CHAPTER II

ENROLLMENTS IN UNDERGRADUATE MATHEMATICAL SCIENCE COURSES

Summary of Conclusions

In the five year period from Fall 1965 to Fall 1970 enrollments in undergraduate mathematical science courses in four-year institutions increased from 1,068,000 to 1,386,000 or 30 percent, the same percentage increase as the number of students in college. This repeats the experience of the preceding five years so that over a ten year period mathematical science enrollments have remained a relatively constant fraction of all course enrollments.

Not all segments of the mathematical sciences have grown equally. Mathematics courses at the level of calculus or below have increased by only 19 percent although still comprising 81 percent of all course enrollments in mathematics. Upperclass mathematics courses have increased more rapidly but even so the total enrollment in all mathematics courses, excluding statistics and computer science, has increased only 20 percent.

Our data show, however, an explosive increase in statistics and computer science. The enrollment in statistics has more than doubled in five years from 43,000 in 1965-66 to 92,000 in 1970-71 while computing enrollments more than tripled from 25,000 to 90,000 in the same period. Thus enrollment increases in statistics and computing accounted for 36 percent of all enrollment increases in the mathematical sciences even though these areas accounted for only 13 percent of actual enrollments in 1970-71.

The gain in mathematical science enrollments from 1965-66 to 1970-71 was 318,000, almost identical to the gain of 324,000 for the previous five years. If mathematical science enrollments continue to grow proportionally to the general enrollment the increases over the next five years could be expected to be smaller both in absolute size and as a percentage of present enrollment.

The Background of the Data

The reader should keep certain things in mind in interpreting the data on course enrollments. The questionnaire reproduced in the appendix was sent to all chairmen of mathematical science departments at a stratified random sample of institutions chosen in the manner described in Chapter I. The present survey is a repetition of earlier surveys done in 1960 and 1965 using quite similar methodology. The enrollment figures reported are our estimates of national totals estimated from sample data by methods described in Chapter I. The unit of reporting is a course enrollment so that no distinction is made between quarter courses, semester courses, and year courses, nor between courses carrying different amounts of credit. The course enrollments are for the first term only. All enrollment totals in this chapter are for universities and four year colleges; two-year college data will be summarized separately in Chapter V. Finally it should be noted that we have collected data on enrollments in undergraduate courses only, although some of the enrollments in these courses are enrollments by graduate students.

Data for Comparison with Mathematical Science Enrollments

The full implications of the information to be presented in this chapter can be understood only if viewed against a background of trends in general enrollments.

It is not entirely clear which enrollment figures are most suitable for purposes of comparison with mathematical science enrollments. Table 2.1 gives several types of undergraduate enrollments as reported and projected by the U.S. Office of Education in [A]. The projections are not predictions but are formal extrapolations based only on percentage trends over the immediately preceding ten year period as applied to population age-groups. Full-time equivalent enrollments are full-time enrollments plus one-third of all part-time enrollments. First-time enrollments are essentially entering freshmen (never before enrolled in higher education).

Between 1960 and 1965 full-time equivalent enrollment increased by 50 percent. and first-time enrollment increased by 47 percent. Between 1965 and 1970, however, full-time equivalent enrollment increased by only 30 percent while the increase in first-time enrollment was only 13 percent. It is important to

Table 2.1

UNDERGRADUATE DEGREE-CREDIT ENROLLMENTS IN FOUR-YEAR COLLEGES AND UNIVERSITIES

(Enrollments in Thousands)

Year (Fall)	Full Time	Percent Increase	Full Time Equivalent	Percent Increase	First Time	Percent Increase
1960	2,077		2,310		709	
		52%		50%		47%
1965	3,159		3,461		1,041	
		32%		30%		13%
1970*	4,169		4,505		1,177	
		22%		22%		18%
1975*	5,082		5,496		1,383	

Source: Projections of Educational Statistics to 1979-80, National Center for Educational Statistics (USOE), Tables 15 and 19.

* Projected.

notice not only that the increase in full-time equivalent enrollment has slowed, but also that the increase of first-time enrollment has slowed even more.

The explanation is to be found in trends in first-time enrollment in two-year colleges. Between 1960 and 1965 first-time enrollment in two-year colleges increased from 214,000 to 401,000. This five year increase of 187,000 was considerably smaller than the increase of 332,000 in four-year institutions. But between 1965 and 1970 the increment in first-time enrollment was 253,000 for two-year colleges compared with only 136,000 for four-year institutions. Moreover, the fact that full-time equivalent enrollment in four-year institutions increased by over a million in this five year period makes it clear that the greater part of enrollment increases in such institutions has come from increases in the number of juniors and seniors.

As a confirmation of this trend and as an indication that the shift of freshman enrollments to junior colleges may in the future be more pronounced than is indicated by the USOE projections, we observe that Garland Parker has reported in the February 1972, issue of School and Society that freshman enrollments in four-year institutions actually declined by 0.7 percent from Fall 1970 to Fall 1971. At the same time preliminary indications (quoted by Parker) are that overall enrollments in two-year colleges increased by somewhat more than 13 percent from 1970 to 1971.

Enrollments in mathematical science courses are affected not only by the number of students in college but also by the fields in which these students specialize. Table 2.2 gives the number of bachelor's degrees awarded in several broad areas in 1961, 1966, and 1971. Our interest is in the trends in such degrees. The number of degrees in mathematics and statistics increased by 49 percent over the most recent five year period. In other fields, degrees in engineering and physical sciences increased least and at less than half the rate of degrees in the broad field of social sciences, humanities, and related professions.

Table 2.2

NUMBERS OF BACHELOR'S DEGREES IN SELECTED FIELDS

(Numbers in Thousands)

	Bachelor's Degrees In 1960-61	Bachelor's Degrees In 1965-66	Bachelor's Degrees In 1970-71	Increase over Last Five Years
Social Sciences, Humanities, and Related Professions	281.5	412.5	674.1	63%
Natural Sciences and Related Professions	113.7	138.5	188.9	36%
Engineering	35.7	35.6	44.7	26%
Biological Sciences	16.1	26.9	38.5	38%
Physical Sciences	15.5	17.1	21.8	27%
Mathematics and Statistics	13.1	20.1	29.9	49%

Source: Projections of Educational Statistics to 1979-80 (USOE), Table 23, with 1970-71 figures from USOE unpublished data.

Moreover, the U.S. Office of Education projections (in [A], table 22) call for degrees in engineering to decrease from 5.2 percent of all bachelor's degrees to 4.4 percent from 1970 to 1980 and for physical science degrees to decrease from 2.7 percent of all bachelor's degrees to 1.6 percent. The article by Parker cited above states that from 1970 to 1971 there was a 17 percent decline in the number of freshman engineering students, a large decline of 14 percent in the number of freshmen in education, and a small drop in the number of freshmen business students.

In summary, these data say that from the time of our 1965-66 survey to the present survey the number of students in four-year institutions has increased 30 percent but that the increase in entering freshmen has been only 13 percent. The number of majors in fields which are heavy users of mathematical science courses has increased much more slowly than the number of majors in other less mathematically oriented fields. The U.S. Office of Education projections as well as the most recent figures given by Parker indicate that these trends will continue, and perhaps intensify, during the next five to ten years.

Although the U.S. Office of Education projections call for a continued increase in the number of bachelor's degrees in the mathematical sciences, recent information on the plans of entering freshmen make it doubtful that these increases will in fact take place. The American Council on Education has conducted a large scale continuing study [B] based on questionnaires administered initially to a sample of entering freshmen. The data displayed in Table 2.3 show that the percentage of freshmen intending to major in mathematics or statistics has declined steadily since 1966. Because of the increased number of entering freshmen, the number of freshmen planning to major in some field of the mathematical sciences has not shown any really significant change. The data do seem to contradict any expectation of a continuing increase in the number of bachelor's degrees in the mathematical sciences.

Enrollments in Mathematical Science Courses

The number of enrollments in undergraduate courses taught by mathematical science departments in four-year institutions was 1,386,000 for the fall term of the academic year 1970-71.

Table 2.3

PROBABLE MAJORS IN MATHEMATICS AND STATISTICS AS DECLARED BY FRESHMEN ENTERING UNIVERSITIES AND FOUR-YEAR COLLEGES

Entering Year (Fall)	Percent of Freshmen Declaring Probable Major in Mathematics or Statistics			Estimated Total Number of Freshmen Majors in Math and Stat in Universities and Four-Year Colleges
	All Four-Year Institutions	Four-Year Colleges	Universities	
1966	5.4	6.0	4.5	48,000
1967	5.3	6.0	4.3	48,000
1968	5.0	5.5	4.2	48,000
1969	4.6	4.9	4.3	47,000
1970	4.1	4.3	3.9	44,000
1971	3.7	3.6	3.8	41,000

Source: American Council on Education, National Norms for Entering College Freshmen (annually); estimated totals calculated from first-time, full-time enrollment, USOE Opening Fall Enrollment in Higher Education (annually).

These enrollments are reported in Tables 2.4 through 2.8. Although the reported data exclude courses regarded by the respondents as graduate courses they include a number of enrollments by graduate students. Courses taught outside mathematical science departments are excluded from these tables; to the extent permitted by the respondents' knowledge these are reported separately in Table 2.9. It is interesting to note the considerable extent to which the enrollment trends in mathematical science courses as reported in Tables 2.4 through 2.8 can be viewed as consequences of the more general trends presented above.

Table 2.4 gives a broad picture of the situation. By consolidating enrollments in individual courses we find that mathematical science departments taught 92,000 students in courses in probability and statistics and 90,000 students in courses in numerical analysis and computing. These courses were taught not only by departments of statistics and computing but also, especially in smaller institutions, by departments of mathematics. At the risk of seeming somewhat arbitrary, we classify all

Table 2.4

TOTAL ENROLLMENTS IN UNDERGRADUATE MATHEMATICAL SCIENCE COURSES IN FOUR-YEAR INSTITUTIONS

(Enrollments in Thousands)

	Fall 1960-61	Fall 1965-66	Percent Increase 1960-61 to 1965-66	Fall 1970-71	Percent Increase 1965-66 to 1970-71
Total Mathematical Science Enrollments	744	1,068	44%	1,386	30%
Exclusive of Numerical Analysis, Computing, and Statistics	714	1,000	40%	1,204	20%
Numerical Analysis and Computing	7	25	257%	90	260%
Statistics	23	43	87%	92	114%

mathematical science courses other than probability and statistics or numerical analysis and computing as "mathematics". Thus defined, mathematics accounts for almost 87 percent of all enrollments with the remainder being divided approximately equally between computer science and statistics. The table shows vividly the extremely rapid growth of enrollment in computer science and statistics.

Table 2.5 gives more details about how enrollments were distributed among various mathematical science subjects. This table also shows trends in enrollments over the ten year period from 1960-61 to 1970-71. The individual entries and the totals in this and succeeding tables were calculated separately from unrounded data and hence details in these tables may not add to totals.

Over the last five years, only a few subjects matched the growth shown by statistics and computing. Among these were finite mathematics, linear and matrix algebra, real variables, and the area of history, logic and foundations. Mathematics courses typically taken mainly by engineering and physical science students showed little or no growth. For example, differential

equations, advanced calculus, and advanced mathematics for engineers and physicists had no increases at all. At a lower level the enrollment in elementary algebra increased from 12,000 to 25,000 and mathematics for elementary school teachers increased from 61,000 to 89,000. It should perhaps be remarked that

Table 2.5

TOTAL ENROLLMENTS IN UNDERGRADUATE MATHEMATICAL SCIENCE COURSES

(Enrollments in Thousands)

	Subject	Fall 1960-61	Fall 1965-66	Fall 1970-71
	TOTAL	744	1,068	1,386
1.	High School Geometry	5	2	3
2.	Elementary Algebra	10	12	25
3.	Intermediate Algebra	33	46	50
4.	Business Mathematics, Mathematics of Finance, etc.	17	21	18
5.	General Mathematics (operations, skills, etc.)	40	21	19
6.	Basic Concepts (structure, logic, sets, etc.)	36	87	74
7.	Mathematics for Elementary School Teachers	23	61	89
8.	Miscellaneous Remedial Courses	8	8	4
9.	College Algebra, Trigonometry, Mathematical Analysis	235	262	301
10.	Finite Mathematics	1	7	47
11.	Analytic Geometry, Calculus	184	295	345
12.	Probability, Statistics	23	43	92
13.	Numerical Analysis	3	5	11
14.	Computing and Related Mathematics	4	20	79
15.	Differential Equations	29	31	31
16.	Theory of Equations	5	1	1
17.	Linear and Matrix Algebra	4	19	47
18.	Modern Algebra	11	20	23
19.	Theory of Numbers	2	3	4
20.	Mathematics for Secondary School Teachers	5	5	7
21.	Advanced Calculus	17	20	20
22.	Advanced Mathematics for Engineers and Physicists	10	12	12
23.	Miscellaneous Applied Mathematics	9	9	8
24.	History, Logic, and Foundations	5	7	18
25.	Advanced Geometry	8	12	13
26.	Topology	1	3	5
27.	Real Variables	1	3	11
28.	Complex Variables	4	6	7
29.	Miscellaneous Undergraduate Mathematics	11	27	22

except for increases in finite mathematics and mathematics for elementary school teachers, the data show very little evidence of significant extension of the services of mathematicians to groups of students who formerly took little mathematics.

It is interesting to examine the distribution of mathematics enrollments by level as recorded in Table 2.6. First, we should observe that in 1970-71 only 19 percent of all undergraduate course enrollments in mathematics were in upperclass courses and that 52 percent were in pre-calculus courses. The five year enrollment increase in pre-calculus courses in four-year institutions was only 20 percent, a reflection of the fact that an increasing proportion of freshmen and sophomores have been attending junior colleges. The even lower percentage increase in calculus enrollments is probably attributable both to this and to relative stability in the number of students majoring in engineering and the physical sciences. The relatively greater increase of 29 percent in junior and senior courses seems to be explainable, in spite of constant enrollments in physical science related courses, by a large increase in the number of courses taken by undergraduate mathematics majors. (As shown in Table 2.2, bachelor's degrees in mathematical science increased by 49 percent between 1965-66 and 1970-71.)

Table 2.6

TOTAL ENROLLMENTS IN UNDERGRADUATE MATHEMATICS COURSES IN FOUR-YEAR INSTITUTIONS BY LEVEL

(Enrollments in Thousands)

Level	Fall 1960-61	Fall 1965-66	Increase 1960-61 to 1965-66	Fall 1970-71	Increase 1965-66 to 1970-71
Below Calculus (Subjects 1-10 of 2.5)	408	527	29%	630	20%
Calculus (Subject 11 of 2.5)	184	295	60%	345	17%
Upperclass Mathematics (Subjects 15-29 of 2.5)	122	178	46%	229	29%

We are now in a position to make an instructive observation about one of the sources of demand for mathematical scientists. It can be argued that mathematics courses at the level of calculus or below are plausible assignments for any faculty member or in some cases for graduate assistants, but that junior and senior courses in mathematics and courses in statistics and computer science may well require special training or special interest. Between 1960-61 and 1965-66 enrollments in upper division mathematics courses increased by 56,000 students while the increases in statistics and computer science courses, at 18,000 and 20,000, respectively, were much smaller. Between 1965-66 and 1970-71, however, the increase in upper division mathematics enrollments was 51,000 compared with 49,000 for statistics and 65,000 for computer science (Table 2.4). Since demand for mathematical scientists is generated more by increased enrollment than by a need for replacements, this observation may help to explain the preferences of chairmen for hiring specialists in statistics amd computer science to be described in the next chapter.

Table 2.7 gives enrollments for fall 1970-71 in the 76 individual mathematical science courses actually listed in the questionnaire. The list of courses used in the most recent survey was sufficiently different from that of previous surveys that meaningful comparisons with prior years are not possible at this level of detail. The label GCMC attached to certain courses refers to courses suggested by the Committee on the Undergraduate Program in Mathematics in its report, A General Curriculum in Mathematics for Colleges, (1965), and the label ACM refers to courses suggested by the Association for Computing Machinery, as listed in Communications of the ACM, March 1968, pp. 151-197. The symbol L in the body of the table indicates an estimated enrollment of less than 500. The reader will remember that the respondents were instructed to report only those courses which they regarded as undergraduate courses. Thus many of the courses which are shown in Table 2.7 as having few students may actually have had significant enrollments which were unreported because some respondents considered these courses to be graduate courses.

The fact that over half of undergraduate mathematics enrollments were in pre-calculus courses has analogues for statistics and computer science. If courses 48 through 51 are viewed as introductory courses in probability and/or statistics, then approximately 91 percent of the total enrollment in undergraduate course in this area was in introductory courses. Similarly, if courses

Table 2.7

DETAILED ENROLLMENTS IN UNDERGRADUATE MATHEMATICAL SCIENCE COURSES BY TYPE OF INSTITUTION

(Enrollments in Thousands)

	Course	Total	Universities	Public Colleges	Private Colleges
	TOTAL	1,386	629	496	261
1.	Arithmetic for College Students	4	1	2	1
2.	High School Geometry	3	L	1	2
3.	Elementary Algebra (H.S.)	25	4	19	2
4.	Intermediate Algebra (H.S.)	50	11	33	6
5.	College Algebra	92	40	45	7
6.	Trigonometry	31	14	16	1
7.	College Algebra and Trigonometry, combined	113	44	52	17
8.	Elem. Math Analysis (algebra,et.) GCMC:0	38	15	13	10
9.	Basic Concepts (structure, logic, sets)	74	21	26	27
10.	General Math (basic skills, operations)	19	3	13	3
11.	Finite Mathematics	47	26	11	10
12.	Math of Finance	4	2	1	1
13.	Business Mathematics	14	3	11	L
14.	Math for Elementary School Teachers	89	28	45	16
15.	Other pre-calculus	27	12	5	10
16.	Analytic Geometry	10	4	5	1
17.	Analytic Geometry & Calculus	224	121	72	31
18.	Calculus GCMC:1,2,4	111	60	22	29
19.	Advanced Calculus GCMC:5	20	11	5	4
20.	Differential Equations	31	16	9	6
21.	Partial Differential Equations	2	1	1	L
22.	Real Analysis GCMC:11,12	11	6	3	2

	Course	Total	Universities	Public Colleges	Private Colleges
23.	Complex Variables	7	4	2	1
	GCMC:13				
24.	Vector Analysis	4	2	2	L
25.	Advanced Math for Engineers and Physicists	12	8	2	2
26.	Fourier Series and Boundary Value Problems	1	1	L	L
27.	Geometry	10	3	4	3
	GCMC:9				
28.	Projective Geometry	2	1	L	1
29.	Differential Geometry	1	1	L	L
	GCMC:9alt.				
30.	Topology	5	2	2	1
31.	Graph Theory	L	L	L	L
32.	Linear Algebra	41	18	8	15
	GCMC:3				
33.	Modern Algebra	23	9	8	6
	GCMC:6				
34.	Matrix Theory	6	3	3	L
35.	Theory of Equations	1	1	L	L
36.	Combinatorial Algebra	L	L	L	L
37.	Foundations of Math	8	2	6	L
38.	Theory of Numbers	4	2	1	1
39.	Set Theory	4	2	1	1
40.	Operational Math.	L	L	L	L
41.	History of Math.	4	1	2	1
42.	Math Logic	2	1	1	L
43.	Math for Sec. School Teachers (methods, etc.)	7	4	2	1
44.	Calculus of Finite Differences	L	L	L	L
45.	Applied Math. (models)	1	1	L	L
	GCMC:10				
46.	Theoretical Mechanics	L	L	L	L
47.	Ecological Mathematics	L	L	L	L
48.	Elementary Statistics (no calculus prereq.)	36	17	7	12
49.	Probability & Stat. (no calculus prereq.)	21	14	4	3

	Course	Total	Universities	Public Colleges	Private Colleges
50.	Math. Statistics (Calculus) GCMC:7S	16	5	8	3
51.	Probability (Calculus) GCMC:2P/7P	11	7	2	2
52.	Applied Statistical Analysis	7	5	1	1
53.	Design & Analysis of Experiments	1	1	L	L
54.	Sampling Methods	L	L	L	L
55.	Analysis of Variance	L	L	L	L
56.	Stochastic Processes	L	L	L	L
57.	Time Series Analysis	L	L	L	L
58.	Multivariate Analysis	L	L	L	L
59.	Nonparametric Statistics	L	L	L	L
60.	Operations Research (Queuing/Optimization)	L	L	L	L
61.	Senior Seminar	3	2	L	1
62.	Independent Study or Honors Course	3	2	L	1
63.	Senior or Honors Thesis	L	L	L	L
64.	Introduction to Computing ACM:B-1	38	23	7	8
65.	Computers and Programming ACM:B-2	26	14	7	5
66.	Introduction to Discrete Structures ACM:B-3	1	1	L	L
67.	Numerical Calculus ACM:B-4	3	2	L	1
68.	Data Structures ACM:I-1	2	2	L	L
69.	Programming Languages ACM:I-2	5	4	L	1
70.	Computer Organization ACM:I-3	3	3	L	L
71.	Systems Programming ACM:I-4	2	1	1	L
72.	Compiler Construction ACM:I-5	1	1	L	L
73.	Switching Theory ACM:I-6	1	1	L	L
74.	Sequential Machines ACM:I-7	L	L	L	L
75.	Numerical Analysis ACM:I-8&9	8	5	2	1
76.	Other: specify	16	10	3	3

L = less than 500

64, 65, 67 and 75 are considered to be introductory to numerical analysis and computing, then 83 percent of all enrollment in undergraduate courses in this area was in introductory courses. There is considerable anecdotal evidence indicating that a student's first courses in statistics and computing tend to be taken much later than his first college course in mathematics, perhaps most commonly when he is an upper division or graduate student. To the extent that this is true shifts in enrollments to two-year colleges would have a smaller effect on statistics and computer science than on mathematics.

Table 2.8 presents enrollments by type of institutions. A feeling for the distinctions among universities, public colleges, and private colleges can quickly be obtained by examining the list of respondents in the appendix. Universities taught 45 percent of all mathematical science courses while 36 percent were taught in public colleges and only 19 percent in private colleges. Enrollments in mathematics courses were less highly concentrated in universities than were enrollments in statistics and computer science; universities had 43 percent of all enrollments in mathematics while the corresponding figures for statistics and computer science were 53 percent and

Table 2.8

ENROLLMENTS IN UNDERGRADUATE MATHEMATICAL SCIENCE COURSES
BY TYPE OF INSTITUTION, FALL 1970-71
(In Thousands)

	All Institutions	Universities	Public Colleges	Private Colleges
All Subjects	1,386	629	496	261
Mathematics	1,204	523	457	224
Remedial	101	19	68	14
Below Calculus	529	205	225	99
Calculus and Analytics	345	185	99	61
Upper Class Subjects	229	114	65	50
Numerical Analysis and Computing	90	57	17	16
Statistics	92	49	22	21

63 percent respectively. Public colleges differed significantly from other institutions in that almost two thirds of all enrollments in mathematics were in pre-calculus courses.

Mathematical Science Courses Taught Outside Mathematical Science Department

The information presented above has been restricted to enrollments in undergraduate mathematical science courses taught within mathematical science departments. Thus, we have considered courses taught by departments of mathematics, statistics, and computer science, but not courses taught by departments specializing in such fields as business and engineering.

The Survey Committee has been interested in courses taught outside mathematical science departments from the very beginning of its work. In the 1965-66 survey sufficient information [E] was collected to demonstrate the widespread existence of this phenomenon, at least in universities. Volume III of the Report of the Survey Committee [J] devotes a chapter to a thorough discussion of this problem, based largely on case studies of the situation at seven major universities.

In the present survey we have tried for the first time to get some quantitative information on the enrollments in such courses. In an effort to gather as much information as possible on this elusive question we went against our usual custom and asked for data for the entire academic year instead of merely the first term. We specifically asked for undergraduate courses only. The discussion in Volume III of the Report of the Survey Committee was not so restricted. That discussion, therefore, reflects concerns at the graduate level which are outside the scope of our present data.

There are difficulties in acquiring data of the same degree of accuracy as our other enrollment data. Since the respondents to the questionnaire (chairmen of mathematical science departments) were reporting on courses outside their own departments, the question asked only for their "estimates" of enrollments. Mathematical science courses taught outside mathematical science departments are not always clearly advertised as such. In fact, chairmen of mathematical science departments are frequently surprised to discover

almost by accident of the existence of mathematical science courses taught by other departments. Thus, the data presented in Table 2.9 should be interpreted as lower bound estimates; the exact enrollments, if known, would probably be larger, possibly by a considerable amount.

Table 2.9

ESTIMATED ENROLLMENTS IN UNDERGRADUATE MATHEMATICAL SCIENCE COURSES TAUGHT OUTSIDE MATHEMATICAL SCIENCE DEPARTMENTS, ALL TERMS OF ACADEMIC YEAR 1970-71

(Enrollments in Thousands)

	Enrollment in Courses Given by Divisions Specializing in:							
	Biol. Science	Physical Sciences	Engi-neering	Educa-tion	Business Admin.	Social Sciences	Other	Total
Probability			4	L	3	L	1	8
Statistics	2	L	5	14	38	58	6	123
Calculus or Diff. Equations	L	1	1		1	L	L	3
Advanced Math for Engineers/Physics		2	5					7
Computer Science & Programming	L	3	40	L	22	1	7	73
Numerical Analysis			2				L	2
Optimization & Linear Programming			3		2	L	1	6
Biomathematics	L		L				1	1
Mathematics of Finance, etc.					7			7
Other	—	—	1	2	1	L	4	8
TOTAL	2	6	61	16	74	59	20	238

L = some, but less than 500.

The estimated number of enrollments in undergraduate mathematical science courses outside mathematical science departments was 238,000 during the entire academic year 1970-71. Dividing this figure by two to get some degree of comparability with data for the fall term only there were in the fall term 119,000 enrollments in mathematical science courses outside mathematical science departments compared with 1,386,000 enrollments within mathematical science departments. Surprisingly, over 40 percent of the total enrollments recorded in Table 2.9 were in colleges rather than in universities.

The divisions teaching the majority of mathematical science courses were engineering (61,000 enrollments), business administration (74,000) and social science departments (59,000). There was comparatively little evidence of the teaching of mathematical science courses by departments in the biological and physical sciences. The bulk (over 86 percent) of the enrollment was in courses in numerical analysis and computer science and in probability and statistics, with very little evidence of teaching of courses such as calculus, linear algebra, or differential equations.

The overall situation in computer science and statistics, including courses given in both mathematical science and other departments, is displayed in Table 2.10. Within the mathematical science departments, about a third of the courses in statistics are taught in statistics departments and half the courses

Table 2.10

ESTIMATED ENROLLMENT IN UNDERGRADUATE COURSES IN STATISTICS AND COMPUTER SCIENCE, BY TYPE OF DEPARTMENT, FALL 1970-71

(Enrollments in Thousands)

	University Departments			Colleges Math. Depts.	Non-Math.Sci.Depts.		Total All Depts.
	Stat.	Comp.Sci.	Math.		Univs.	Colleges	
Probability and Statistics	32	-	17	43	32	34	158
Numerical Analysis and Computing	-	46	11	33	27	11	128

in computing in computer science departments, this mostly in institutions which offer graduate specialization in these areas. Again using one-half the academic year data, approximately 66,000 out of 158,000 students in probability and statistics and 38,000 out of 128,000 students in numerical analysis and computer science courses during the fall term were taught outside mathematical science departments. This table is presented here for comparison with faculty data in the next chapter.