (na)	256 (504)	0 (12)	6 (330)	**1629** **(2557)**
Total Mathematics Depts	**1416** **(1762)**	**262** **(779)**	**79** **(na)**	**393** **(1189)**	**14** **(18)**	**169** **(454)**	**2254** **(4202)**

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

TABLE E.11 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 2005, with fall 2000 figures in parentheses. (CBMS2000 data from Table E.18.)

	Number of middle-level computer science sections taught by						
	Tenured/ tenure-eligible	Other full-time (total)	Other full-time (doctoral)	Part-time	GTA	Ukn	**Total sections**
Mathematics Departments							
Univ (PhD)	19 (12)	36 (8)	19 (na)	3 (0)	3 (0)	0 (4)	**61** **(24)**
Univ (MA)	72 (286)	11 (27)	0 (na)	6 (106)	0 (0)	33 (46)	**121** **(465)**
Coll (BA)	613 (422)	98 (93)	70 (na)	6 (65)	0 (0)	22 (10)	**739** **(590)**
Total Math Depts	**703** **(720)**	**145** **(128)**	**89** **(na)**	**15** **(171)**	**3** **(0)**	**55** **(60)**	**921** **(1079)**

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

TABLE E.12 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 and tenure-eligible (TTE) faculty, and total number of advanced level sections, by type of department in fall 2005. (Data for fall 2000 are not available.)

Mathematics Departments	Sections taught by TTE	Total sections	**Statistics Departments**	Sections taught by TTE	Total sections
Advanced mathematics courses					
Univ (PhD)	2184	2625			
Univ (MA)	1382	1622			
Coll (BA)	2941	3507			
Total advanced mathematics	6506	7754			
Advanced statistics courses			**Advanced statistics courses**		
Univ (PhD)	434	869	Univ (PhD)	343	499
Univ (MA)	359	714	Univ (MA)	140	156
Coll (BA)	604	771			
Total advanced statistics	1398	2354	Total advanced statistics	483	654
Total all advanced courses	**7904**	**10108**	**Total all advanced courses**	**483**	**654**

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

Tables E.13 and E.14: Data on section sizes

Table E.13 summarizes data on average section sizes for a wide array of courses. Except in upper-level mathematics and statistics courses, average section size declined between fall 2000 and fall 2005. The Mathematical Association of America (MAA) has recommended 30 as the appropriate maximum class size in undergraduate mathematics [MAAGuidelines], and in fall 2005, national average section sizes were somewhat above that recommended limit. In particular, section sizes in doctoral departments often substantially exceeded that MAA guideline.

After the publication of CBMS2000, some doctoral department chairs asked for data on the average recitation size for calculus courses that are taught in lecture/recitation mode. CBMS2000 could provide only very rough estimates, but those estimates were good enough to convince several deans to add GTA slots to their doctoral mathematics departments. CBMS2005 collected better data on recitation sizes in various calculus courses and in elementary statistics courses, and these data are presented by type of department in Table E.13.

TABLE E.13 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 2005, with fall 2000 data in parentheses. Also, all departments' average section sizes from previous CBMS surveys. (CBMS2000 data from Table E.11.)

	Average section size Fall 2005 (2000)								
	Mathematics Depts			Statistics Depts					
	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	**All Depts 1990**	**All Depts 1995**	**All Depts 2000**	**All Depts 2005**
Mathematics courses									
Precollege	40 (39)	31 (33)	22 (23)			31	31	29	28
Introductory (incl. Precalc)	48 (51)	34 (35)	25 (26)			35	34	35	33
Calculus	45 (45)	27 (29)	21 (21)			35	31	32	32
Advanced Mathematics	20 (18)	15 (12)	10 (10)			16	12	13	14
Statistics courses									
Elementary Statistics	47 (46)	34 (33)	26 (27)	60 (58)	63 (65)	37	38	37	35
Upper Statistics	17 (21)	13 (19)	13 (15)	40 (36)	22 (25)	24	19	22	19
CS courses									
Lower CS	25 (50)	22 (21)	18 (20)	16 (13)	66 (58)	24	22	22	19
Middle CS	19 (39)	8 (16)	8 (16)	48 (na)	16 (90)	15	14	22	9
Upper CS	15 (21)	8 (12)	7 (10)	0 (na)	0 (30)	14	12	11	8

TABLE E.14 Average recitation size in Mainstream Calculus I and II and other Calculus I courses and in Elementary Statistics courses that are taught using lecture/recitation method, by type of department in fall 2005. Distance-learning sections are not included. (A calculus course is "mainstream" if it leads to the usual upper-division mathematical sciences courses.)

For Lecture/Recitation Courses	Average recitation section size		
	Univ (PhD)	Univ (MA)	College (BA)
Calculus Courses			
Mainstream Calculus I	28	19	21
Mainstream Calculus II	26	20	15
Other Calculus I	29	na	na
Elementary Statistics			
in Mathematics Depts	30	32	22
in Statistics Depts	32	19	na