CHAPTER 1

UNDERGRADUATE STUDENTS

This chapter reports estimated national student enrollments in university and four-year college mathematical and computer science courses in fall 1985. Detailed course-by-course enrollments for universities, public four-year colleges and private four-year colleges are given in Appendix E. This chapter also contains analyses of undergraduate degrees granted in the mathematical and computer sciences. Extra computer science data is provided in Chapter 4. The current chapter provides some specially prepared data on undergraduate statistics. Where data is known and relevant, it also provides information on changes in undergraduate student phenomena over time.

HIGHLIGHTS

- While overall undergraduate enrollments in universities and four-year colleges were almost stable since 1980, mathematics enrollments increased by 6%, statistics by 41% and computer science by 74%.

- The number of undergraduate degrees in mathematics and statistics (all types, including mathematics education) was 20,096, up from 13,906 in 1980 but not up to the 24,181 level of 1975. The number of degrees in computer science was 29,107, up from 8,917 in 1980 and from 3,636 in 1975.

- After a sharp rise from 1975 to 1980, the enrollments in remedial mathematics were 251,000, up from 242,000 five years earlier, a 4% increase.

- The enrollments in upper division mathematics courses were up 52% over 1980 levels reversing a downward trend from the '70's.

- Undergraduate statistics enrollments have been increasing markedly since 1960.

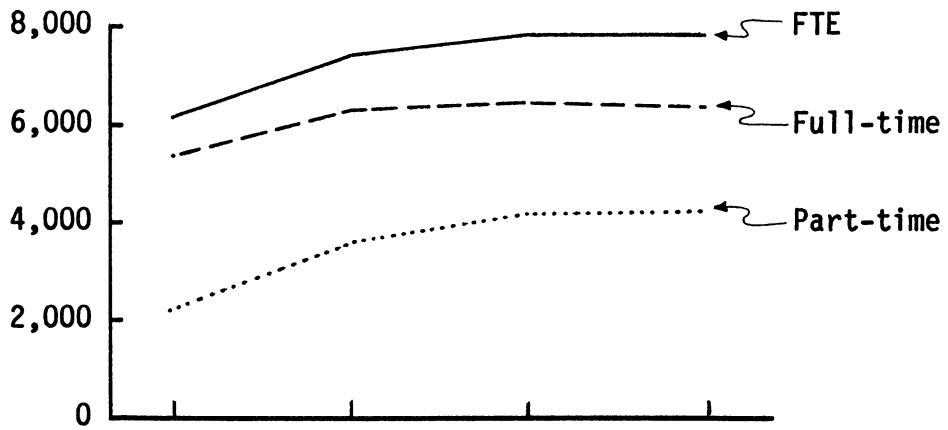
TRENDS IN UNDERGRADUATE EDUCATION

We begin with some data over time from Department of Education Publications "Projections of Educational Statistics", "Digest of Educational Statistics" and other national compilations of information about undergraduates or prospective undergraduates. With this data as background, we then look at mathematical and computer science student data from this Survey. For the reader's convenience, we have organized much special data about computer science as a separate and later Chapter 4.

Since 1970, full-time undergraduate enrollments in all higher education (including two-year colleges) have increased by 20% and part-time enrollments have more than doubled. Overall FTE (full-time equivalent) enrollments have increased by 30%. Much of this increase has been at the two-year college level. Graph 1-A gives the full-time, part-time, and FTE enrollments over time.

GRAPH 1 - A

UNDERGRADUATE ENROLLMENTS IN HIGHER EDUCATION SINCE 1970
(In Thousands)



	1970	1975	1980	1985
FTE Equiv.	6,035	7,433	7,843	7,860
Full-time	5,280	6,169	6,362	6,320
Part-time	2,096	3,510	4,113	4,277

Based on reports from various institutions, Department of Education sources use a part-time student enrollment as equivalent to 36% of a full-time enrollment. Over the period 1970-1985, the total increase in overall FTE undergraduate enrollments was 30%. By comparison undergraduate student course enrollments in the mathematical and computer sciences in all of higher education increased by 76% from 1970 to 1985. Even with all computer science enrollments deleted, the increase in undergraduate enrollments in mathematical sciences from 1970 to 1985 was over 50%. And 1970, the base year, was at the end of a boom period in science in the 1960's. These figures clearly show a rapidly increasing

role for both the mathematical and computer sciences in higher education.

Looking only at the four-year college and university sector, overall FTE enrollments increased about 16% in the period from 1970 to 1985 and mathematical sciences enrollments (not counting computer science enrollments) increased 40%, (From Tables 1-2 and 1-10). This occurred over a period when almost the entire growth of the combined mathematics and computer science faculty since 1970 has been concentrated in computer science (Table 2-5).

PROBABLE MAJORS OF ENTERING FRESHMEN IN HIGHER EDUCATION

Table 1-1 below shows the trend over time of the choices of academic majors in a number of disciplines. The data comes from The American Freshman: National Norms for Fall 1985 by Astin, A. W., King, M. R. and Richardson, G.T. and earlier editions of this report. The trends in the various disciplines shown seem to conform to conventional wisdom. It is encouraging that the "mathematics and statistics" category appears to have "bottomed out". Among the "hard" sciences and engineering, only the mathematical sciences show an upswing, albeit mild, since 1980.

TABLE 1 - 1

PERCENTAGES OF ENTERING FRESHMEN PLANNING
MAJORS IN SELECTED DISCIPLINES

	1965	1970	1975	1980	1985
Business	14.3	16.2	18.9	23.9	26.8
Education	10.6	11.6	9.9	7.7	7.1
Engineering	9.8	8.6	7.9	11.8	10.7
Humanities & Arts	24.3	21.1	12.8	8.9	8.3
Mathematics & Statistics	4.5	3.2	1.1	0.6	0.8
Physical Science	3.3	2.3	2.7	2.0	1.6
Social Sciences	8.2	8.9	6.2	6.7	7.6
Computer Science	-	-	-	2.5	2.3
Data Proc. and Comp. Prog.	-	-	-	2.4	2.1

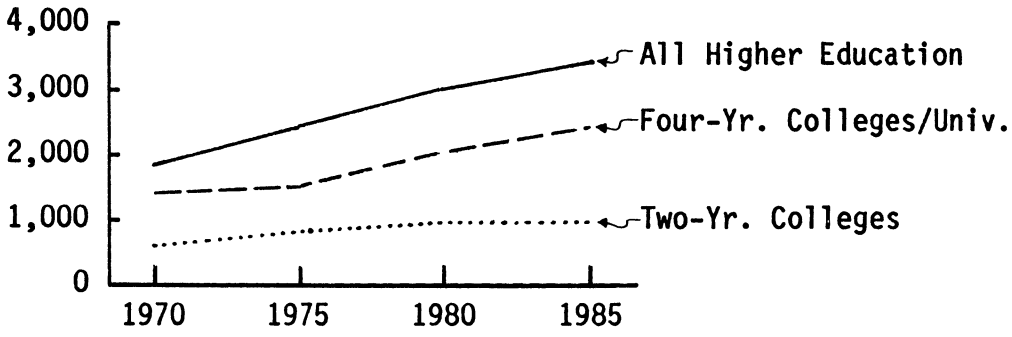
The 1986 figures for computer science and for data processing and computer programming were 1.9% and 1.6%. The profiles on "first choices of intended specific fields of study of college bound seniors" prepared annually for the College Board and involving responses from some million high school seniors show somewhat similar patterns and trends. In mathematics and statistics, the figures from 1975, 1980 and 1985 are 2.4, 1.1 and 1.1 respectively. However, the overall computer science and systems analysis figures for the same years were 2.8, 4.2 and 7.2.

TOTAL MATHEMATICAL AND COMPUTER SCIENCE ENROLLMENTS SINCE 1970

Graph 1-B gives total undergraduate enrollments in the mathematical and computer sciences in two-year colleges and in the four-year colleges and universities. The growth can be compared to that of all undergraduate enrollments shown in Graph 1-A and to that of faculty growth shown in Table 2-2.

GRAPH 1 - B

TOTAL MATHEMATICAL AND COMPUTER SCIENCE ENROLLMENTS IN HIGHER EDUCATION
(In Thousands)



	1970	1975	1980	1985
All Higher Educ.	1,970	2,371	3,043	3,421
4-Yr. Col./Univ.	1,386	1,497	1,995	2,387
2-Yr. College	584	874	1,048	1,034

UNDERGRADUATE MATHEMATICS ENROLLMENTS OVER TIME

From the earlier Surveys and a Department of Education Report of 1960 authored by Clarence Lindquist (who also did the basic statistical work for the 1965 to 1980 Surveys) we see some interesting changes over time in undergraduate enrollments. We look first at mathematics course enrollments by levels of courses and separately at statistics and computer science. In Table 1-2 we give course enrollments by four categories A: Remedial (courses 1-4); B: Other pre-calculus (courses 5-14); C: Calculus level (courses 15-19); and D: Advanced (courses 20-44). The comparable long term trend data for statistics is in Table 1-11 and for computer science is in Table 4-10. See Appendix B or E for the course numbers and titles. We use the course designations and numbers from the

present Survey and adapt the course lists from the earlier Surveys to fit the present list. We used the lists on page 28 of the 1975 Survey report for the 1960-1970 data. It is necessary to make some arbitrary decisions, e.g. general mathematics (basic skills, operations) is regarded as a remedial course, A, even though it was not previously listed that way; mathematics for elementary school teachers is regarded as B even though it was sometimes listed as an upper division course; linear algebra (now listed in C as 19) and in D (as 34) earlier was listed only once and thus enrollments had to be arbitrarily apportioned. Computer science courses have changed in name and level rather dramatically, thus forcing some arbitrary decisions. But the general trends are rather clearcut.

TABLE 1 - 2

ENROLLMENTS IN VARIOUS LEVELS OF MATHEMATICS COURSES
(in Thousands)

	1960	1965	1970	1975	1980	1985
A: Remedial	96	89	101	141	242	251
B: Other pre-calc.	349	468	538	555	602	593
C: Calculus level	180	315	414	450	590	637
D: Advanced	92	133	162	106	91	138
Total	717	1005	1215	1252	1525	1619

Roughly speaking, A represents high school mathematics taught in college, B represents other freshmen level mathematics at a level below calculus, C represents the first two years of mathematics for those able to start with calculus, and D represents upper division mathematics. It should be noted that a great deal of elementary statistics and computer science is also taught in mathematics departments. Thus figures in Table 1-2 and in Table 1-3 below do not represent departmental teaching loads but levels of mathematics courses taken. Below we give the percentages of mathematics courses taken at various levels over time obtained from Table 1-2 above.

TABLE 1 - 3

PERCENTAGES OF ENROLLMENTS IN VARIOUS LEVELS OF MATHEMATICS

	1960	1965	1970	1975	1980	1985
A: Remedial	13%	9%	9%	11%	16%	15%
B: Other pre-calc.	49%	46%	45%	44%	39%	37%
C: Calculus level	24%	29%	34%	36%	39%	39%
D: Advanced	14%	16%	12%	9%	6%	9%

There has been a small but encouraging increase in the sum of C and D from 45% in 1965 to 48% in 1985. The big jump in remedial enrollments for 1975-80 occurred at a time of the development of specially funded federal programs designed to get colleges and universities to address remediation issues and was accompanied by an equally large reduction in the percentage of enrollments in other pre-calculus mathematics. In that light, this change was merely a shift downward from other pre-calculus courses to remedial--perhaps a reflection of both falling student entrance test scores at the lower levels and more faculty attention to that problem.

Since most undergraduate statistics courses taught in mathematical science departments are taught in the (primary) mathematics department, it is reasonable to look at the total mathematics and statistics undergraduate load over time. The detailed (and explosive) growth in statistics enrollments, per se, is given in Table 1-11. Combining mathematics and statistics enrollments in the two categories of (1) pre-calculus and (2) calculus-and-beyond we have the following phenomena.

TABLE 1 - 4

COMBINED MATHEMATICS AND STATISTICS ENROLLMENTS BY LEVEL

	1965	1970	1975	1980	1985
Pre-Calculus Courses					
1-14, 45, 46	54%	54%	57%	57%	54%
Calculus and Beyond					
15-44, 47-54	46%	46%	43%	43%	46%

The 1960 figures were 61% and 39% making the detailed data from that original study somewhat suspect in light of this almost constant distribution of course load by level.

Since computer science as a subject has developed only within the past 25 years, there has, of course, been phenomenal growth in computer science enrollments over that period. The time trends for computer science are given in Table 4-10.

In Table 1-5, we give the enrollments in four-year colleges and universities over time in several specific mathematics courses.

TABLE 1 - 5

ENROLLMENTS OVER TIME IN SOME SPECIFIC MATHEMATICS COURSES
(in Thousands)

Subject	1960	1965	1970	1975	1980	1985
Arith./Gen. Math.	48	29	23	32	63	45
H.S. Alg. & Geo.	48	60	78	109	179	202
Lib. Arts Math.	36	87	74	103	63	59
Math for Elem. Teachers	23	61	89	68	44	54
Coll. Alg., Trig.	235	262	301	259	345	352
Finite Math.	1	7	47	74	95	88
Anal. Geo. & Calc.	184	295	345	397	517	534
Diff. Equations	29	31	31	29	45	45
Linear/Matrix Alg.	4	19	47	28	37	47
Adv. Calc.	17	20	20	14	11	14
Other Undergrad. Math.	(94)	(134)	(160)	(139)	(126)	(179)
Total Math. Enrollment (Stat. & C.S. not included)	717	1005	1215	1252	1525	1619

UNDERGRADUATE ENROLLMENTS IN THE MATHEMATICAL
AND COMPUTER SCIENCES FOR 1980 AND 1985

In Table 1-6A, we give 1980 and 1985 enrollments for various course levels in mathematics, statistics, and computer science and in Table 1-6B we give the separate totals for all undergraduate mathematics, statistics and computer science in these years.

TABLE 1 - 6A

1980 AND 1985 MATHEMATICS, STATISTICS AND COMPUTER SCIENCE ENROLLMENTS BY LEVELS IN UNIVERSITIES & PUBLIC & PRIVATE FOUR-YEAR COLLEGES*
(In Thousands)**

	1980				1985				
	Univ.	Pu.	Pr.	Total	Univ.	Pu.	Pr.	Total	Ch.
Remedial math.	63	151	28	242	56	155	40	251	+4%
Other pre-calc.	214	261	127	602	200	280	113	593	-1%
Calc. level	282	175	133	590	281	258	101	637	+8%
Adv. level math.	28	29	32	91	47	66	25	138	+52%
Elem. stat./prob.	33	48	23	104	52	54	39	144	+38%
Adv. stat.	25	13	6	43	37	18	10	66	+53%
Lower level C.S.	69	77	60	206	94	155	101	350	+70%
Middle level C.S.	12	14	8	35	18	34	13	66	+89%
Upper level C.S.	30	35	19	80	54	61	28	142	+78%
Total	756	803	434	1993	839	1081	470	2387	20%

The enrollment figures above show that remediation is still a major but not a significantly growing problem. The increase in advanced level math enrollments was fairly evenly spread over all types of courses: core math, math for secondary school teachers and applied math.

The statistics figures are for enrollment in the mathematical and computer sciences type departments not in psychology, education, business, etc.

The list of computer science courses did not include data processing per se (at an elementary level) but a small number of data processing enrollments might have appeared in an "other" category.

* and ** See footnotes on next page.

TABLE 1 - 6B

TOTAL 1980 AND 1985 UNDERGRADUATE ENROLLMENTS IN MATHEMATICS, STATISTICS AND COMPUTER SCIENCE*
(In Thousands)**

	1980				1985			
	Univ.	Pu.	Pr.	Total	Univ.	Pu.	Pr.	Total
Mathematics	587	616	320	1525	584	759	279	1619
Statistics	58	61	29	148	89	72	49	208
Computer Science	111	126	85	322	166	250	142	558
Total	756	803	434	(1993)	839	1081	470	(2387)

* It should be noted, as remarked in the Introduction to this report, that enrollments as well as faculty data in the university, public college and private college categories are not directly comparable to the AMS Survey Groups I, II, & III; M; and B categories. The Dept. of Education lists of institutions for the three categories from which the Survey samples were drawn have considerable but not total overlap with the AMS lists of departments. A comparison of the Survey and AMS lists suggest that total mathematics enrollments in the Survey "university" category should be marginally lower than enrollments in Groups I, II, & III departments.

** The course-by-course enrollments are given in Appendix E. To maximize the accuracy of primary published data, they were individually rounded to the nearest thousand. This process led to some total enrollments being different from the sum of the addends, e.g. 1.3 + 2.3 + 3.3 = 6.9 rounds to 1 + 2 + 3 which is not 7. Consequently, the numbers in Tables 1-6A and 1-6B do not always sum correctly to the last digit.

AVAILABILITY OF SELECTED UPPER LEVEL MATHEMATICAL COURSES IN UNIVERSITIES AND FOUR-YEAR COLLEGES IN 1985

In the 1985 questionnaire, departments were asked to report on whether particular courses were being offered in the academic year 1985-86 or had been offered in the academic year 1984-85. In previous surveys, the question did not contain the reference to the preceding year. The Survey Committee felt that because many advanced courses are only offered on a two-year cycle, particularly in smaller institutions, the proper reference frame on availability should cover a two-year cycle. It turned out that with this revised wording asking for the availability of courses over two years, there were much higher percentages of institutions offering various upper level courses. The Survey committee believes that this year's data more accurately represents the status of course availability. Twenty-one out of the thirty percentages below are about half again as high as those reported in 1980.

TABLE 1 - 7

PERCENTAGE OF INSTITUTIONS OFFERING SELECTED COURSES IN 1984-85 OR 1985-86

	Course	Univ.	Pu.4-Yr.	Pr.4-Yr.
1)	Theory of Numbers	65%	56%	20%
2)	Combinatorics	63%	22%	5%
3)	Foundations of Mathematics	27%	30%	17%
4)	Set Theory	33%	24%	3%
5)	History of Mathematics	42%	39%	9%
6)	Geometry	79%	77%	47%
7)	Math. for Sec. Sch. Teachers	45%	55%	40%
8)	Mathematical Logic	35%	19%	12%
9)	Applied Math./Math. Model.	51%	37%	26%
10)	Operations Research	44%	33%	26%

AVERAGE SECTION SIZE AT VARIOUS COURSE LEVELS

From the main questionnaire on course enrollments and numbers of sections, we are able to get the following information:

- The average section size in remedial mathematics is about 32 with intermediate algebra sections a bit larger and arithmetic and general mathematics sections a bit smaller.

- The average section size in other pre-calculus mathematics is 35 with each course having an average section size within 3 of that number except for business mathematics with 43, finite mathematics with 39, and mathematics for elementary school teachers with 29.

- The average section size in calculus-level courses is 34 with calculus for biological, social and management sciences at 40 and discrete mathematics and linear/matrix algebra just under 30.

- The average section size for advanced level courses in mathematics is 19.

- In statistics, at the elementary (freshman) level the average section size is 37 and at the advanced level is 30.

- For the lower, middle and upper level courses in computer science the average section sizes are 31, 26, and 22 respectively.

BACHELORS DEGREES IN THE MATHEMATICAL AND COMPUTER SCIENCES

Three different types of data are given in the tables below: in Table 1-8, the overall numbers of bachelors degrees in various specialties for the twelve months ending on June 30 of 1975, 1980 and 1985; in Table 1-9, the 1984-1985 numbers of bachelors degrees by type of department; and in Table 1-10, the 1984-1985 bachelors degrees reported by mathematics departments and tabulated by category of institution. Together these tables and accompanying comments give an interesting picture of undergraduate major programs. The reader is also referred to Table 1-13 and Table 4-11 for separate data relevant to statistics and computer science degree programs.

The numbers given below include only the given institution's majors in mathematics, computer science or statistics departments (by whatever name it is called). There were eight other mathematical science departments of various special descriptions whose data were submitted in the Survey. But the total number (eight) of such departments divided among various strata for sampling was too small to make meaningful projections to national totals of undergraduate degrees for such types of departments. Those eight departments reported a total of 320 degrees. Thus the counts of degrees given in this Survey may be a bit low, particularly in some of the specialty areas.

The numbers of bachelors degrees in the mathematical and computer sciences took a major leap in the five year period from 1980 to 1985, with computer science degrees more than tripling and, when joint majors are included, overall mathematics degrees increasing toward the 1974-75 levels. The current Survey asked for counts of joint majors as well as for individual majors for the period July 1984 to June 1985. In earlier Surveys, such joint majors would presumably have been counted as degrees only in the field of the department in which they studied.

The recent 1985-86 Taulbee Survey of the Computer Science Board indicates a cessation of growth in the number of computer science undergraduate degrees. Recent AMS Surveys indicate a modest reduction in computer science enrollments.

TABLE 1 - 8

NUMBERS OF BACHELORS DEGREES

Special Area	1974-75	1979-80	1984-85
Mathematics (General)	17,713	10,160	12,102
Applied Mathematics	1,120*	1,527*	1,215
Math. Education	4,778	1,752	2,567
Computer Science	3,636	8,917	29,107
Statistics	570	467	538
Operations Res.	---	---	312*
Joint C.S. & Mathematics	---	---	3,084
Joint Math. & Statistics	---	---	121
Joint C.S. & Statistics	---	---	157
Total	27,817	22,823	49,203

* The applied mathematics categories in 1974-75 and 1979-80 include figures from the small categories "actuarial science" and "other" not included in this year's questionnaire. However, the additional "operations research" category this year presumably would have been included under "other" or "applied mathematics" in earlier years. The counts of joint majors are in addition to the separate individual listings for mathematics, computer science or statistics majors since the total number of "bachelors degrees awarded by your department" was specifically asked for.

The 50% increase in the number of bachelors degrees in mathematics education since 1980 is encouraging. It should be noted that the questionnaire was sent to mathematics departments, per se, and in many universities and some public colleges, mathematics education students are handled separately by colleges or departments of education rather than by mathematics departments. Thus the figures cited are understood to be incomplete as counts of the total number of secondary education graduates

in mathematics. However, the trend data should be meaningful since the counts over time are comparable.

The actual number of degrees in the mathematical sciences including joint majors but not including computer science or mathematics education as such has gone from 19,403 in 1974-75 to 12,154 in 1979-80 to 17,529 in 1984-85. The increase since 1979-80 was about 44%.

The totals of mathematics, statistics and computer science degrees may be compared with Department of Education figures for the July 1984 to June 1985 period which show 15,146 mathematics degrees (including 371 statistics majors) and 38,878 computer and information science majors. With some uncertainties as to how to classify some applied mathematics degrees and whether (all?) information science degrees would have been counted in the CBMS Survey, the figures appear to be generally consistent with Survey data.

Recent data from the 1986 AMS Survey which counts majors in school for the junior-senior years show a slight decrease in such majors in the mathematical sciences over the past year and a larger decrease in computer science majors over that period.

THE DISTRIBUTION OF BACHELORS DEGREES GRANTED IN 1984-85 AMONG VARIOUS TYPES OF DEPARTMENTS

Table 1-9 below gives the distribution of majors by type of department. It should be noted that "Mathematics Departments" is the catch-all category for universities or colleges which do not have separate statistics or computer science departments; such mathematics departments normally perform (part of) the functions of departments in those disciplines.

TABLE 1 - 9

NUMBERS OF BACHELORS DEGREES BY TYPE OF DEPARTMENT, JULY 1984-JUNE 1985

	Math Dept.	C.S. Dept.	Stat. Dept.	Total
Mathematics (general)	11,956	146	0	12,102
Applied Mathematics	1,215	0	0	1,215
Math. Education	2,567	0	0	2,567
Computer Science	8,646	20,416	45	29,107
Statistics	212	0	326	538
Operations Res.	302	0	10	312
Joint Mathematics & C.S.	2,519	565	0	3,084
Joint Math. & Statistics	102	0	19	121
Joint C.S. & Statistics	2	148	7	157
Total	27,521	21,275	407	49,203

There are several items in the table worthy of note. As expected, all mathematics education degrees are from mathematics departments. About 82% of joint mathematical and computer science majors are reported by mathematics departments. The development of computer science major programs within mathematics departments must be preceded by extensive course programs in computer science. Thus although the number of computer science sections taught in mathematics departments is almost the same as in computer science departments, we should not expect mathematics departments to produce as many computer science degrees as do computer science departments.

In Table 1-10, numbers of bachelors degrees in mathematics departments are shown by type of institution. For comparison purposes, the total FTE Faculty Size (Full-time plus 1/3 Part-time) is given in the bottom line. It gives partial support to the common belief that private colleges, with their attention to undergraduates, do turn out

proportionately somewhat more bachelors degrees in the mathematical sciences. It is not clear whether the computer science category should be included in such comparisons. In any event, the non-existence of competing engineering and various specialty degree programs in private colleges presumably contributes to the observed differences. Note how applied mathematics degrees are concentrated in universities and public colleges and mathematics education degrees in the colleges. However as noted above, in some universities and public colleges, mathematics education degrees are the province of colleges or schools of education and thus are not included in the counts given. The higher incidence of separate computer science departments in universities presumably accounts for the smaller number of computer science degrees in university mathematics departments.

TABLE 1 - 10

1984-85 BACHELORS DEGREES FROM MATHEMATICS DEPARTMENTS
BY CATEGORY OF SCHOOL FOR VARIOUS DEGREE TYPES

	Univ.	Pu. 4-Yr.	Pr. 4-Yr.	Total
Mathematics (general)	3,467	4,277	4,212	11,956
Applied Mathematics	624	537	54	1,215
Mathematics Educ.	324	1,376	867	2,567
Computer Science	1,865	3,175	3,606	8,646
Statistics	115	97	0	212
Operations Research	259	43	0	302
Joint C.S. & Math	605	1,102	811	2,519
Joint Math. & Stat.	25	77	0	102
Joint C.S. & Stat.	0	2	0	2
Total	7,284	10,686	9,551	27,521
FTE Faculty Total Size (for comparison purposes)	5,681	8,866	5,664	

See Table 4-11 for a separate breakdown of degrees from computer science departments by category of institution. See the Introduction for a discussion indicating that the categories are not directly comparable to AMS Survey Group I, II & III; Group M; and Group B.

STATISTICS AS AN UNDERGRADUATE SUBJECT

The data generally cited elsewhere but organized below gives much information about undergraduate statistics. Enrollments in statistics in departments of the mathematical and computer sciences has grown rapidly over the past twenty-five years, at both elementary and advanced levels. We classify probability as a part of statistics for this purpose. Total enrollments in probability courses themselves are quite small and some include a probability and statistics designation. See Appendix B or E for Course titles.

TABLE 1 - 11

UNDERGRADUATE ENROLLMENTS IN STATISTICS OVER TIME
(in Thousands)

	1960	1965	1970	1975	1980	1985
Elem. Stat./Prob. Courses 45, 46	4	11	57	99	104	144
Adv. Stat./Prob. Courses 47-54	16	32	35	42	43	64
Total	20	43	92	141	147	208

We may conjecture on various reasons for the continuing impressive growth of undergraduate statistics enrollments:

(1) The increasing quantification of society, causing numerical data, its collection, use, analysis and interpretation to be much more widespread.
(2) The developing computer age which underlies much of (1) above.
(3) The increasing student choice of business as a major subject and the computerization and quantification of the whole business community resulting in statistics and probability and their applications becoming an integral part of the business curriculum.

The distribution of types of statistics courses among universities, public colleges and private colleges is revealed in Table 1-12. (See Appendix E for individual course enrollments).

TABLE 1 - 12

1985 STATISTICS COURSE ENROLLMENTS BY CATEGORY OF INSTITUTION
(in Thousands)

	Univ.	Pu. 4-Yr.	Pr. 4-Yr.	Total
Elem. Stat./Prob. (No Calc. prereq. 45, 46)	52	54	39	144
Math. Stat./Prob. (Calculus prereq. 47, 48)	17	14	9	39*
Other Stat. Courses (49-54)	20	4	1	25

* Total from original data

The distribution of elementary courses is roughly proportional to the distribution of pre-calculus non-remedial courses in mathematics departments except that the public four-year college figure above is too low. But as the courses get more specialized, the colleges show relatively low course enrollments. With the courses 47-54 lumped together the enrollments are roughly proportional to the numbers of statisticians on the three faculties (see Table 2-12).

The numbers of degrees in statistics has been reported by the Survey only for 1974-75, 1979-80, and 1984-85.

TABLE 1 - 13

NUMBERS OF STATISTICS UNDERGRADUATE DEGREES OVER TIME

1974 - 75	1979 - 80	1984 - 85
570	467	816

The figure 816 is from 538 reported as statistics majors, 121 as joint mathematics and statistics majors and 157 as joint computer science and statistics majors. Of these 278 joint majors only 26 were from statistics departments. Thus, since in previous Surveys there was no place to list joint majors, it seems very likely that in earlier years almost all joint majors in statistics would have been listed only as mathematics or computer science majors. Of the 538 statistics degrees, 326 were from statistics departments and 212 from mathematics departments. In addition, mathematics departments produced 302 operations research degrees and statistics departments produced 10. Statistics departments also produced 45 computer science majors. The total number of degrees reported by statistics departments was 407 with mathematics departments reporting another 514 in statistics or operations research. Thus with other joint statistics majors, there were 1,173 majors with a very large dose of statistics. Unfortunately, the available data from the earlier surveys does not give us a basis for a comparison of these latter numbers over time.

For information on statisticians on the faculty, see Table 2-12.

REMEDIAL MATHEMATICS

Table 1- 14 below shows the enrollments in the four remedial courses since 1975 in the various categories of institutions.

TABLE 1 - 14

ENROLLMENTS OVER TIME IN REMEDIAL COURSES BY CATEGORY OF INSTITUTIONS
(in thousands)

	Arith.	Gen. Math.	Elem. Alg.	Inter. Alg.
Univ.				
1975	----	----	4	26
1980	2	4	13	44
1985	3	2	15	36
Pu. 4-Yr.				
1975	5	23	22	46
1980	11	37	54	48
1985	8	18	52	77
Pr. 4-Yr.				
1975	1	3	L*	9
1980	1	8	7	12
1985	4	11	8	17

*L means some but less than 500

With remedial mathematics courses playing an important role in many departments' instructional and faculty loads, a special one-page supplemental questionnaire on remediation was sent to all sampled mathematics departments. The response rate was noticeably less than the response rate from four-year college and university mathematics

departments and thus the data below is not as reliable as the rest of the data. The reader is referred to other parts of this chapter and to Appendix E for additional enrollment and trend data on remedial mathematics.

Remedial mathematics was not explicity defined but in the four-year college and university questionnaires the courses listed as remedial (high school) were arithmetic, general math (basic skills), elementary algebra and intermediate algebra (high school). The data cited below are summaries from all responses considered together without regard to type of institution and without projecting by strata to the total population.

a) 19% of the academic units administering the remedial programs were outside the mathematics department.

b) 34% of the units handling remediation reported follow-up studies on success rates of students.

c) 35% of the faculty are full-time with 36% of the full-time faculty being tenured and another 30% on tenure track.

d) 18% of the combined full- and part-time faculty staffing the remedial program have doctorates with an additional 49% having master's degrees. Of the doctorates, 27% have their degrees in mathematics education and 19% have their degrees outside mathematics or mathematics education.

e) Course load credit practices varied from 65% giving credit in arithmetic to 90% in intermediate algebra (high school).

f) Credit-toward-graduation practices varied from 10% for arithmetic to 61% for intermediate algebra (high school). However, the question was worded, "Is credit toward graduation given", with "yes" and "no" boxes to check. Thus if credit were given only in some very special curricula or under special circumstances such as a student not having high school credit for the course, the

"yes" box would presumably have been checked. It is known from other sources that, in many institutions, majors in mathematics, engineering or physical science receive no credit toward graduation for any course below calculus.

g) The percentage of all remedial sections taught by part-time faculty varied from 34% in intermediate algebra to about 45% in each of arithmetic, general mathematics (basic skills) and elementary algebra.