Chapter 4
First-Year Courses: Calculus and Statistics

Data Highlights

By and large, this chapter contains data not previously collected in CBMS surveys. It shows that, in PhD departments, just under half, 48%, of mainstream Calculus I enrollment was taught in the large lecture/recitation format. Considering only the enrollment in the regular section format of mainstream Calculus I, tenured/tenure-eligible faculty taught just under 50% of the enrollment in these sections at PhD departments, as compared to 77% of the enrollment at MA departments and 84% of the enrollment at BA departments.

On the other hand, there is little difference among departments in the percent of enrollment in mainstream Calculus I that were taught from a "reform" text: 27% for PhD departments, 31% for MA departments, and 29% for BA departments. However, MA departments have the largest percentage of mainstream Calculus I enrollment using graphing calculators, 44%, followed by BA departments at 39%, and PhD departments at 33%. All of these numbers represent substantial increases over the 1990 percentages. For example, in 1990 graphing calculators were used by no more than 3% of the sections of mainstream Calculus I, no matter the type of department.

All of the percentages in the above paragraph are somewhat lower for mainstream Calculus II and quite a bit lower for non-mainstream Calculus I.

Among the various types of departments there is a marked difference in the way that the two statistics courses, elementary statistics and probability and statistics (no calculus prerequisite), were taught. For example, just over a fifth of the students enrolled in elementary statistics at PhD mathematics departments were in a large lecture/recitation format, while at PhD statistics departments this percentage was 33%. On the other hand, 29% of the enrollment of this course is taught by tenured/tenure-eligible faculty at PhD mathematics departments, and at PhD statistics depart-

ments the corresponding percentage is 46%. Finally, 42% of the students enrolled in this course in PhD mathematics departments have required computer assignments, while this figure rises to 61% for PhD statistics departments.

Explanation of the Tables

This chapter contains six tables, all in a landscape format, that present data on mainstream and non-mainstream Calculus I and II, elementary statistics, and probability and statistics with no calculus prerequisite.

These tables present data by the different types of departments: PhD, MA, and BA. Whenever one of these tables gives data on the percentage of enrollment taught by various kinds of faculty, the percentages for each type of department total 100%. For example, in Table FY.1, in the first row of data titled "Large lecture with recitation", the percentages given for PhD universities: 76, 17, 5, and 2, total 100% (except for rounding errors). The 100% enrollment for this large lecture course at PhD mathematics departments is 40,500. The actual enrollment, not percentage of enrollment, taught by tenured/tenure-eligible faculty is computed by multiplying 76% (expressed in decimal form .76) and 40,500, which gives an actual enrollment of 30,780. Tables FY.1, FY.3, FY.5, and FY.6 have similar presentations.

In contrast, Tables FY.2 and FY.4 give percentages which do not total 100%. Instead they report on categories of enrollment which may overlap. For example, the same student may be taught from a "reform" text, use a graphing calculator, and be assigned writing assignments, and, so, would be counted in each category.

Only Table FY.2 contains data from the 1990 CBMS survey on the percent of sections of mainstream Calculus I and II that use graphing calculators, have writing assignments, have required computer assignments, and have assigned group projects.

TABLE FY.1 Percentage of enrollment in Mainstream Calculus I and Mainstream Calculus II taught by tenured/tenure-eligible, other full-time, part-time, and graduate teaching assistants in Departments of Mathematics by size of sections and type of school: Fall 1995. Also total enrollments (in thousands) and average section sizes.

Course	Percentage of enrollment taught by												Enrollment (thousands)			Ave. section size		
	Tenured/ tenure-eligible			Other full-time			Part-time			Graduate teaching assistants								
	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)
Mainstream calculus I																		
Large lecture with recitation	76	100	0	17	0	0	5	0	0	2	0	0	100% 40.5	100% 2	100% 0	100	84	-
Regular section <30	42	83	83	14	10	7	9	6	10	35	1	0	100% 15.5	100% 20	100% 48	24	26	23
Regular section ≥30	53	70	88	16	16	2	10	12	9	22	3	0	100% 28	100% 20	100% 18	38	35	35
Course **total**	62	77	84	16	12	6	7	9	10	15	2	0	100% 84	100% 42	100% 66	47	30	25
Mainstream calculus II																		
Large lecture with recitation	68	0	0	15	0	0	5	0	0	12	0	0	100% 18	100% 0	100% 0	84	-	-
Regular section <30	58	84	88	7	11	11	9	6	1	26	0	0	100% 10	100% 10	100% 20	25	24	18
Regular section ≥30	50	83	88	16	11	6	7	5	6	27	0	0	100% 14	100% 16	100% 5	39	35	34
Course total	59	84	88	13	11	10	**7**	**5**	**2**	20	0	0	100% 42	100% 16	100% 25	43	28	20
Total mainstream calculus **I & II**	61	79	85	15	12	7	**7**	**8**	**8**	17	0	0	100% 126	100% 58	100% 91	46	29	23

Tables FY.1 and FY.2

These tables are an elaboration of Tables SFY.18 and SFY.19 in chapter 1, *Summary*.

These tables give detailed information on the different kinds of instructors who teach mainstream Calculus I and II and what instructional format is used to teach these courses at the various types of institutions. While there are striking differences in some of the percentages according to the type of institution and format of the course, the number of students for each percentage should be considered when making comparisons. When the actual number of students is considered, instead of percentages, some of the differences are moderated. For example, Table FY.2 shows that in BA departments of mathematics the percentage of students enrolled in regular sections of mainstream Calculus I using graphing calculators was 29% for those regular sections with fewer than 30
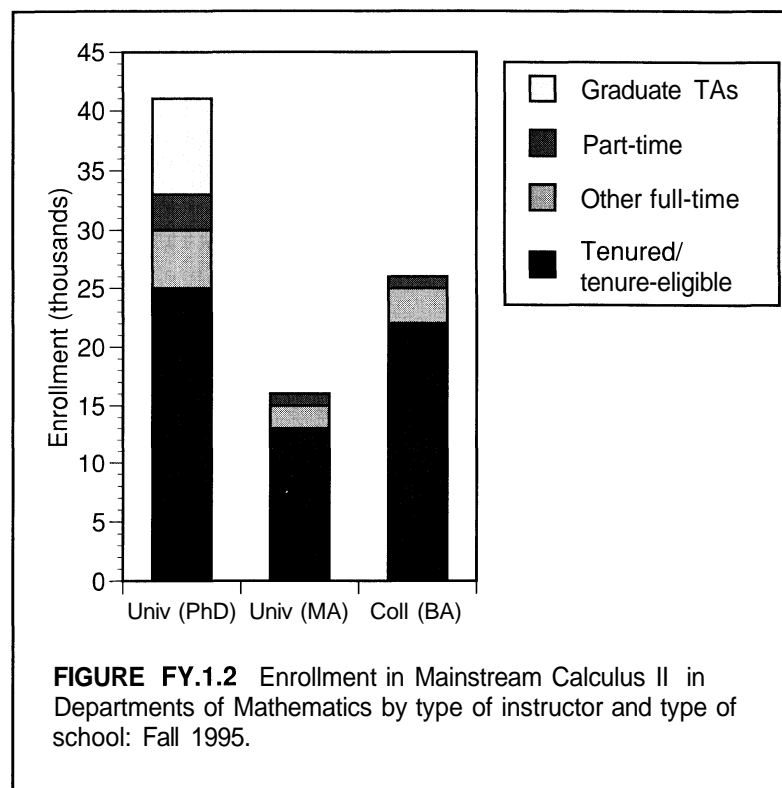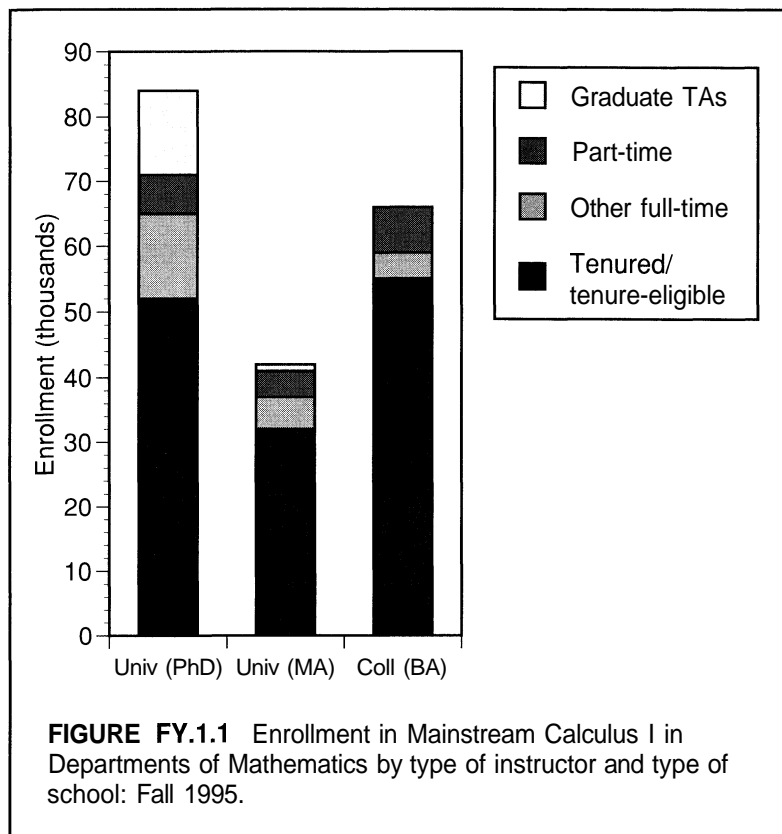
students, but 63% for those regular sections with 30 or more students. The total enrollment was 48,000 for the smaller enrollment sections and 18,000 for the larger enrollment sections. This means that nearly 14,000 students enrolled in the smaller enrollment sections used graphing calculators, as compared to a little over 11,000 students in the larger enrollment sections who used graphing calculators.
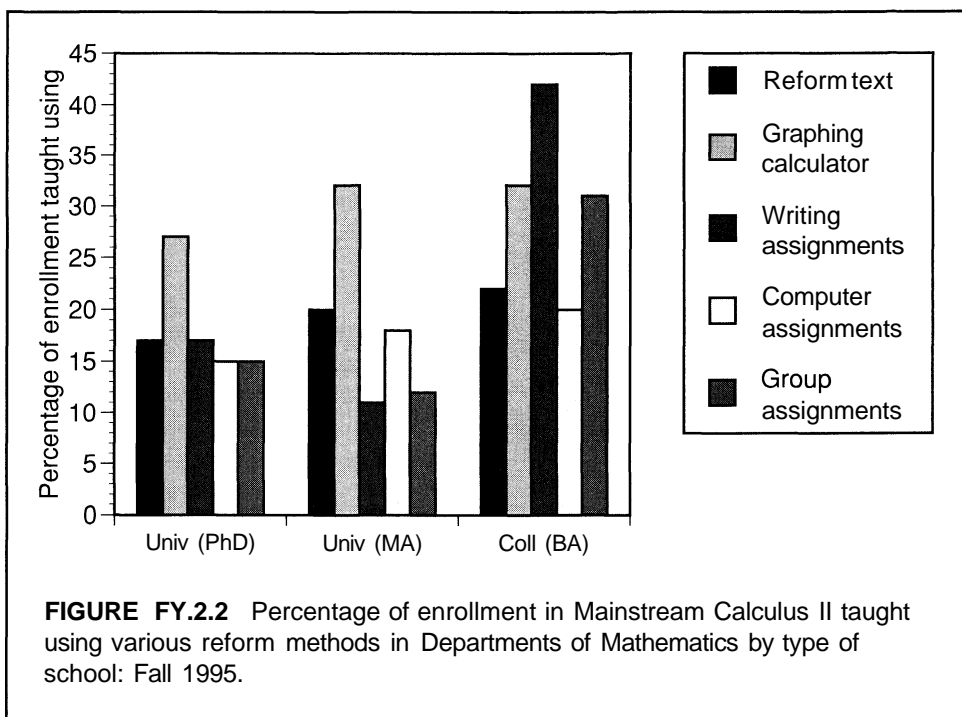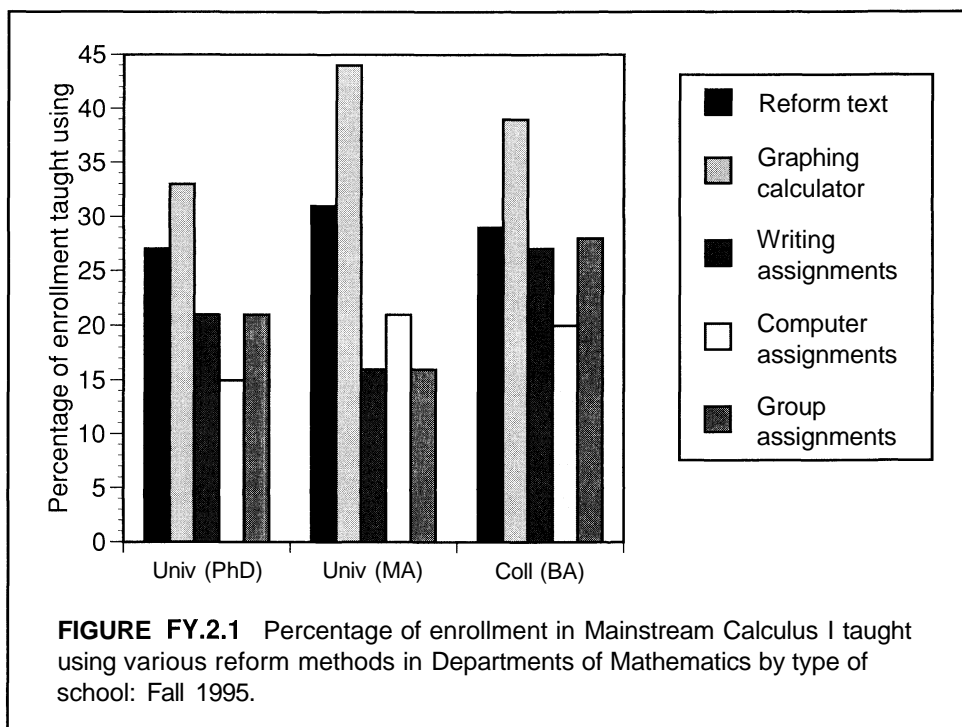
A second example is, again, in the use of graphing calculators in mainstream Calculus I, this time in PhD universities. The percentage of students varies greatly according to the instructional format, but the actual number of students in each format who use graphing calculators varies little, ranging between 8400 and 10,100.

TABLE FY.2 Percentage of enrollment in Mainstream Calculus I and Mainstream Calculus II taught using various reform methods in Departments of Mathematics by size of sections and type of school: Fall 1995. Also total enrollments (thousands) and average section sizes.

Course	taught from a "reform" text*			using graphing calculators			having writing assignments			having required computer assignments			having assigned group projects			Enrollment (thousands)			Ave. section size		
	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)
Mainstream calculus I																					
Large lecture with recitation	30	20	0	25	20	0	23	20	0	18	20	0	28	20	0	40.5	2	0	100	84	-
Regular section <30	44	39	23	60	52	29	37	16	19	17	23	13	25	21	23	15.5	20	48	24	26	23
Regular section ≥30	13	24	44	30	37	63	8	14	45	8	19	38	9	10	40	28	20	18	38	35	35
Course total	27	31	29	33	44	39	21	16	27	15	21	20	21	16	28	84	42	66	47	30	25
1990 percent. of sections	na	na	na	3	3	2	2	2	21	5	8	14	1	2	5						
Mainstream calculus II																					
Large lecture with recitation	15	0	0	18	0	0	14	0	0	18	0	0	21	0	0	18	0	0	84	-	-
Regular section <30	18	22	25	30	33	36	20	16	46	14	19	21	7	14	34	10	10	20	25	24	18
Regular section ≥30	18	18	8	37	31	12	12	4	25	11	18	17	12	10	20	14	16	5	39	35	34
Course total	17	20	22	27	32	32	17	11	42	15	18	20	15	12	31	42	16	25	43	28	20
1990 percent. of sections	na	na	na	3	1	2	2	1	23	3	7	10	1	1	3						
Total mainstream calculus I & II	24	28	27	31	41	37	20	15	31	15	20	20	19	15	29	126	58	91	46	29	23

* The primary text (or set of notes etc.) generally reflects the pedagogical principles of the reform calculus movement.

FIGURE FY.1.1 Enrollment in Mainstream Calculus I in Departments of Mathematics by type of instructor and type of school: Fall 1995.

FIGURE FY.1.2 Enrollment in Mainstream Calculus II in Departments of Mathematics by type of instructor and type of school: Fall 1995.

FIGURE FY.2.1 Percentage of enrollment in Mainstream Calculus I taught using various reform methods in Departments of Mathematics by type of school: Fall 1995.

FIGURE FY.2.2 Percentage of enrollment in Mainstream Calculus II taught using various reform methods in Departments of Mathematics by type of school: Fall 1995.

Tables FY.3 and FY.4

These tables are an elaboration of Tables SFY.20 and SFY.21 in chapter 1, *Summary*.

In PhD mathematics departments, graduate teaching assistants teach 32% of the students enrolled in the non-mainstream calculus, while at the MA and BA mathematics departments part-time faculty teach about the same percentage of students enrolled in these same courses.

There seems to be some use of "reform" material in small sections of non-mainstream Calculus I taught at PhD universities, but little use of such material elsewhere in the non-mainstream calculus courses.
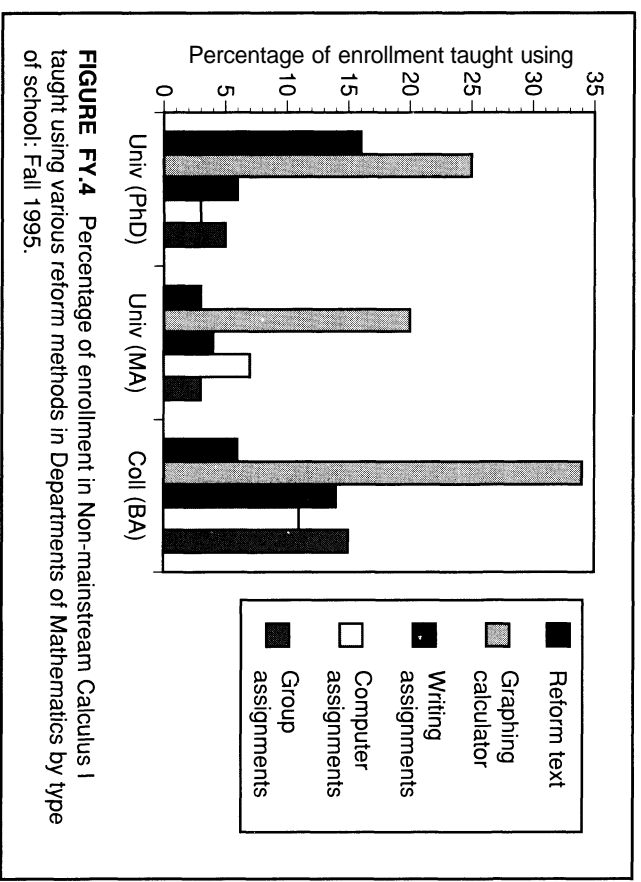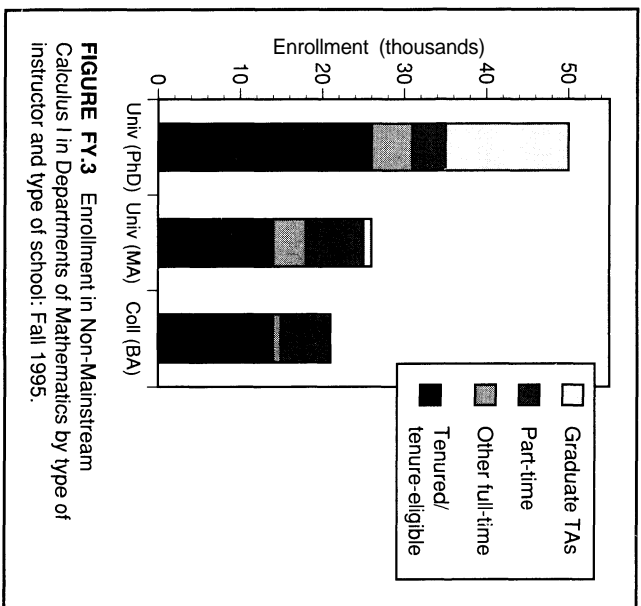
TABLE FY.3 Percentage of enrollment in Non-mainstream Calculus I and Non-mainstream Calculus II taught by tenured/tenure-eligible, other full-time, part-time, and graduate teaching assistants in Departments of Mathematics by size of sections and type of school: Fall 1995. Also total enrollments (in thousands) and average section sizes.

| Course | Percentage of enrollment taught by | | | | | | | | | | | | Enrollment (thousands) | | | Ave. section size | | |
| | Tenured/ tenure-eligible | | | Other full-time | | | Part-time | | | Graduate teaching assistants | | | | | | | | |
	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)
Non-mainstream calculus I																		
Large lecture with recitation	84	0	0	10	0	0	2	0	0	4	0	0	100% 16.0	100% 0	100% 0	108	-	-
Regular section <30	45	53	60	11	11	4	7	36	36	36	0	0	100% 4.5	100% 10.5	100% 12.5	24	26	22
Regular section ≥30	36	52	83	9	20	2	11	21	15	44	7	0	100% 29.5	100% 16.5	100% 7.5	51	38	36
Course total	52	53	69	10	16	3	8	26	29	30	5	0	100% 50	100% 27	100% 20	54	33	26
Non-mainstream calculus II All sections	39	53	52	8	23	12	10	24	36	44	0	0	100% 10	100% 2	100% 2	42	25	21
Course total	39	53	52	8	23	12	10	24	36	44	0	0	100% 10	100% 2	100% 2	42	25	21
Total Non-mainstream calculus I & II	50	53	67	10	16	4	8	26	30	32	5	0	100% 60	100% 29	100% 22	52	32	25

TABLE FY.4 Percentage of enrollment in Non-mainstream Calculus I taught using various reform methods in Departments of Mathematics by size of sections and type of school: Fall 1995. Also total enrollments (thousands) and average section size.

Course	Percentage of enrollment																								Enrollment (thousands)				Ave. section size			
	taught from a "reform" text*				using graphing calculators				writing assignments				having required computer assignments				having assigned group projects				Univ (PhD)	Univ (MA)	Coll (BA)		Univ (PhD)	Univ (MA)	Coll (BA)	
	Univ (PhD)	Univ (MA)	Coll (BA)		Univ (PhD)	Univ (MA)	Coll (BA)		Univ (PhD)	Univ (MA)	Coll (BA)		Univ (PhD)	Univ (MA)	Coll (BA)		Univ (PhD)	Univ (MA)	Coll (BA)									
Non-mainstream Calculus I																															
Large lecture with recitation	8	0	0		4	0	3		0	11	0		01	0	8		8	0	6		160	P	1.8		—	—	—	
Regular section <30	6	0	6		1	14	20		0	15	3		0	6	9		1	11	20		4.5	10.1	12.5		24	26	22	
Regular section ≥30	24	10	0		0	0	01		0	5	6		8	0	8		0	6	20		16.1	7.5			51	88	88	
Course total	16	8	6		25	20	34		9	4	14		8	7	11		01	8	16		21	27	20	54	108	26	22	26

* The primary text (or set of notes etc.) generally reflects the pedagogical principles of the reform calculus movement.

FIGURE FY.3 Enrollment in Non-Mainstream Calculus I in Departments of Mathematics by type of instructor and type of school: Fall 1995.

Legend: Graduate TAs; Part-time; Other full-time; Tenured/tenure-eligible.

FIGURE FY.4 Percentage of enrollment in Non-mainstream Calculus I taught using various reform methods in Departments of Mathematics by type of school: Fall 1995.

Legend: Reform text; Graphing calculator; Writing assignments; Computer assignments; Group assignments.

Tables FY.5 and FY.6

These tables are an elaboration of Tables SFY.22 and SFY.23 in chapter 1, *Summary*.

While there are some differences in the way these two courses are offered between PhD statistics departments and the three types of mathematics departments, the one large difference is the percentage of students who have required computer assignments. In PhD statistics departments, 60% of the students in these two courses have required computer assign-ments, compared to 39% of students enrolled in these courses in PhD mathematics departments. Perhaps this disparity has to do with the type of faculty offering the courses. In PhD mathematics departments, 31% percent of students enrolled in these two courses are taught by tenured or tenure-eligible faculty, while the comparable figure for statistics PhD departments is 41%. On the other hand, it could be the result of different approaches to the course by the two departments.

TABLE FY.5 Percentage of enrollment in Elementary Statistics (no calculus) and Probability and Statistics (no calculus) taught by tenured/tenure-eligible, other full-time, part-time, and graduate teaching assistants in Departments of Mathematics by size of sections and type of school: Fall 1995. Also percentage of students in classes requiring computer assignments, total enrollments (in thousands) and average section sizes.

| Course | Percentage of enrollment taught by | | | | | | | | | | | | Enrollment (thousands) | | | % of students having required computer assigns. | | | Ave. section size | | |
| | Tenured/ tenure-eligible | | | Other full-time | | | Part-time | | | Graduate teaching assistants | | | | | | | | | | | |
	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)
Elementary Statistics (no calculus)																					
Lecture with recitation	41	100	0	35	0	0	24	0	0	0	0	0	100% 3.5	100% 1	100% 0	26	0	0	175	130	-
Regular section <30	0	69	88	0	10	2	0	17	10	0	4	0	100% 0.0	100% 8	100% 17	0	26	65	-	25	23
Regular section ≥30	26	67	65	4	12	7	14	14	28	56	7	0	100% 13.5	100% 20	100% 34	46	33	63	40	41	35
Course total	29	69	73	10	11	5	16	15	22	46	6	0	100% 17	100% 29	100% 51	42	30	64	45	35	30
Probability and Statistics (no calculus)																					
All sections	36	75	69	1	12	0	12	10	31	51	3	0	100% 6	100% 6	100% 6	31	53	34	34	31	27
Course total	36	75	69	1	12	0	12	10	31	51	3	0	100% **6**	100% **6**	100% **6**	31	53	34	34	31	27
Total both courses	31	70	72	8	11	5	15	14	23	47	5	0	100% 23	100% 35	100% 57	39	34	61	41	34	30

TABLE FY.6 Percentage of enrollment in Elementary Statistics (no calculus) and Probability and Statistics (no calculus) taught by tenured/tenure-eligible, other full-time, part-time, and graduate teaching assistants in Departments of Statistics by size of sections and type of school: Fall 1995. Also percentage of students in classes requiring computer assignments, total enrollments (in thousands) and average section sizes.

Course	Percentage of enrollment taught by								Enrollment (thousands)		% of students having required computer assigns.		Ave. section size	
	Tenured/ tenure-eligible		Other full-time		Part-time		Graduate teaching assistants							
	Univ (PhD)	Univ (MA)	Univ (PhD)	Univ (MA)	Univ (PhD)	Univ (MA)	Univ (PhD)	Univ (MA)	Univ (PhD)	Univ (MA)	Univ (PhD)	Univ (MA)	Univ (PhD)	Univ (MA)
Elementary Statistics (no calculus)														
Lecture with recitation	74	0	10	0	7	0	9	0	100% 11	100% 0	71	0	175	-
Regular section <30	49	0	44	0	7	0	0	0	100% 5	100% 0	97	0	22	-
Regular section ≥30	27	50	8	25	11	25	54	0	100% 17	100% 2	44	25	48	45
Course total	46	50	14	25	9	25	31	0	100% 33	100% 2	61	25	52	45
Probability and Statistics (no calculus)														
All sections	19	86	2	14	4	0	75	0	100% 7	100% 1	58	43	52	30
Course total	19	86	2	14	4	0	75	0	100% 7	100% 1	58	43	52	30
Total both courses	41	63	12	21	8	17	39	0	100% 40	100% 3	60	39	52	39

FIGURE FY.6 Enrollment in Elementary Statistics (no calculus) in Departments of Statistics with PhD programs by type of instructor: Fall 1995.

FIGURE FY.5 Enrollment in Elementary Statistics (no calculus) in Departments of Mathematics by type of instructor and type of school: Fall 1995.