**Chapter 3: Mathematical Sciences Bachelor’s 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 bachelor’s degrees awarded through the nations’ mathematics and statistics departments (Table E.1.A-E.1.D),
* enrollments in mathematical sciences courses and number 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 department, 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 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 enrollment 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 appears in Chapter 6.

Highlights:

1. **Number of bachelor’s degrees awarded:**

* The estimated total number of mathematical sciences bachelor’s 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 bachelor’s 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 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 bachelor’s 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 bachelor’s degrees in the mathematical sciences awarded by each level of mathematics department increased. The bachelors-level departments awarded the greatest estimated number of bachelor’s degrees in the mathematical sciences, but when computer science degrees are removed, the doctoral-level departments awarded the greatest estimated number of bachelor’s 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 bachelor’s 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.

1. **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. 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 precollege-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 statistics departments in fall 2015 were 3 times the estimated enrollments in fall 2010. Introductory statistics course enrollments showed slower growth. 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.

1. **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

1. **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 b 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.

1. **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 was 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 master’s or doctoral degrees.

**Table E.1: Bachelor’s degrees granted between July 1, 2014 and June 30, 2015**

The CBMS 2015 survey (Table S.3 of Chapter 1) estimated that the total number of mathematical sciences bachelor’s 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 bachelor’s 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 bachelor’s 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 bachelor’s 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 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 bachelor’s degrees awarded, the estimated total is 22,266, seemingly an increase over the past surveys.

Table E.1.A presents the estimated number of bachelor’s 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.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.

Table E.1.A breaks down the estimated numbers of degrees awarded in 2014-15 by the level of department awarding the degree. In the 2005 and 2010 CBMS surveys, most of the growth in the number of bachelor’s degrees awarded in mathematics occurred at the doctoral-level mathematics departments. In 2005, for the first time, the estimated number of bachelor’s 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.

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 bachelor’s 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 bachelor’s 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 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 bachelor’s degrees awarded in computer science by mathematics departments. In 1994-5 the CBMS study estimated that mathematics departments awarded 2,741 bachelor’s degrees in computer science (Table S.3 of Chapter 1), while Table E.1.A shows that in 2014-15 this number was 3.968. Most of bachelor’s degrees awarded in computer science in 2014-15 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 not later in this chapter, the 2015 report on enrollments shows a decline in computer science enrollments over 2010 in mathematics departments.

Table E.1.B shows that in 2014-15 the estimated number of bachelor’s degrees awarded by statistics departments was 1,847, compared with 838 in 2009-10, and compared with 416 degrees awarded by mathematics departments in 2014-15. The number of degrees awarded by doctoral-level 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.

Table E.1.A (respectively, Table E.1.B) breaks down the estimated number of bachelor’s 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 bachelor’s 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 was 46%. The estimated percentage of bachelor’s 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 bachelor’s 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 bachelor’s 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.

Table E.1.A also 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 number of computer science degrees awarded, in all levels of mathematics departments combined women were 33% of degrees awarded in 2014-15 and 16% of degrees awarded in 2009-10. See Figure E.1.1, which shows the estimated number of degrees awarded to women, broken down by gender in 2004-5, 2009-10, and 2014-15

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

We have compared estimates of the number of degrees awarded obtained in the CMBS survey, to the estimates of these numbers obtained in the Annual Survey, and in data available through NCES. In both the 2010 and the 2015 CBMS surveys, the estimated number of bachelor’s degrees awarded was less that 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 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. It is now possible in the data given to NCES 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 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 bachelor’s 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 bachelor’s 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, master’s, or bachelor’s) by the mathematics department at the institution (the level of a possible statistics department is not used, and the assumption is made 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 bachelor’s 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 bachelor’s 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 bachelor's degree totals certainly include degrees viewed within the department as falling within Computer Science broadly, and certainly include joint math and CS bachelor's 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 (most?) of these CS-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 bachelor’s 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, 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.

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 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.

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 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 enrollments in the three levels of mathematics departments and two levels of statistics 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.

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 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 are now taught in many different formats. 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 4 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 offered in statistics departments was almost identical in 2010 and 2015.

**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 (Unk) (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 institution 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 Unk rank instructors reported; the numbers of these Unk seem roughly comparable in the two surveys.

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 reappointment 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 the estimated number of calculus-level sections decreased by 4% (0.6 SEs) from 2010 to 2015 by Table E.3, 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 1010, 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).

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% taught by OFT faculty, 25% taught by PT faculty, and 4% taught by GTAs; in all levels of statistics departments combined, an estimated 14% of the introductory-level sections were taught by TTE faculty, 25% taught by OFT faculty, 10% taught by PT faculty, and 31% 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).

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 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 in all levels of mathematics departments combined by TTE faculty 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 played by TTE faculty.

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, occurred in sections in statistics departments, and in sections of calculus-level classes 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 upper-level statistics courses sections, 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 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.

August 12, 2017