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STATISTICAL ABSTRACT OF UNDERGRADUATE PROGRAMS IN THE MATHEMATICAL SCIENCES AND COMPUTER SCIENCE IN THE UNITED STATES

1990–91 CBMS Survey

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   CUPM ad hoc Subcommittee, Lynn A. Steen, Editor.

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Any opinions, findings, conclusions, or recommendations expressed herein do not necessarily reflect the views of the National Science Foundation.

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This survey was supported by the NSF under Grant SRS-8914939. The NSF also supported the 1970, 1975, 1980, and 1985 surveys. The effort of Dr. Mary Golladay, Director, Education and Human Resources Program, Division of Science Resource Studies, the National Science Foundation, is appreciated. The careful administration of the grant by Ms. Rhoda Goldstein, Associate Director for Finance and Administration, and the guidance provided by Ms. Beverly Ruedi, Editorial Assistant, the Mathematical Association of America are also appreciated.

Thanks are due to the Conference Board of the Mathematical Sciences for its continued support.

The format and organization of this report differs from that of past surveys. Hopefully the reader will find the contents useful and the format pleasing.

FOREWORD

This is the sixth in a series of CBMS reports on undergraduate programs in the mathematical sciences and computer science. The first report was published in 1965 and a new one has appeared every five years thereafter. This report compiles statistical information on a broad range of measures in both two-year and four-year institutions in the United States. It contains information on course enrollment, faculty, baccalaureate degrees, class size and format for selected introductory courses, and computer science programs, all of which were reported in previous surveys. The data were collected in fall 1990 and, in most instances, are based upon figures for this academic period. Information collected for the first time in the 1990 survey includes

- statistics on mathematical science libraries;
- information on programs for majors;
- requirements for mathematics majors;
- number of support staff in departments;
- institutional travel funds expenditures in 1989-90;
- instructional contributions of graduate teaching assistants.

This report does not contain any information on graduate programs.

The data from four-year college and university departments are reported by discipline: mathematics, statistics, and computer science. Here "mathematics department" means a department in which mathematics is the primary discipline although it may be a multiply-titled department or it may contain subunits in related disciplines. Data from other related departments, such as operations research or applied mathematics, are reported with mathematics departments.

Data on two-year colleges were obtained from the head of the mathematical sciences program. The mathematical sciences program generally includes computer science. This report uses the phrase "two-year college mathematics programs" to describe both the academic activities and the faculty of such programs.

The four-year and university departments were further divided according to the highest **mathematics** degree offered by the institution. Thus the division of statistics and computer science departments into PhD, master's, and bachelor's granting institutions may not be by that department's highest degree. In an analysis of respondents, however, there were only 3 computer science departments whose highest degree did not match the corresponding mathematics department's highest degree. Similarly, there was a good fit in statistics departments.

All estimates in this report were obtained from a sample of institutions. As such, they are subject to statistical errors caused by design, reporting techniques, and non-response. They likely differ from the numbers that would have been obtained had there been a complete census using the same survey procedures. The response rate from four-year college departments of computer science was 33%; thus data for this group have a lower confidence level than do data from the other groups. All previous CBMS surveys were based upon

samples of institutions as well. A description of the technical aspects of the survey can be found in Appendix II.

The report is organized into nine chapters. The first is a summary chapter presenting data from both two-year and four-year institutions. Chapters 2-7 give data on four-year colleges and universities in the following areas: enrollment, faculty, introductory courses including calculus I and II, programs for majors, further details on computer science majors, and mathematical science libraries. Chapter 8 presents information on enrollment and courses in two-year colleges. Chapter 9 provides data on faculty in two-year colleges. Appendix I contains detailed enrollment numbers in all four-year and university departmental courses since 1970. Appendix II is a description of survey techniques and response rates and Appendix III lists the survey respondents. Appendixes IV and V contain, respectively, the survey form for the four-year colleges and universities, and the two-year colleges.

Most tables in the report are accompanied by figures highlighting aspects of the table and a few lines of text amplifying the table or comparing the table to other tables in the report. Each chapter begins with a brief summary page which also identifies those tables in the chapter of special interest to either four-year mathematics, statistics, computer science, or two-year mathematics.

The data in this survey are in good agreement with relevant data from three other surveys. The Higher Education Survey No. 5, "A Survey of Mathematics and Statistics Departments at Higher Education Institutions," sponsored by the National Science Foundation, reported that the fall 1989 enrollment in four-year colleges and universities was 1,870,000; the 1990 figure as reported by this survey was 1,795,000. (The HES survey asked for mathematical/statistical course enrollment by level which may have been interpreted by some respondents to include departmental computer science enrollment. Enrollment data in this CBMS survey are obtained from individual course enrollment. The mathematics/statistics course total in this survey does not include the 180,000 students enrolled in computer science courses taught in mathematics departments.) The 1989 HES two-year college enrollment was 1,047,000, while this survey's 1990 figure was 1,295,000. The HES survey gave full-time four-year mathematics/statistics faculty size as 17,850; this survey reported 19,411 full-time faculty of which 16,090 taught only mathematics/statistics, 1492 taught only computer science and 1829 regularly taught both. How respondents to the HES survey reported the last two categories of faculty is not clear. The HES survey reported 6,600 full-time two-year mathematics program faculty in 1989; this survey reports 7,222 in 1990.

The Computer Science Board conducts a survey of (only) PhD granting departments, the Taulbee survey. While they combine U.S. and Canadian departments in their report, a private communication from the survey directors indicates that the U.S. PhD computer science faculty in fall 1990 numbered 2569 tenured or tenure track (or research) faculty plus 366 full-time equivalent non-tenure track teachers which included part-time faculty. This survey reported 2756 full-time faculty. The Taulbee survey reported 7,080 bachelor degrees awarded in 1989-90; this survey's figure is 7201.

In 1990 the American Mathematical Society commissioned a survey of mathematical science libraries in (only) PhD granting mathematics departments. Except for one minor category, that report is in general agreement with the relevant data from this survey, which also includes information on mathematical science libraries in non-PhD granting four-year colleges and universities.

The phrase "mathematical sciences," as used in CBMS reports prior to 1985, included computer science, but now does not, agreeing with the present NSF taxonomy. This report uses this phrase only in describing the mathematical science library. Otherwise, the phrases used are "mathematics," "statistics," and "computer science" in the hope that this makes for greater clarity.

Don O. Loftsgaarden was the consulting statistician for this survey and report. Ann E. Watkins was the principal author of the two-year college chapters with contributions by Donald J. Albers. Donald C. Rung wrote the remaining sections and was the overall supervisor.

Comments on this volume are welcome, as are suggestions for future surveys.

CONTENTS

Chapter 1

SUMMARY

This chapter contains 12 tables and accompanying figures which summarize two-year and four-year college and university fall 1990 enrollment, numbers of full-time and part-time faculty and graduate teaching assistants, age distribution of full-time faculty, percent of women among full-time faculty, and the number of bachelor's degrees awarded in 1989-90.

Since 1985, four-year college and university enrollment has remained steady in mathematics but declined in statistics and computer science; two-year college enrollment has increased substantially. The number of four-year college and university full-time faculty in mathematics showed a modest increase over 1985, in statistics remained constant, in computer science showed a large increase, while the number of two-year faculty also showed a modest increase. Part-time faculty numbers were down slightly in four-year institutions, but up dramatically in two-year colleges. The percent of full-time faculty members who are women increased in all categories. The number of bachelor's degrees in mathematics remained level, in statistics increased, and in computer science declined significantly.

Data on two-year colleges can be found in this chapter and also in chapters 8 and 9 which are devoted solely to two-year colleges. Chapters 2 through 7 are devoted exclusively to four-year colleges and universities.

For those wishing information on certain disciplines only, below are listed those tables in this chapter containing information on the various fields covered by the report. At the beginning of each chapter similar paths are given for that chapter.

For information on four-year college and university mathematics see
Tables S.1, S.2, S.3, S.4, S.5, S.9, S.10, S.11, S.12.

For information on two-year college mathematics programs see
Tables S.1, S.2, S.4, S.6, S.9, S.10, S.ll, S.12.

For information on four-year college and university statistics see
Tables S.1, S.2, S.3, S.4, S.7, S.9, S.10, S.ll, S.12.

For information on four-year college and university computer science see
Tables S.1, S.2, S.3, S.4, S.5, S.8, S.9, S.10, S.ll, S.12.

TABLE S.1 Enrollment (thousands) in Mathematics, Statistics and Computer Science courses at four-year colleges and universities and two-year colleges: Fall 1970, 1980, 1985, 1990; Fall 1990 broken down by department.

Fall enrollment (thousands)

	Four-year Colleges and Universities				1990 Totals by Dept			Two-year Colleges			
Courses	1970	1980	1985	1990	Math Dept	Stat Dept	CS Dept	1970	1980	1985	1990
Math	1188	1525	1620	1624	1621	2	1	555	925	900	1241
Stat	92	147	208	173	125	43	5	16	28	36	54
CS	106	321	558	491	180	0	311	13	95	98	98
TOTAL	1386	1993	2386	2288	1926	45	317	584	1048	1034	1393

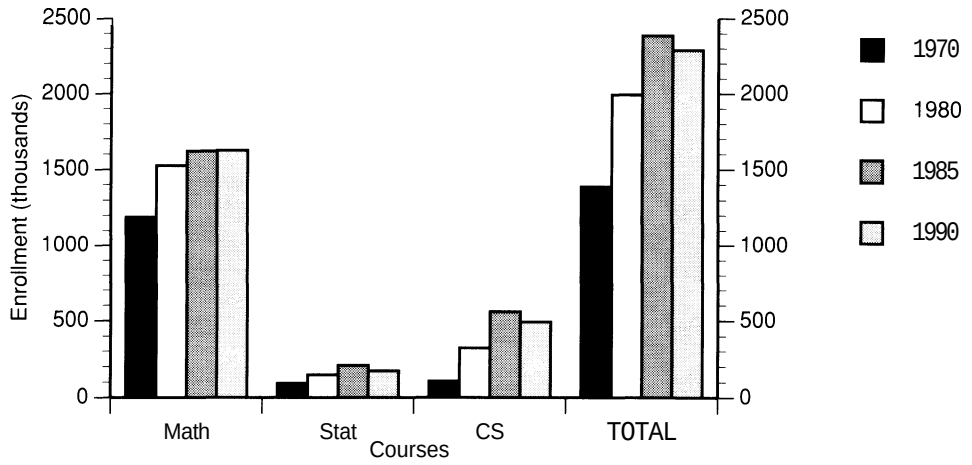

FIGURE S.1.1 Enrollment (thousands) in Mathematics, Statistics and Computer Science courses at four-year colleges and universities: Fall 1970, 1980, 1985, 1990.

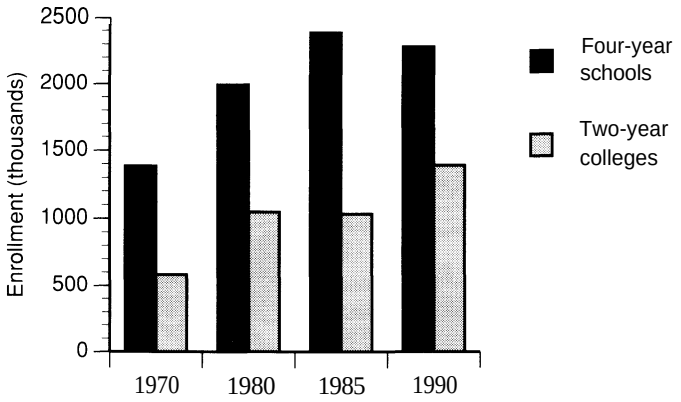

FIGURE S.1.2 Combined enrollment (thousands) in Mathematics, Statistics and Computer Science courses at four-year colleges and universities and in two-year colleges: Fall 1970, 1980, 1985, 1990.

TABLE S.1 A highlight of fall 1990 enrollment is the almost 35% increase in two-year college enrollment over the last five years. This is the first survey in this series to separate enrollments in mathematics, statistics and computer science by type of department. Table S.1 shows that mathematics departments are major contributors in both statistics and computer science, teaching 72% of all statistics enrollment and 37% of all computer science enrollment. For the first time, enrollment in statistics and computer science courses decreased, declining 17% and 12% respectively from 1985 levels. Finally the two-year college enrollment is now 38% of the total enrollment, an historic high.

The survey revealed that the total fall **1989** enrollment in four-year and university departments of mathematics, statistics and computer science was one half the total **1989-90** academic year enrollment. This ratio prevailed across all types of departments. While it is true that departments with a semester calendar generally have a lower spring semester enrollment, this is balanced by those departments on term-type calendars where the fall enrollment is less than the total enrollment in the remaining terms. Thus an estimate for 1990-91 academic year enrollment is obtained by doubling the fall 1990 totals.

National Higher Education Statistics: Fall 1991 (National Center for Education Statistics, Office of Educational Research and Improvement, U.S. Department of Education) reported the fall 1990 institutional undergraduate full-time and part-time enrollment in four-year colleges and universities as 6,684,000; the comparable figure for two-year institutions was 5,184,000.

TABLE S.2 Enrollment (thousands) by level in Mathematics, Statistics and Computer Science courses in four-year college and university Departments of Mathematics, Statistics and Computer Science and in two-year college Mathematics Programs: Fall 1970, 1980, 1985, 1990. (Unavailable historical data is indicated by a "-".)

	Fall enrollment (thousands)											
	Four-year Colleges and Universities								Two-year Colleges			
	Math Depts				Stat Depts		CS Depts		Math Programs			
Course level	1970	1980	1985	1990	1970	1990	1970	1990	1970	1980	1985	1990
Math courses												
Remedial	101	242	251	261	0	0	0	0	191	441	482	724
Precalculus	538	602	593	593	0	0	0	0	134	180	188	245
Calculus	414	590	637	647	0	1	0	0	59	86	97	128
Advanced	135	91	138	120	0	1	0	1	0	0	0	0
Other (2-year)									171	218	133	144
TOTAL MATH	1188	1525	1619	1621	0	2	0	1	555	925	900	1241
Stat courses												
Elementary	-	-	-	87	-	29	0	3	16	28	36	54
Advanced	-	-	-	38	-	14	0	2	0	0	0	0
TOTAL STAT	60	-	-	125	32	43	0	5	16	28	36	54
CS courses												
Lower	-	-	-	134	0	0	-	204	13	95	98	98
Middle	-	-	-	12	0	0	-	25	0	0	0	0
Upper	-	-	-	34	0	0	-	82	0	0	0	0
TOTAL CS	60	-	-	180	0	0	46	311	13	95	98	98
GRAND TOTAL	1308	-	-	1926	32	45	46	317	584	1048	1034	1393

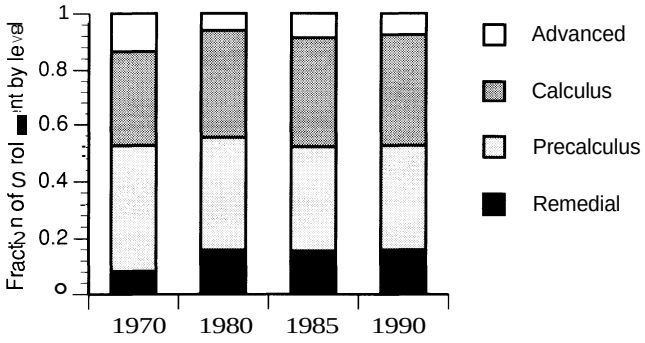

FIGURE S.2.1 Fraction of enrollment in Mathematics courses by level in four-year college and university Departments of Mathematics: Fall 1970, 1980, 1985, 1990.

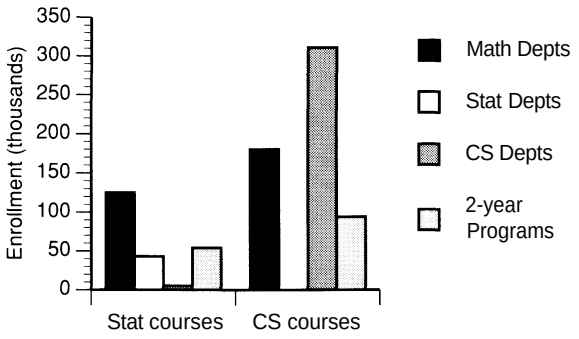

FIGURE S.2.2 Enrollment in Statistics and Computer Science courses in four-year college and university Departments of Mathematics, Statistics and Computer Science and in Mathematics Programs at two-year colleges: Fall 1990.

TABLE S.2 This table amplifies Table S.1, reporting enrollment by level of course. (Table E.1 in chapter 2 gives an even more detailed breakdown on enrollment, while Appendix I gives the specific enrollment in each course offered by four-year and university departments, and Table TYR.3 in chapter 8 gives the enrollment in each course offered by two-year programs.) While remedial course enrollment has increased substantially over the last 20 years, so has enrollment in non-remedial mathematics courses. For example, in four-year institutions calculus and advanced-level enrollment has remained at about 47% of the total mathematics enrollment during this period. In fall 1990 the total two and four-year calculus-level enrollment was 777,000. In four-year college and university mathematics departments, enrollment in courses above the precalculus level (including advanced statistics and middle and upper level computer science courses) was 44% of the total mathematics department enrollment; for statistics departments the comparable percent was 36%; for computer science departments it was 35%.

TABLE S.3 Number of Bachelors Degrees awarded by four-year college and university Departments of Mathematics, Statistics and Computer Science (combined) between July 1 and June 30 in 1974-75, 1979-80, 1984-85 and 1989-90, by selected majors and by sex for totals in 1989-90.

Major	1974-75	1979-80	1984-85	1989-90
Math including Applied Math	18833	11687	13317	13303
Math Ed	4778	1752	2567	3116
Statistics	570	467	538	618
Actuarial Math	-	-	-	245
Operations Research	-	-	312	236
Joint CS & Math	-	-	3084	1485
Joint Math & Stat	-	-	121	135
Joint CS & Stat	-	-	157	53
SUBTOTAL Math & Stat	24181	13906	20096	19191
(number of women)	-	-	-	8695
SUBTOTAL CS	3636	8917	29107	21126
(number of women)	-	-	-	6278
Other	0	0	0	962
(number of women)	0	0	0	351
GRAND TOTAL	27817	22823	49203	41279
(number of women)	-	-	-	15324

The other degrees are those that did not fall in any of the categories above.

TABLE S.3 During the last five years the number of computer science degrees, including joint degrees with mathematics and statistics, declined by 30%. The number of mathematics and statistics degrees, excluding mathematics education degrees, remained nearly level while the number of mathematics education degrees increased by 21%. Female graduates comprised 45% of the total mathematics and statistics bachelor's degrees and 30% of the computer science bachelor's degrees. These data were not available in previous surveys.

National Education Statistics: Fall 1991 (referenced in Table S.1) reported 1,050,000 total bachelor's degrees awarded in 1989-90. Thus the mathematical sciences and computer science each awarded about 2% of the total bachelor's degrees awarded.

Tables E.5 and E.6 in chapter 2 give a further breakdown of the bachelor's degrees awarded in 1989-90. In those tables, the joint degree totals are reported according to the department awarding the degree. In Table S.3, the joint degree totals are included under mathematics and statistics even though 562 were awarded by computer science departments.

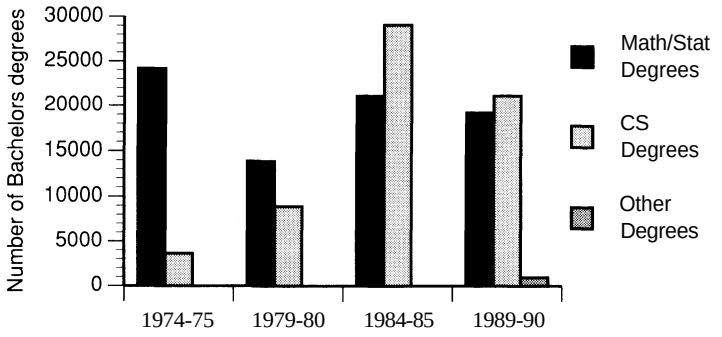

FIGURE **S.3.1** Number of Bachelors degrees awarded with Mathematics and Statistics majors or joint majors (including joint Computer Science majors), those with Computer Science majors and those with other majors by four-year college and university Departments of Mathematics, Statistics and Computer Science (combined) for **1974-75, 1979-80, 1984-85, 1989-90.**

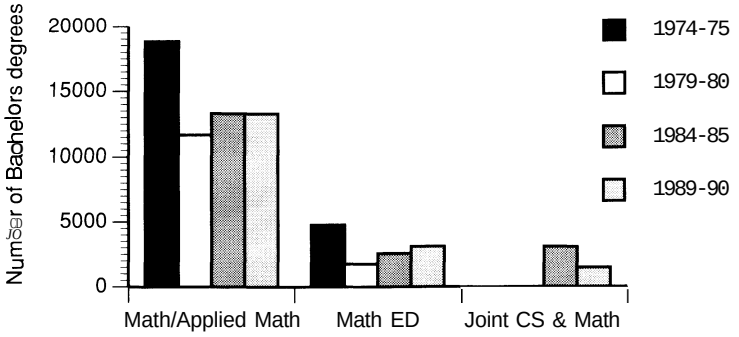

FIGURE S.3.2 Number of Bachelors degrees, for three selected majors, awarded by four-year college and university Departments of Mathematics and Computer Science between July 1 and June 30 in **1974-75, 1979-80, 1984-85** and 1989-90.

TABLE S.4 Number of full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science and in two-year college Mathematics Programs: Fall 1970, 1980, 1985, 1990.

	Number of full-time faculty			
	1970	1980	1985	1990
Four-year colleges and universities				
Math Depts	15655	16022	17849	19411
Stat Depts	700	610	740	735
CS Depts	688	1672	3605	5318
TOTAL	17043	18304	22194	25464
Two-year colleges				
Math Programs	4879	5623	6277	7222
GRAND TOTAL	21922	23927	28471	32686

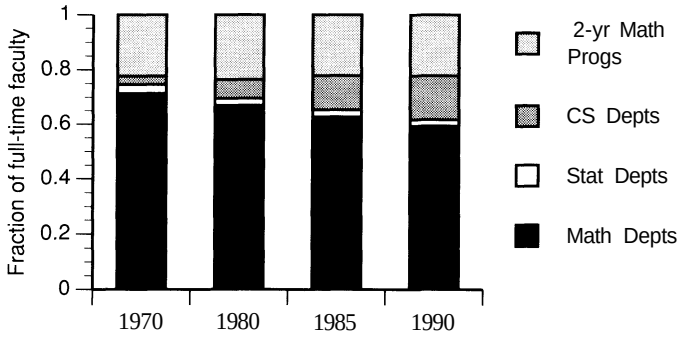

FIGURE S.4.1 Fraction of full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science and two-year college Mathematics Programs: Fall 1970, 1980, 1985, 1990.

TABLE S.4 In four-year institutions, as compared to 1985, the number of full-time mathematics faculty increased by almost 9%; the number of statistics faculty remained level; and the number of computer science faculty increased by 48%. (In all tables in this survey full-time faculty means actual faculty count, not full-time equivalent. The number of part-time faculty is reported separately.) Using Table S.1, the enrollment per full-time mathematics faculty member in four-year institutions was just under 100; in statistics department the ratio was 61; while computer science's ratio was 60. The corresponding 1970 ratios were 84, 46, and 67, respectively. The 1990 two-year college enrollment per full-time faculty member was 193, compared to the 1970 ratio of 119. Using Table S.2, in four-year colleges and universities, the ratio of calculus and above

enrollments (including statistics and computer science) per full-time faculty member was 44 in mathematics departments, and 21 in both statistics and computer science departments.

Over the last five years the two-year college mathematics program faculty increased by 15%, while Table S.1 shows that during this period enrollment increased by 35%.

The 1990 edition of the *Digest of Educational Statistics* reported that the 1987 total of full-time and part-time higher education faculty with the rank of instructor or above was 793,000. The comparable total from this survey for the mathematical sciences and computer science was 54,679 including 21,993 part-time faculty (reported in Table S.12).

The tables in chapter 3 give more detailed data on four-year and university faculty. For more detailed two-year faculty information see chapter 9.

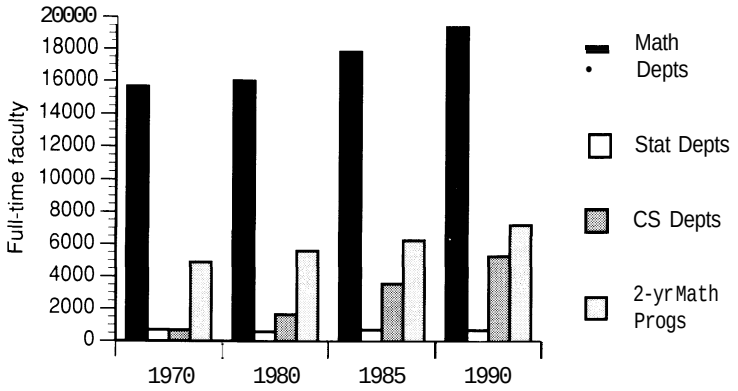

FIGURE S.4.2 Number of full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science and two-year college Mathematics Programs: Fall 1970, 1980, 1985, 1990.

TABLE S.5 Number of full-time faculty in four-year college and university Departments of Mathematics by highest degree and in 1990 by teaching responsibility: Fall 1970, 1980, 1985, 1990.

					1990 totals broken down by teaching responsilibity		
	1970	1980	1985	1990	Math/ Stat	CS	Math/Stat and CS
Doctoral degree	9744 (62%)	12497 (78%)	13208 (74%)	14963 (77%)	12824	816	1323
Other degree	5911 (38%)	3525 (22%)	4641 (26%)	4448 (23%)	3266	676	506
TOTAL	15655	16022	17849	19411	16090	1492	1829

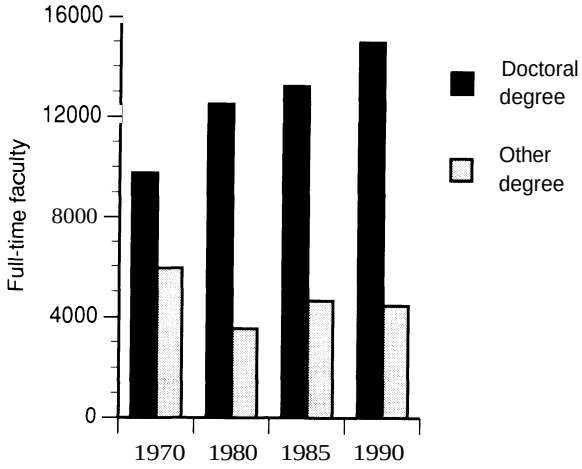

FIGURE S.5.1 Number of full-time faculty in four-year college and university Departments of Mathematics by highest degree: Fall 1970, 1980, 1985, 1990.

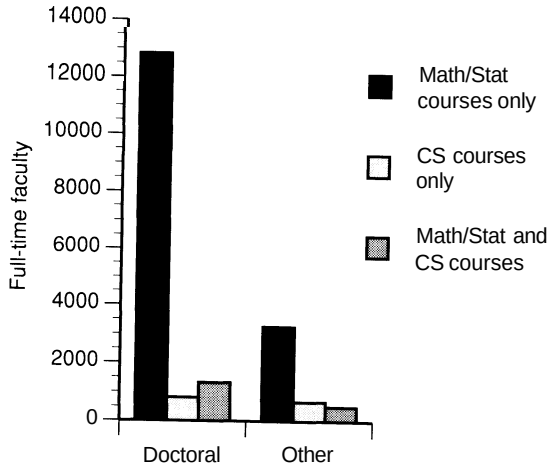

FIGURE S.5.2 Number of full-time faculty in four-year college and university Departments of Mathematics by highest degree and teaching responsibility: Fall 1990.

TABLE S.5 For the first time, mathematics department faculty is reported according to teaching responsibilities. The number of faculty teaching only mathematics in Fall 1990 courses was not significantly higher than the 1970 total, when presumably almost all of the teaching was in mathematics and statistics only.

TABLE S.6 Number of full-time faculty in two-year college Mathematics Programs by highest degree: Fall 1970, 1980, 1985, 1990.

Number of faculty	1 970	1980	1985	1990
Doctorate	195 (4%)	843 (15%)	816 (13%)	1193 (17%)
Masters + 1 yr	2293 (47%)	2137 (38%)	2448 (39%)	2442 (34%)
Masters	2049 (42%)	2361 (42%)	2699 (43%)	3296 (45%)
Bachelors	342 (7%)	282 (5%)	314 (5%)	291 (4%)
TOTAL	4879	5623	6277	7222

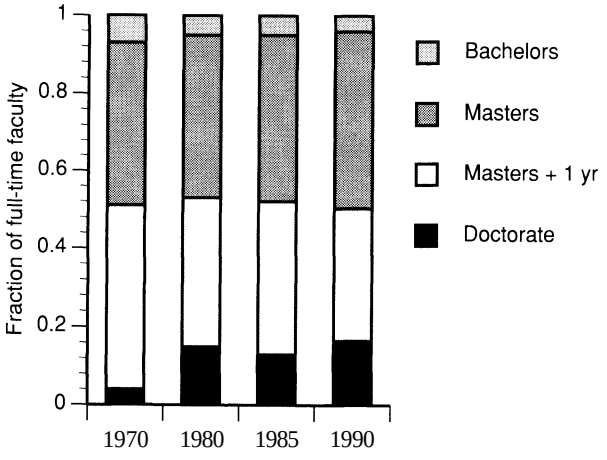

FIGURE S.6.1 Fraction of full-time faculty in two-year college Mathematics Programs by highest degree: Fall 1970, 1980, 1985, 1990.

TABLE S.6 The educational level of full-time two-year college mathematics program faculty has remained much the same except for an increase in the percentage of doctoral-holding faculty.

TABLE S.7 Full-time faculty in four-year college and university Departments of Statistics by highest degree: Fall 1970, 1980, 1985, 1990.

	1970	1980	1985	1990
Doctoral degree	-	587 (96%)	718 (97%)	706 (96%)
Other degree	-	23 (4%)	22 (3%)	29 (4%)
TOTAL	700	610	740	735

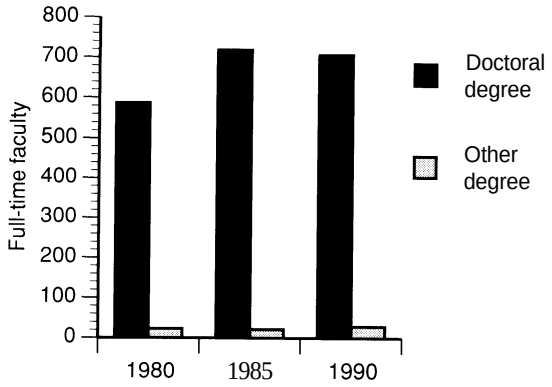

FIGURE S.7.1 Number of full-time faculty in four-year college and university Departments of Statistics by highest degree: Fall 1980, 1985, 1990.

TABLE S.7 Since 1970, there has been little increase in the number of statistics departments faculty. As was noted in the 1985 CBMS report, the 1980 number probably represents an undercount.

TABLE S.8 Full-time faculty in four-year college and university Departments of Computer Science by highest degree: Fall 1970, 1980, 1985, 1990.

	1970	1980	1985	1990
Doctoral degree	527 (77%)	1117 (67%)	2537 (70%)	4189 (79%)
Other degree	161 (23%)	550 (33%)	1068 (30%)	1129 (21%)
TOTAL	688	1667	3605	5318

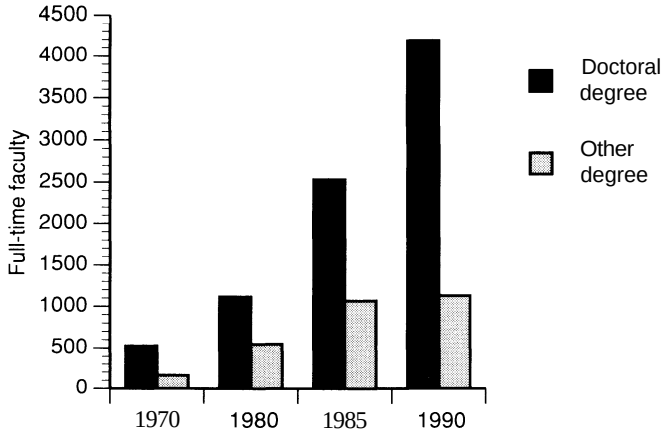

FIGURE S.8.1 Number of full-time faculty in four-year college and university Departments of Computer Science by highest degree: Fall 1970, 1980, 1985, 1990.

TABLE S.8 The number of full-time faculty in computer science departments increased by 48% during the last five years. The percent of doctoral faculty in fall 1990 was nearly the same as the 1970 figure, when, presumably, much of the computer science faculty was chosen from mathematical science departments.

TABLE S.9 Age distribution of full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science and two-year college Mathematics Programs for Fall 1990 and average age: Fall 1975, 1985, 1990.

										Faculty	Average Age		
Depts	<30	30-34	35-39	40-44	45-49	50-54	55-59	60-66	>66	TOTAL 1990	1975	1985	1990
4-year schools													
Math	7%	12%	14%	15%	16%	16%	10%	9%	1%	19411	40.5	44.5	45.6
Stat	6%	15%	16%	16%	14%	10%	12%	9%	2%	735	40.6	-	44.8
CS	9%	14%	22%	15%	16%	16%	5%	3%	0%	5318	38	40.5	41.9
2-year schools													
Math	5%	8%	10%	21%	22%	21%	8%	5%	0%	7222	41.8	43.3	45.4

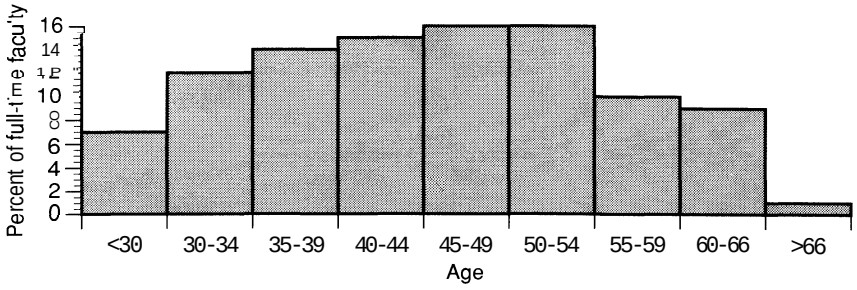

FIGURE S.9.1 Age distribution of full-time faculty in four-year college and university Departments of Mathematics. Total full-time faculty is 19,411: Fall 1990.

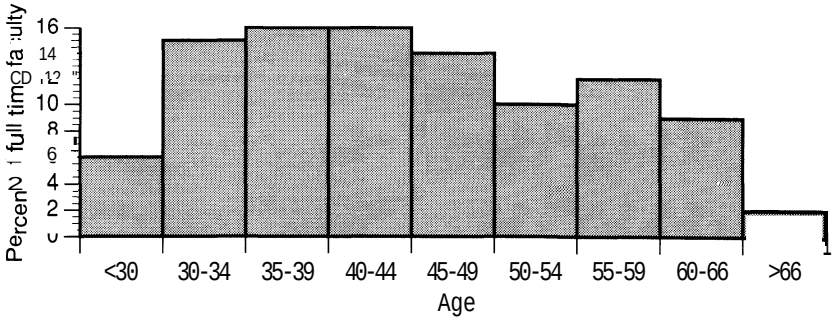

FIGURE S.9.2 Age distribution of full-time faculty in four-year college and university Departments of Statistics. Total full-time faculty is 735: Fall 1990.

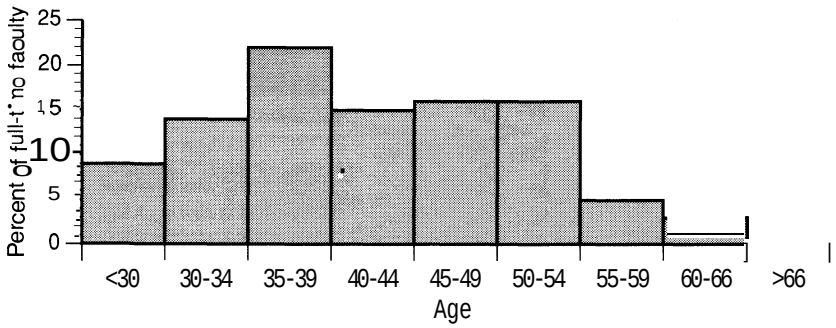

FIGURE S.9.3 Age distribution of full-time faculty in four-year college and university Departments of Computer Science. Total full-time faculty is 5318: Fall 1990.

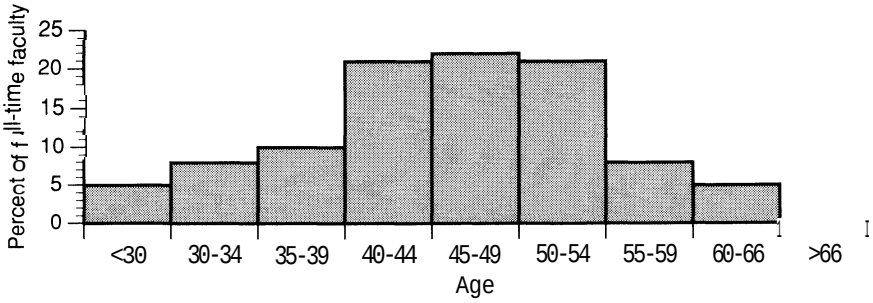

FIGURE S.9.4 Age distribution of full-time faculty in two-year college Mathematics Programs. Total full-time faculty is 7222: Fall 1990.

TABLE S.9 While the average age of faculty in the three disciplines increased over 1985 levels, the average annual increase during 1985-1990 in mathematics was not as pronounced as the average annual increase in the 1975-1985 period.

TABLE S.10 Percent women among full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science and two-year college Mathematics Programs: Fall 1975, 1980, 1985, 1990; percent women among faculty aged less than 35: Fall 1990.

	Math Depts	Stat Depts	CS Depts	2-Yr Math Programs
Women among full-time faculty 1975	10%	-	-	21%
Women among full-time faculty 1980	14%	-	-	25%
Women among full-time faculty 1985	15%	10%	13%	31%
Women among full-time faculty 1990	20%	14%	16%	34%
Women among faculty aged less than 35 1990	25%	24%	12%	51%
TOTAL FACULTY 1990	19411	735	5318	7222

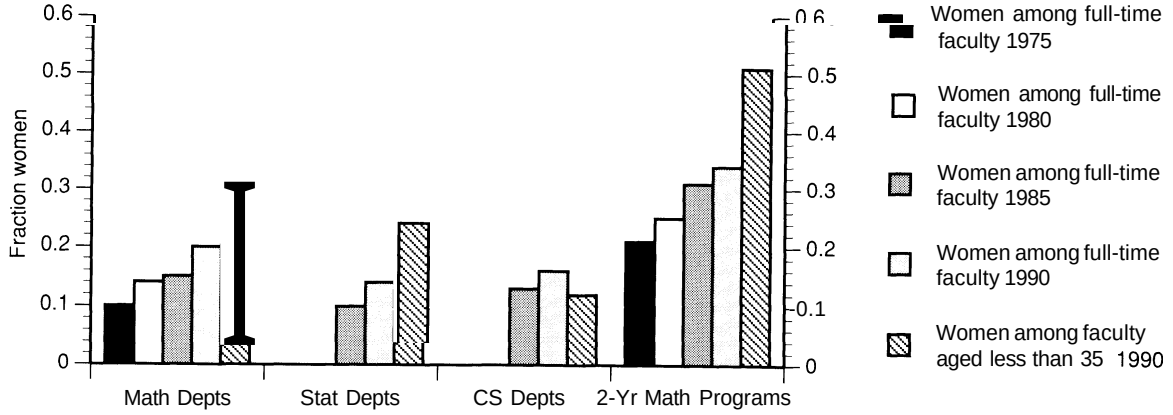

FIGURE S.10.1 Fraction women among full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science and two-year college Mathematics Programs: Fall 1975, 1980, 1985, 1990. Also fraction women among full-time faculty aged less than 35: Fall 1990.

TABLE S.10 Over the last ten years the percent increase of faculty members in mathematics departments who are women averaged 1% a year. This is the first CBMS survey to report the percent of women among those faculty age 34 or less. Only in computer science departments was this percent less than the overall percent. A "–" indicates data were not available.

TABLE S.11 Percent of sections taught by full-time and part-time faculty and graduate teaching assistants in four-year college and university Departments of Mathematics, Statistics and Computer Science and two-year college Mathematics Programs: Fall 1990.

	Four-year schools			Two-year schools
	Math Depts	Stat Depts	CS Depts	Math Programs
Total number of sections	67098	978	9533	51835
Percent taught by full-time faculty	75%	78%	80%	58%
Percent taught by part-time faculty	16%	15%	11%	42%
Percent taught by graduate TAs	9%	7%	9%	0%

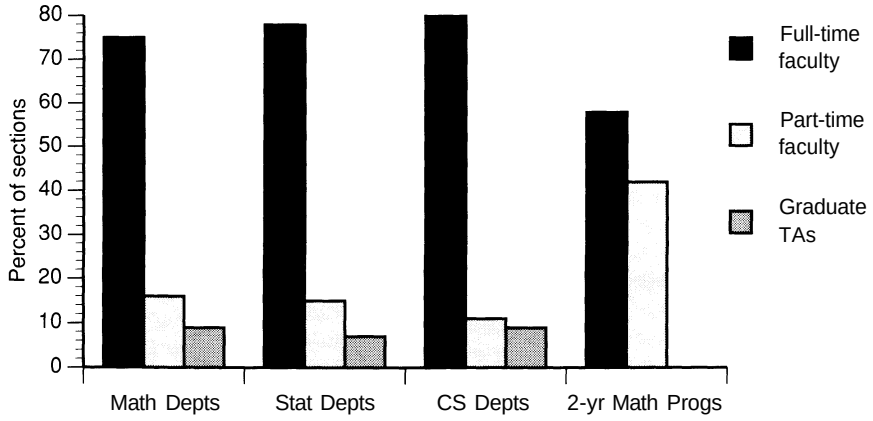

FIGURE S.11.1 Percent of sections taught by full-time and part-time faculty and graduate teaching assistants in four-year college and university Departments of Mathematics, Statistics and Computer Science and two-year college Mathematics Programs: Fall 1990.

TABLE S.11 In four-year institutions a substantial number of sections continued to be taught by a combination of part-time faculty and graduate teaching assistants. But it pales when compared to the overwhelming number (and percent) of sections taught by part-time two-year college faculty.

TABLE S.12 Number of part-time faculty and graduate teaching assistants in four-year college and university Departments of Mathematics, Statistics and Computer Science and two-year college Mathematics Programs: Fall 1970, 1980, 1985, 1990. Part-time faculty as a percent of full-time faculty is given in parentheses. Graduate TAs are available only for Fall 1990.

	Part-time faculty				Graduate TAs
	1970	1980	1985	1990	1990
Four-year colleges and universities					
Math Depts	2436 (15%)	5456 (34%)	7087 (40%)	6786 (35%)	7297
Stat Depts	93 (13%)	132 (22%)	118 (18%)	90 (12%)	449
CS Depts	300 (18%)	726 (43%)	1984 (55%)	1437 (27%)	3626
Two -year colleges					
Math Programs	2213 (45%)	6661 (118%)	7433 (118%)	13680 (189%)	

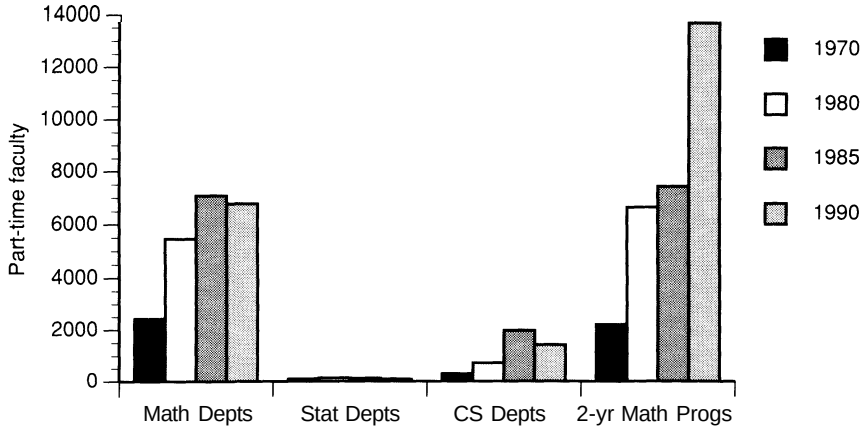

FIGURE S.12.1 Number of part-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science and two-year college Mathematics Programs: Fall 1970, 1980, 1985, 1990.

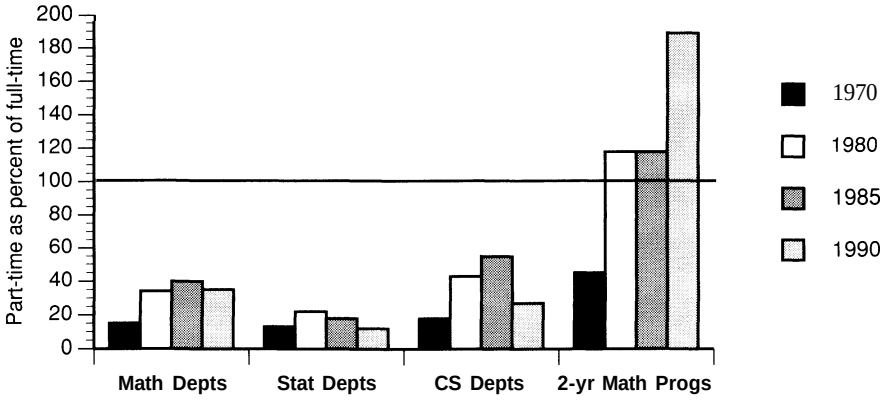

FIGURE S.12.2 Number of part-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science and two-year college Mathematics Programs as a percent of full-time faculty: Fall 1970, 1980, 1985, 1990.

TABLE S.12 There was a modest decline in the number of part-time faculty in mathematics and statistics departments; a sharp decline in this number for computer science departments, reflecting, no doubt, both the decline in computer science enrollment and the increase in the number of full-time faculty. There was a staggering increase in the number of part-time faculty in two-year college mathematics programs, almost doubling since 1985. Most of the graduate assistants were at universities; these are reported in more detail in the enrollment section.

Chapter 2

ENROLLMENT

The six tables in this chapter present data on enrollment in four-year colleges and universities according to the type of mathematics degree awarded (PhD, MA or BA) and by the disciplines: mathematics, statistics or computer science. The number of sections offered as well as average section size are presented. Also shown is the percentage of mathematics departments that offer selected advanced mathematics courses and a detailed breakdown of bachelor degrees awarded.

The tables emphasize the central role mathematics departments play in teaching statistics and computer science, especially at the MA and BA level.

In particular, mathematics departments offered almost as many sections of computer science as did computer science departments. Average section size was considerably larger in PhD universities than in their MA and BA counterparts. More detailed information on calculus I and II, introductory statistics, and computer science I is given in Chapter 4.

Bachelor degrees are reported in detail with women comprising a majority of mathematics education degrees but a minority of all other degrees.

For information on four-year college and university mathematics see
Tables E.1, E.2, E.3, E.4, E.5 and E.6.

For information on four-year college and university statistics see
Tables E.1, E.2, E.3, E.6.

For information on four-year college and university computer science see
Tables E.1, E.2, E.3, E.5.

TABLE E.1 Enrollment (thousands) for Mathematics, Statistics and Computer Science courses in four-year college and university Departments of Mathematics, Statistics and Computer Science by level of course and by type of school. Also full-time faculty: Fall 1990.

Fall 1990 enrollment (thousands)

	Math Depts			Stat Depts			CS Depts			
	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	TOTAL
Number of full-time faculty	6427	5058	7926	668	53	14	2746	1408	1164	25464
Math courses										
Remedial	68	93	100							261
Precalculus	206	202	185							593
Calculus	337	122	188	1						648
Adv math	58	29	33	1					1	122
TOTAL MATH	669	446	506	2					1	1624
Stat courses										
Elem stat	14	27	46	25	4				3	119
Adv stat	18	12	8	14					2	54
TOTAL STAT	32	39	54	39	4				5	173
CS courses										
Lower CS	9	42	83				100	60	44	338
Middle CS	1	4	7				11	8	6	37
Upper CS	6	12	16				47	19	16	116
TOTAL CS	16	58	106				158	87	66	491
GRAND TOTAL	717	543	666	41	4		158	87	72	2288

TABLE E.1 This is an elaboration of Table S.2, reporting on enrollment by type of departments. While the division into PhD, MA, and BA is according to the highest **mathematics** degree awarded by the institution, an analysis of the statistics and computer science departments reporting indicates that there is a close fit with the highest degree awarded by these departments. Certainly noteworthy is the myriad of courses taught by the BA mathematics departments who taught 31% of all mathematics enrollment; 31% of all statistics enrollment, and 22% of all computer science enrollment. In PhD mathematics departments the ratio of enrollment to total full-time faculty was 112; for MA departments it was 107, and for BA departments the ratio was 84. For statistics and computer science departments this ratio was a nearly identical 60. The faculty totals are reported in Table F.1.

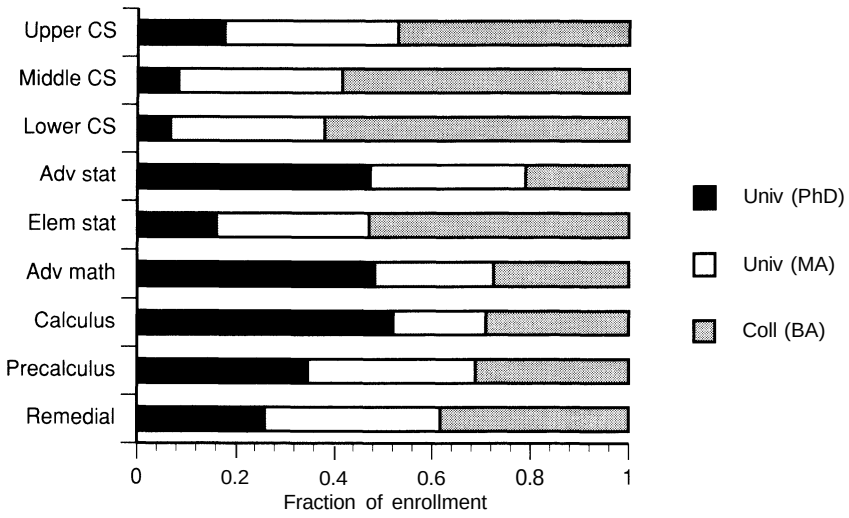

FIGURE E.1.1 Fraction of total enrollment in four-year college and university Departments of Mathematics by level of courses and by type of school: Fall 1990.

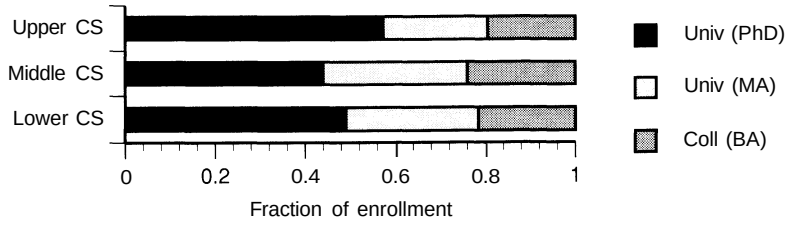

FIGURE E.1.2 Fraction of total enrollment in four-year college and university Departments of Computer Science by level of the courses and by type of school: Fall 1990.

TABLE E.2 Number of sections of Mathematics, Statistics and Computer Science courses in four-year college and university Departments of Mathematics, Statistics and Computer Science by level of the course and by type of school: Fall 1990.

Number of sections: Fall 1990.

	Math Depts			Stat Depts			CS Depts			
	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	TOTAL
Math courses										
Remedial	1775	2854	3835							8464
Precalculus	4669	5872	6628	6			2			17177
Calculus	8343	4188	8044	11			3		3	20592
Adv math	2723	1803	3124	31			6	2		7689
TOTAL MATH	17510	14717	21631	48			11	2	3	53922
Stat courses										
Elem Stat	286	818	1497	382	105	7			78	3173
Adv stat	601	592	537	382	19	35	3		82	2251
TOTAL STAT	887	1410	2034	764	124	42	3		160	5424
CS courses										
Lower CS	262	1650	3731				1971	1597	1546	10757
Middle CS	46	214	565				317	286	321	1749
Upper CS	307	811	1323				1619	903	794	5757
TOTAL CS	615	2675	5619				3907	2786	2661	18263
GRAND TOTAL	19012	18802	29284	812	124	42	3921	2788	2824	77609

TABLE E.2 While mathematics departments have 37% of all computer science enrollment, they taught just under 50% of all computer science sections. The largest effort was at the calculus level with 20,592 sections offered. However the definition of a section in calculus courses is complicated by the variety of ways institutions count recitation and lecture sections.

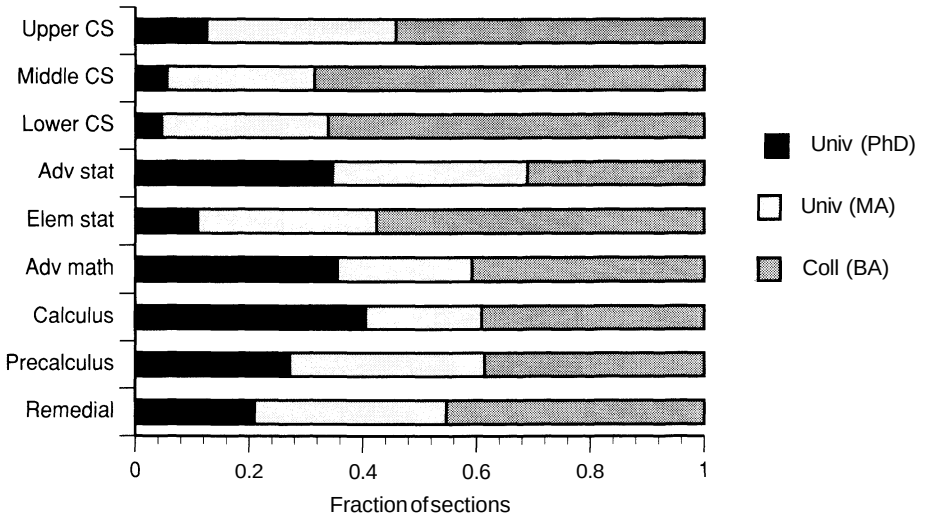

FIGURE E.2.1 Fraction of total sections in four-year college and university Departments of Mathematics by level of the courses and by type of school: Fall 1990.

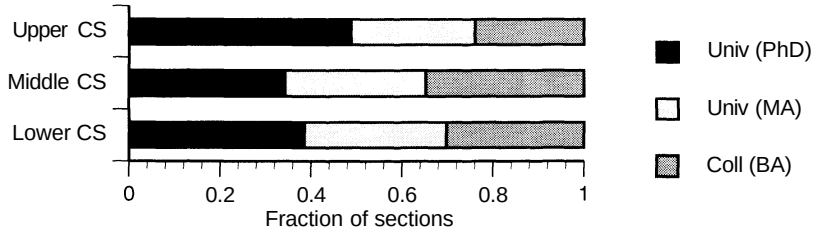

FIGURE E.2.2 Fraction of total sections in four-year college and university Departments of Computer Science by level of the courses and by type of school: Fall 1990.

TABLE E.3 Average section size for Mathematics, Statistics and Computer Science courses in four-year college and university Departments of Mathematics, Statistics and Computer Science by level of the courses and by type of school: Fall 1990.

Average size of sections

	Math Depts			Stat Depts			CS Depts				
	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	Univ (PhD)	Univ (MA)	Coll (BA)	All Depts 1990	All Depts 1985
Math courses											
Remedial	38	33	26							31	32
Precalculus	44	34	28							35	35
Calculus	41	29	23							35	34
Adv math	22	16	11							16	19
Stat courses											
Elem stat	48	33	31	65	39	20				37	37
Adv stat	29	21	15	37	23	10				24	30
CS courses											
Lower CS	33	25	22				51	38	29	29	31
Middle CS	29	18	12				35	29	19	21	26
Upper CS	20	15	12				29	20	20	20	22

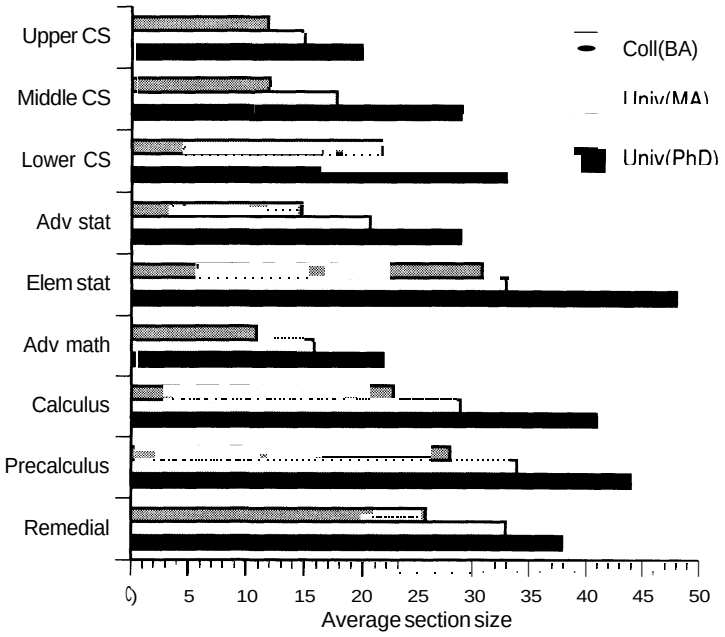

FIGURE E.3.1 Average section size for Mathematics, Statistics and Computer Science courses in four-year college and university Departments of Mathematics by level of the courses and by type of school: Fall 1990.

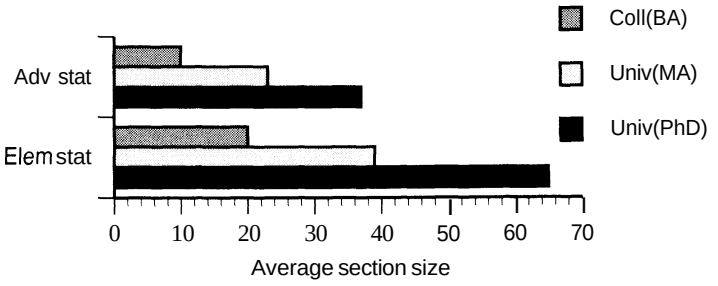

FIGURE E.3.2 Average section size for Statistics courses in four-year college and university Departments of Statistics by level of the courses and by type of school: Fall 1990.

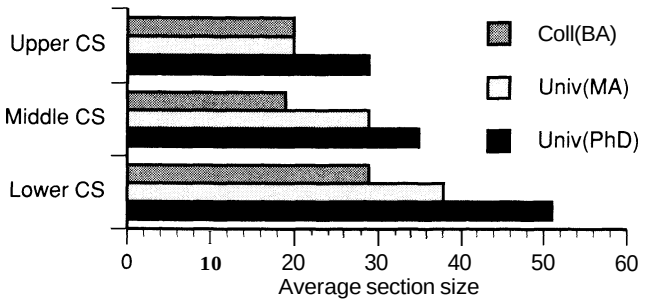

FIGURE E.3.3 Average section size for Computer Science courses in four-year college and university Departments of Computer Science by level of the courses and by type of school: Fall 1990.

TABLE E.3 Average section sizes for advanced courses in all three disciplines declined from 1985 levels. All levels in computer science courses showed a smaller size than in 1985, no doubt reflecting the decline in computer science enrollment.

TABLE E.4 Percent of four-year college and university Departments of Mathematics offering selected advanced level mathematics courses within two consecutive academic years, 1989-91 by type of school and also for all departments 1984-86.

	All depts 1984-86	All depts 1989-91	1989-91 Univ (PhD)	1989-91 Univ (MA)	1989-91 Coll (BA)
Number of schools	1423	1421	165	236	1020
Modern Algebra	-	79%	98%	94%	73%
Adv Calc/ Real Analysis	-	43%	72%	56%	36%
Geometry	60%	72%	82%	85%	67%
Topology	-	35%	67%	51%	26%
Theory of Numbers	37%	39%	79%	64%	26%
Combinatorics	17%	17%	43%	21%	11%
Appl Math/ Modeling	32%	33%	57%	50%	25%
Intro Operations Res	-	19%	26%	30%	14%
Foundations of math	22%	22%	31%	27%	19%
Math for Sec Teachers	45%	34%	36%	57%	28%
Senior sem/ Ind study	-	42%	64%	51%	36%

TABLE E.4 The increase in geometry course offerings nearly matches the decline in mathematics for secondary school teachers offerings. Perhaps some institutions used the geometry course in place of a special mathematics education course.

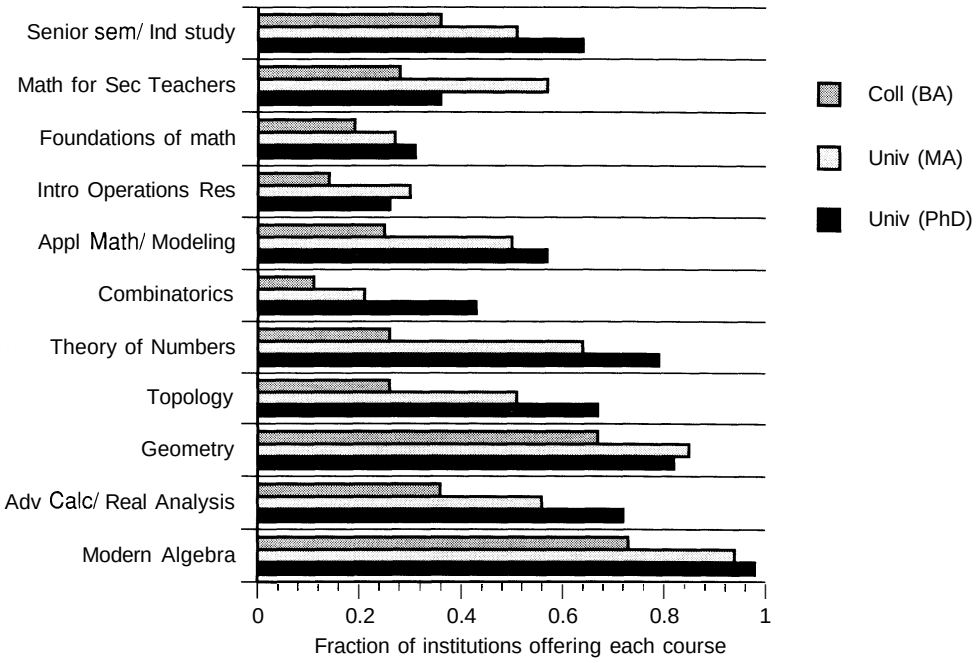

FIGURE E.4.1 Fraction of four-year college and university Departments of Mathematics offering selected advanced level mathematics courses within two consecutive academic years 1989-1991 by type of school.

TABLE E.5 Bachelors Degrees in Computer Science awarded by four-year college and university Departments of Mathematics and Computer Science between July 1, 1989 and June 30, 1990 by type of school and gender of the degree recipient.

	Math Depts				CS Depts				
	Univ (PhD)	Univ (MA)	Univ (BA)	TOTAL MATH DEPTS	Univ (PhD)	Univ (MA)	Univ (BA)	TOTAL CS DEPTS	TOTAL
CS Degrees (including joint majors)									
Male	**449**	1181	**1860**	**3490 (69%)**	5314	**3894**	**2549**	**11757 (70%)**	**15247 (70%)**
Female	**84**	**632**	**869**	**1585 (31%)**	**1887**	**1830**	1155	**4872 (30%)**	**6457 (30%)**

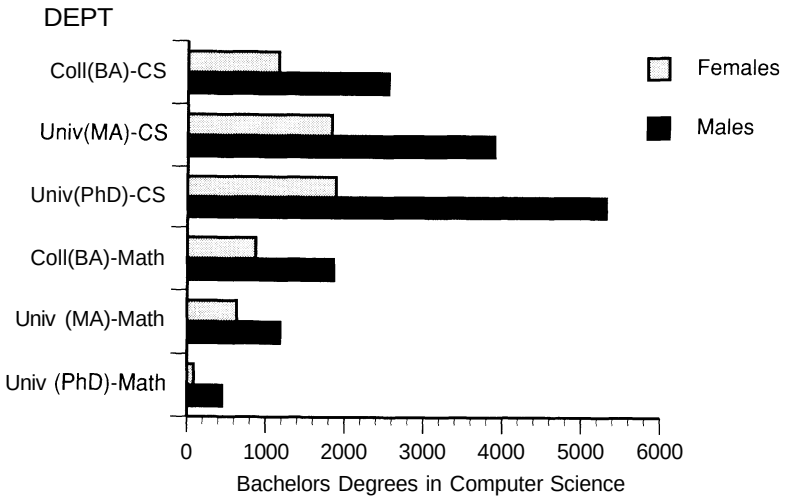

FIGURE E.5.1 Bachelors Degrees in Computer Science awarded by four-year college and university Departments of Mathematics and Computer Science between July 1, 1989 and June 30, 1990 by type of school and department and gender of the degree recipient.

TABLE E.5 This table includes joint computer science-mathematics degrees awarded by computer science departments only. Joint degrees awarded by mathematics departments are included in Tables E.6 and S.3. The gender breakdown was not asked in previous CBMS surveys.

TABLE E.6 Bachelors Degrees in Mathematics, Statistics and Mathematics Education awarded by four-year college and university Departments of Mathematics and Statistics between July 1, 1989 and June 30, 1990 by gender of degree recipient and type of school.

	Math Depts				Stat Depts			
	Univ (PhD)	Univ (MA)	Coll (BA)	TOTAL MATH	Univ (PhD)	Univ (MA)	TOTAL STAT	GRAND TOTAL
Math Degrees (including Act Sci. OR and joint degrees)								
Male	3696	1933	2893	8522	0	0	0	8522 (57%)
Female	1970	1672	2663	6305	0	0	0	6305 (43%)
Stat Degrees (including joint degrees)								
Male	124	79	25	228	201	8	209	437 (65%)
Female	41	37	27	105	125	3	128	233 (35%)
Mathematics education								
Male	190	602	343	1135	0	0	0	1135 (36%)
Female	310	862	809	1981	0	0	0	1981 (64%)
TOTAL								
Male	4010 (63%)	2614 (50%)	3261 (48%)	9885 (54%)	201 (62%)	8 (73%)	209 (62%)	10094 (54%)
Female	2321 (37%)	2571 (50%)	3499 (52%)	8391 (46%)	125 (38%)	3 (27%)	128 (38%)	8519 (46%)

TABLE E.6 This table includes joint degrees in statistics and/or computer science awarded by mathematics and statistics departments. It does not contain any degrees classified as "other." These are reported only in Table S.3. The gender of graduates was not asked in previous CBMS surveys.

FIGURE E.6.1 Bachelors Degrees in four-year college and university Departments of Mathematics by type of degree and gender of the degree recipient between July 1, 1989 and June 30, 1990.

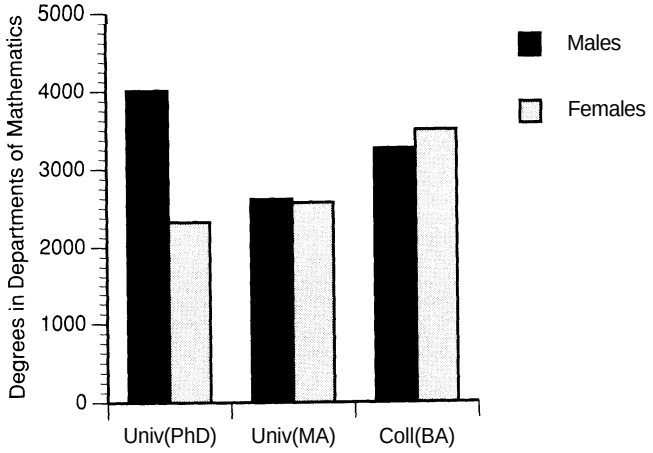

FIGURE E.6.2 Bachelors Degrees in four-year college and university Departments of Mathematics by type of school and gender of the degree recipient between July 1, 1989 and June 30, 1990.

Chapter 3

FACULTY

This chapter contains 13 tables and accompanying figures. It presents data on four-year college and university faculty according to the highest mathematics degree awarded by the institution (PhD, MA, or BA) and disciplines (mathematics, statistics, and computer science) covered by the report. It includes data on the size of the full-time and part-time faculty and number of graduate teaching assistants along with the number and percent of sections taught by each group. The tenure and doctoral-holding status of full-time faculty are given in addition to age, gender, racial/ethnic distributions, average contact hours per week, and death/retirement figures.

A fairly large minority of mathematics department faculty taught computer science courses either exclusively or together with mathematics teaching. The size of the mathematics faculty increased modestly, but computer science showed a large increase. The percent of mathematics faculty with tenure remained at the 1985 level, while the percent tenured in statistics and computer science increased. As might be expected, the percent of doctoral faculty was largest for PhD universities, and lowest for four-year colleges. Part-time faculty and graduate teaching assistants continued to teach a significant percent of classes, with the percent highest in PhD mathematics departments.

For information on four-year college and university mathematics see

Tables F.1, F.2, F.3, F.4, F.5, F.6, F.7, F.10, F.13.

For information on four-year college and university statistics see

Tables F.1, F.2, F.3, F.4, F.5, F.6, F.8, Ell, F.13.

For information on four-year college and university computer science see

Tables F.1, F.2, F.3, F.4, F.5, F.6, F.9, F.12, F.13.

TABLE F.1 Number of full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science by instructional responsibilities and type of school; also average number of faculty per department: Fall 1990.

Number of faculty teaching:

	Math/ Stat only	CS only	Math/ Stat and CS	TOTAL Faculty	No. of Depts	Ave. no. faculty/ dept
Math Depts						
Univ(PhD)	6134	128	165	6427	165	39
Univ(MA)	4156	468	434	5058	236	21
College(BA)	5800	896	1230	7926	1020	7
TOTAL MATH	16090	1492	1829	19411	1421	14
Stat Depts						
Univ(PhD)	668	0	0	668	53	13
Univ(MA)	53	0	0	53	5	11
College(BA)	14	0	0	14	2	7
TOTAL STAT	735	0	0	735	60	12
CS Dept						
Univ(PhD)	4	2736	6	2746	136	20
Univ(MA)	0	1405	3	1408	105	13
College(BA)	0	1164	0	1164	238	5
TOTAL CS	4	5305	9	5318	479	11
GRAND TOTAL	16829	6797	1838	25464	1960	

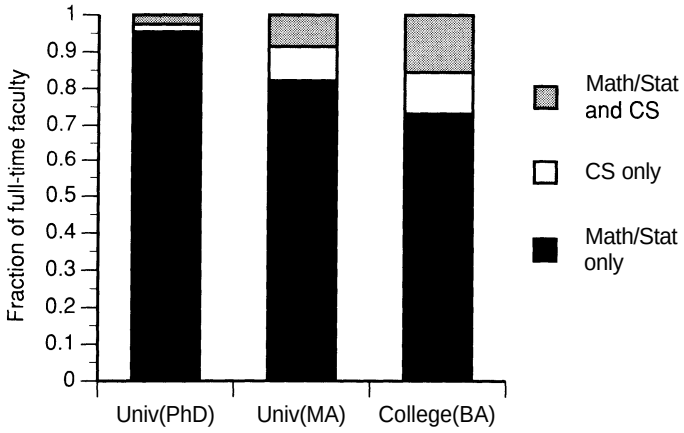

FIGURE F.1.1 Type of instructional responsibility of full-time faculty in four-year college and university Departments of Mathematics: Fall 1990.

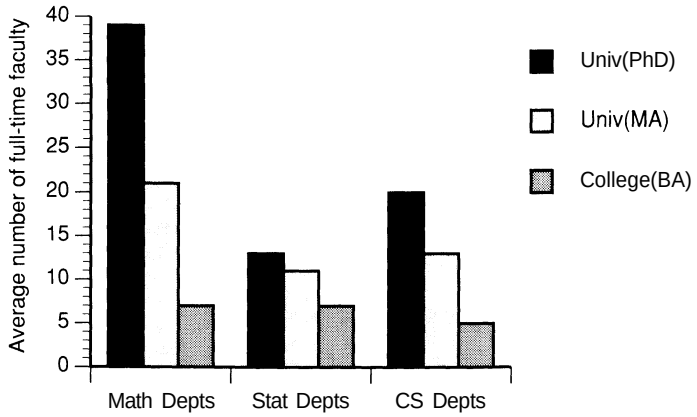

FIGURE F.1.2 Average number of full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science by type of school: Fall 1990.

TABLE El Again we emphasize that the number of full-time faculty is by actual count not full-time equivalents. In MA and BA mathematics departments there was a large fraction of facultyteaching computer science courses. By way of comparison, assuming that those faculty teaching both computer science and mathematics/statistics courses divide their teaching evenly between the disciplines, then the computer science teaching faculty was 16% of the total MA mathematics faculty and 26% of the total BA mathematics faculty. From Table E.1, computer science course enrollment stood at 11% of the total enrollment for MA schools and 16% for BA schools.

TABLE F.2 Tenure status of full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science by type of school for Fall 1990. Available data for 1975, 1980 and 1985 also given.

	Tenured 1975	Tenured 1980	Tenured 1985	Tenured 1990	No. tenured 1990	No. untenured 1990	TOTAL faculty 1990
Math Depts							
Univ(PhD)				74%	4781	1646	6427
Univ(MA)				61%	3079	1979	5058
Univ(BA)				61%	4828	3098	7926
TOTAL MATH	73%	72%	65%	65%	12688	6723	**19411**
Stat Depts							
Univ(PhD)				72%	484	184	668
Univ(MA)				75%	40	13	53
Univ(BA)				29%	4	10	14
TOTAL STAT	71%	62%	68%	72%	528	207	735
CS Depts							
Univ(PhD)				54%	1495	1251	2746
Univ(MA)				52%	732	676	1408
Univ(BA)				50%	583	581	1164
TOTAL CS	65%	51%	42%	53%	2810	2508	5318

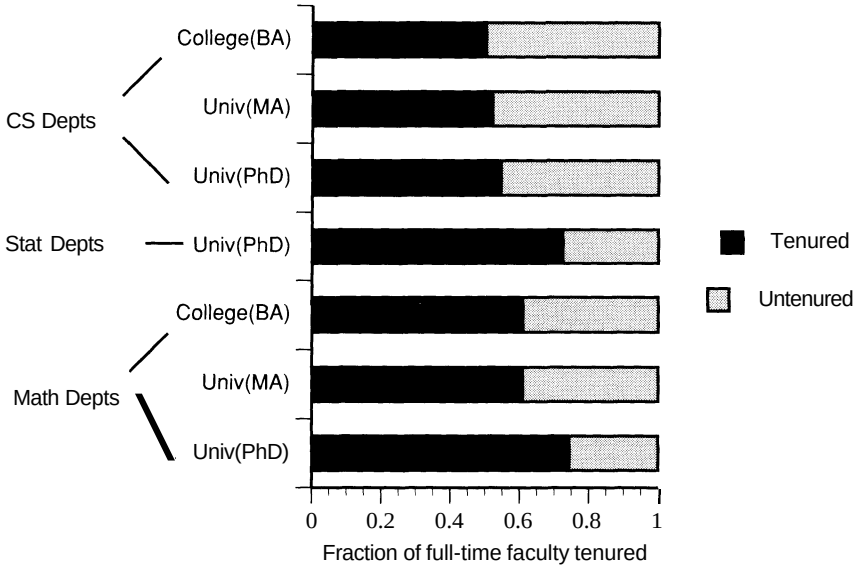

FIGURE F.2.1 Fraction of full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science tenured and untenured by type of school: Fall 1990.

TABLE E2 It is perhaps a surprise that although the average age of mathematics faculty increased (see Table F.4) the percent of tenured faculty is the same (65%) as in 1985. Both statistics and computer science showed an increase in the percent of tenured faculty over 1985 figures.

TABLE F.3 Gender and Racial/Ethnic groups among full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science for Fall 1990 and among new PhDs from U.S. Departments of Mathematics and Statistics for 1980-1990.

	Full-time faculty	Women	Women among faculty <35	Amer. Indian/ Alaskan	Asian/ Pacific Islander	Black, not Hispanic	Hispanic	White, not Hispanic
Math Dept								
Univ(PhD)	6427	10.3%	18.2%	0.2%	8.1%	1.0%	2.0%	88.8%
Univ(MA)	5058	22.7%	34.1%	0.0%	9.6%	3.5%	1.1%	85.8%
College(BA)	7926	25.8%	25.3%	0.0%	6.6%	3.1%	0.5%	89.8%
OVERALL MATH	19411	19.8%	25.2%	0.1%	7.9%	2.5%	1.1%	88.4%
Stat Dept								
Univ(PhD)	668	13.6%	24.7%	0.3%	21.5%	0.3%	2.4%	75.6%
Univ(MA)	53	22.6%	0.0%	0.0%	3.7%	0.0%	0.0%	96.3%
College(BA)	14	14.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
OVERALL STAT	735	14.3%	23.5%	0.3%	19.8%	0.3%	2.1%	77.5%
CS Dept								
Univ(PhD)	2746	11.1%	10.3%	0.0%	16.1%	0.3%	1.5%	82.0%
Univ(MA)	1408	17.1%	17.5%	0.5%	16.5%	4.8%	2.4%	75.9%
College(BA)	1164	28.1%	16.4%	0.0%	6.4%	0.0%	0.0%	93.5%
OVERALL CS	5318	16.4%	12.4%	0.1%	14.0%	1.4%	1.4%	83.1%
PhD Grads from U.S. Math and Stat Depts 1980-1990	New Grads 8201	17.0%	na	0.2%	23.1%	1.5%	2.1%	73.1%

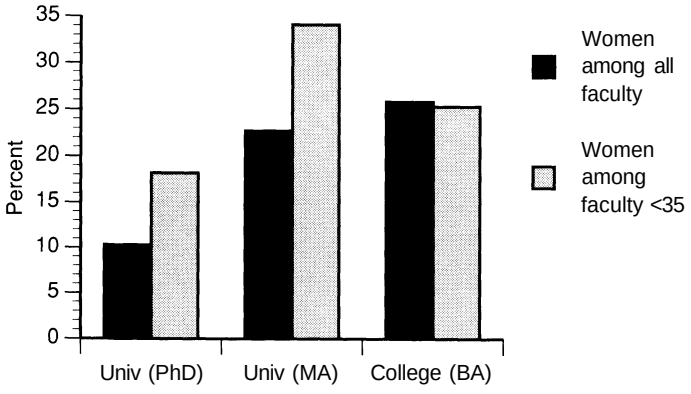

FIGURE F.3.1 Percent women among full-time faculty and among full-time faculty aged 34 or less in four-year college and university Departments of Mathematics: Fall 1990.

TABLE E3 Minorities, except for Asian/ Pacific Islanders, remain underrepresented among PhD graduates in the mathematical sciences. While women have received 17% of the mathematical sciences PhDs granted in the 80's, they are almost 20% of the faculty. Almost all traditionally Black universities and colleges are in the MA and BA categories.

TABLE F.4 Age distribution of full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science by type of school: Fall 1990.

	<30	30-34	35-39	40-44	45-49	50-54	55-59	60-66	>66	TOTAL FACULTY	Ave age
Math Depts											
Univ(PhD)	6%	12%	13%	13%	15%	17%	12%	10%	2%	6427	46.5
Univ(MA)	6%	11%	12%	15%	16%	21%	12%	6%	1%	5058	45.1
Coll(BA)	8%	14%	14%	16%	18%	13%	8%	9%	0%	7926	44.5
ALL MATH	7%	12%	14%	15%	16%	16%	10%	9%	1%	19411	45.6
Stat Depts											
Univ(PhD)	6%	16%	16%	17%	12%	10%	12%	9%	2%	668	44.6
Univ(MA)	6%	10%	19%	15%	28%	9%	9%	4%	0%	53	43.3
Coll(BA)	0%	0%	0%	0%	57%	0%	14%	29%	0%	14	53
ALL STAT	6%	15%	16%	16%	14%	10%	12%	9%	2%	735	44.8
CS Depts											
Univ(PhD)	13%	16%	21%	17%	13%	11%	4%	4%	1%	2746	41.2
Univ(MA)	5%	14%	13%	20%	22%	15%	8%	3%	0%	1408	43.6
Coll(BA)	4%	9%	33%	4%	15%	31%	3%	1%	0%	1164	42.8
ALL CS	9%	14%	22%	15%	16%	16%	5%	3%	0%	5318	41.9

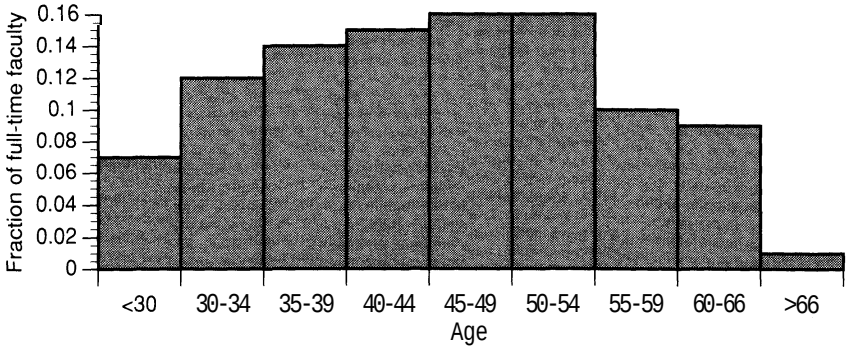

FIGURE F.4.1 Age distribution of full-time faculty in four-year college and university Departments of Mathematics: Fall 1990.

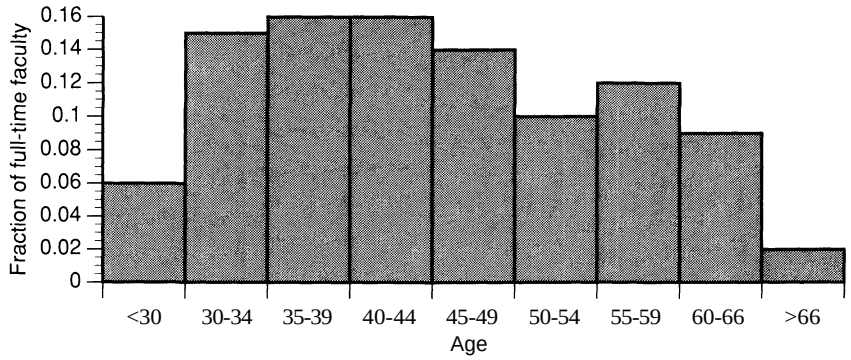

FIGURE F.4.2 Age distribution of full-time faculty in four-year college and university Departments of Statistics: Fall 1990.

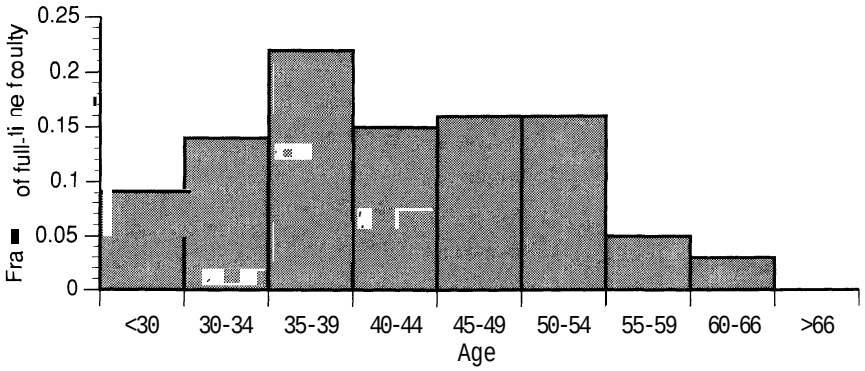

FIGURE F.4.3 Age distribution of full-time faculty in four-year college and university Departments of Computer Science: Fall 1990.

TABLE F.5 Deaths and retirements of full-time faculty from four-year college and university Departments of Mathematics, Statistics and Computer Science from Sept. 1, 1989 to Aug. 31, 1990 given as a percent of full-time faculty. Historical data is included when available.

	1979-80	1984-85	1989-90	Number of full-time faculty 1990
Math Dept				
Univ(PhD)	-	-	2.1%	6427
Univ(MA)	-	-	1.3%	5058
Univ(BA)	-	-	1.5%	7926
OVERALL MATH	0.9%	1.2%	1.6%	19411
Stat Dept				
OVERALL STAT	-	-	2.3%	735
CS Dept				
OVERALL CS	-	-	0.8%	5318

TABLE E5 If the percent of retirements and deaths for mathematics departments continues to follow the growth pattern of the last ten years, in 1995 the number of such deaths or retirements will exceed 400 per year.

TABLE F.6 Percent of departments having various weekly loads in classroom contact hours for full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science by type of school: Fall 1990.

	Number of schools	Contact hours					
		< 6hrs	6 hrs	7-8 hrs	9-11 hrs	12 hrs	>12 hrs
Math depts							
Univ(PhD)	165	15%	46%	24%	13%	0%	2%
Univ(MA)	236	3%	5%	6%	34%	38%	14%
College(BA)	1020	3%	2%	7%	26%	37%	25%
Stat depts							
Univ(PhD)	53	23%	77%	0%	0%	0%	0%
Univ(MA)	5	0%	0%	67%	33%	0%	0%
College(BA)	2	0%	0%	0%	0%	100%	0%
CS depts							
Univ(PhD)	136	44%	44%	7%	2%	0%	3%
Univ(MA)	107	0%	15%	15%	34%	30%	6%
College(BA)	240	10%	0%	0%	31%	26%	33%

TABLE E6 Full-time faculty in university mathematics departments continued to have more classroom contact hours than their counterparts in statistics and computer science, except at the college level where the patterns were similar.

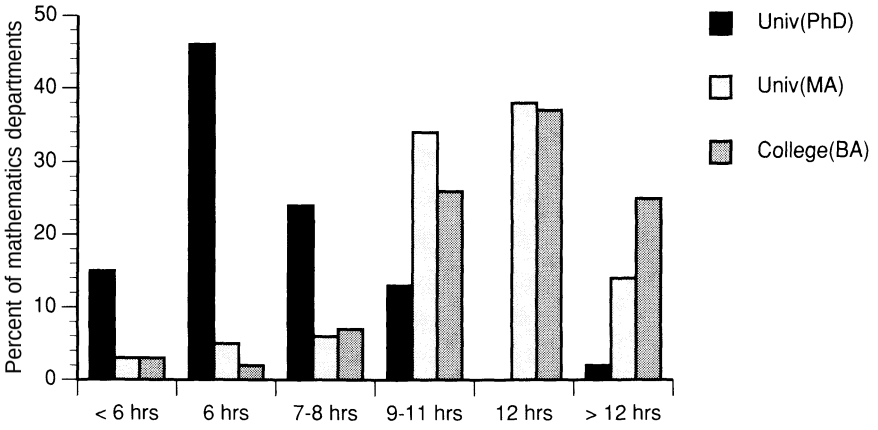

FIGURE F.6.1 Expected or typical weekly load in classroom contact hours for full-time faculty in four-year college and university departments of Mathematics by type of school: Fall 1990.

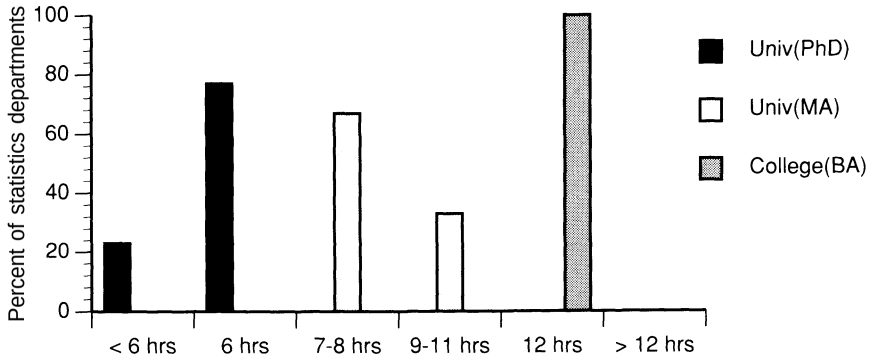

FIGURE F.6.2 Expected or typical weekly load in classroom contact hours for full-time faculty in four-year college and university departments of Statistics by type of school: Fall 1990.

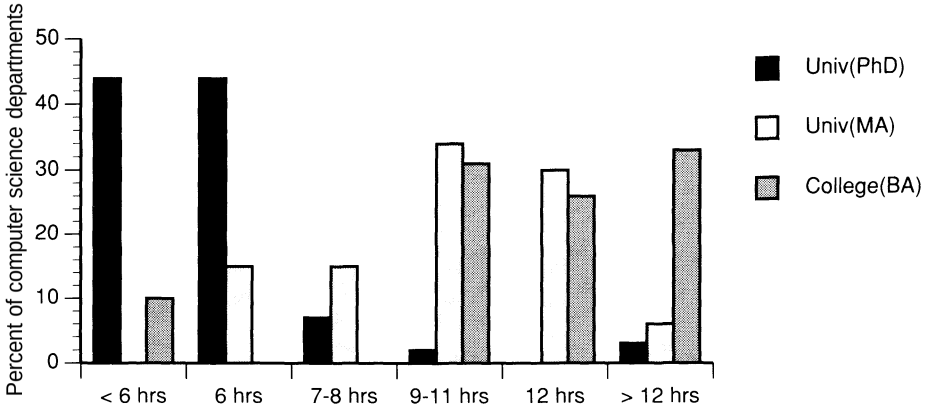

FIGURE F.6.3 Expected or typical weekly load in classroom contact hours for full-time faculty in four-year college and university Departments of Computer Science by type of school: Fall 1990.

TABLE F.7 Full-time faculty in four-year college and university Departments of Mathematics by highest degree and type of school: Fall 1990.

	Univ (PhD)	Univ (MA)	College (BA)	TOTAL
Doctoral degree	6058 (94%)	3620 (72%)	5285 (66%)	14963 (77%)
Other degree	369 (6%)	1438 (28%)	2641 (34%)	4448 (23%)
TOTAL	6427	5058	7926	19411

TABLE E7 In 1970, the number of doctoral-holding faculty in private college departments of mathematics was 42% of the total. While this survey organizes insitutions by highest mathematics degree awarded, there is a reasonable fit between BA departments of mathematics and private college departments. The 1990 percent of 66% doctorates in BA colleges indicates a substantial upgrading of the educational level of this faculty over the last 20 years.

TABLE F.8 Full-time faculty in four-year college and university Departments of Statistics by highest degree and type of school: Fall 1990.

	Univ (PhD)	Univ (MA)	College (BA)	TOTAL
Doctoral degree	650 (97%)	50 (94%)	6 (43%)	706 (96%)
Other degree	18 (3%)	3 (6%)	8 (57%)	29 (4%)
TOTAL	668	53	14	735

TABLE F.9 Full-time faculty in four-year college and university Departments of Computer Science by highest degree and type of school: Fall 1990.

	Univ (PhD)	Univ (MA)	College (BA)	TOTAL
Doctoral degree	2595 (95%)	984 (70%)	610 (52%)	4189 (79%)
Other degree	131 (5%)	424 (30%)	554 (48%)	1129 (21%)
TOTAL	2746	1408	1164	5318

TABLE F.10 Percent of sections taught by full-time and part-time faculty and graduate teaching assistants in four-year college and university Departments of Mathematics by type of school: Fall 1990.

	Univ(PhD)	Univ(MA)	College(BA)	TOTAL
Total number of sections	19012	18802	29284	67098
Percent taught by full-time faculty	63%	76%	82%	75%
Percent taught by part-time faculty	12%	18%	18%	16%
Percent taught by graduate TAs	25%	6%	0%	9%

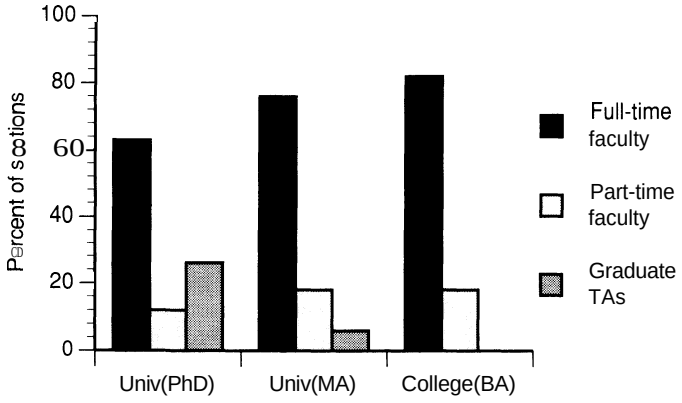

FIGURE F.10.1 Percent of sections taught by full-time and part-time faculty and graduate teaching assistants in four-year college and university Departments of Mathematics by type of school: Fall 1990.

TABLE E10 This table gives an analysis of the instructional impact of part-time faculty and graduate teaching assistants. (Sections of graduate teaching assistants are included only if it is their own course.) At the PhD departments, part-time faculty and graduate teaching assistants accounted for just over 7,000 sections, while Table E.2 shows that the number of sections in remedial and precalculus mathematics for these departments totaled 6444.

TABLE F.11 Percent of sections taught by full-time and part-time faculty and graduate teaching assistants in four-year college and university Departments of Statistics by type of school: Fall 1990.

	Univ(PhD)	Univ(MA)	College(BA)	OVERALL
Total number of sections	812	124	42	978
Percent taught by full-time faculty	83%	69%	53%	78%
Percent taught by part-time faculty	10%	22%	47%	15%
Percent taught by graduate TAs	7%	9%	0%	7%

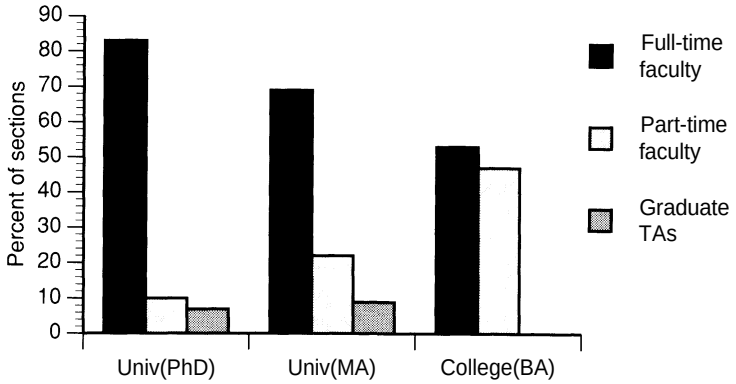

FIGURE F.11.1 Percent of sections taught by full-time and part-time faculty and graduate teaching assistants in four-year college and university Departments of Statistics by type of school: Fall 1990.

TABLE Ell As in Table F.10, sections for graduate teaching assistants are included only if it is their own course.

TABLE F.12 Percent of sections taught by full-time and part-time faculty and graduate teaching assistants in four-year college and university Departments of Computer Science by type of school: Fall 1990.

	Univ(PhD)	Univ(MA)	College(BA)	OVERALL
Total number of sections	3921	2788	2824	9533
Percent taught by full-time faculty	76%	78%	88%	80%
Percent taught by part-time faculty	11%	12%	10%	11%
Percent taught by graduate TAs	13%	10%	2%	9%

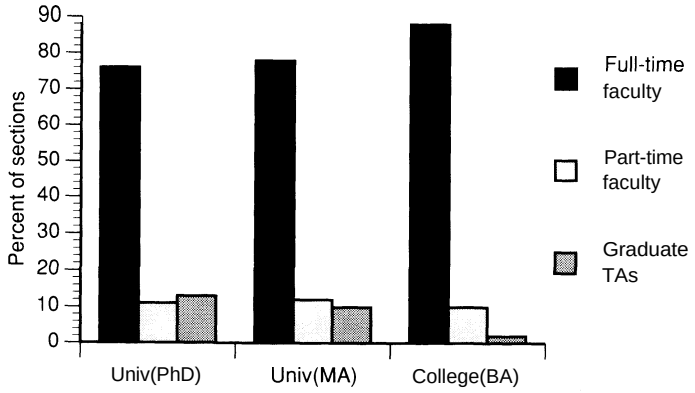

FIGURE F.12.1 Percent of sections taught by full-time and part-time faculty and graduate teaching assistants in four-year college and university Departments of Computer Science by type of school: Fall 1990.

TABLE E12 Sections for graduate teaching assistants were included only if it was their own course. In PhD computer science departments, graduate teaching assistants taught 13% of all sections; in mathematics departments the corresponding number was 25%.

TABLE F.13 Number of part-time faculty and graduate teaching assistants in four-year college and university Departments of Mathematics, Statistics and Computer Science by type of school. The percent that part-time faculty and Graduate TAs are of full-time faculty is given in parentheses: Fall 1990.

	Part-time faculty	Graduate TAs	No. of depts	Ave. no. of part-time	Ave. no. of GTAs
Math Depts					
Univ(PhD)	1129 (18%)	6261 (97%)	165	7	38
Univ(MA)	2052 (41%)	845 (17%)	236	8	4
College(BA)	3605 (45%)	191 (2%)	1020	4	0
TOTAL MATH	6786 (35%)	7297 (38%)	1421	5	5
Stat Depts					
Univ(PhD)	67 (10%)	419 (63%)	53	1	8
Univ(MA)	23 (43%)	30 (57%)	5	5	6
Coliege(BA)	0 (0%)	0 (0%)	2	0	0
TOTAL STAT	90 (12%)	449 (61%)	60	1	7
CS Depts					
Univ(PhD)	400 (15%)	2836 (103)	136	3	21
Univ(MA)	464 (33%)	647 (46%)	105	4	6
College(BA)	573 (49%)	143 (12%)	238	2	1
TOTAL CS	1437 (27%)	3626 (72%)	479	3	8
GRAND TOTAL	8313 (33%)	11372 (45%)	1960		

TABLE F.13 For PhD mathematics and computer science departments there was nearly a match between the number of full-time faculty and graduate teaching assistants. The table indicates a vigorous master's program at the MA computer science departments. The number of part-time college and university faculty continued to be a significant percentage of the full-time faculty total, especially at the collegiate level. Perhaps the graduate TA's in BA colleges are graduate students in other departments.

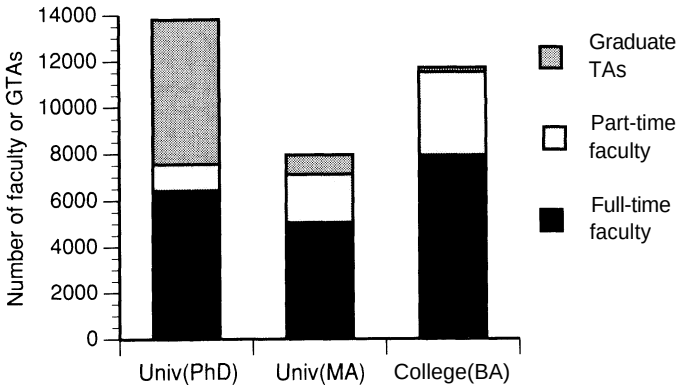

FIGURE F.13.1 Number of full-time faculty, part-time faculty and graduate teaching assistants in four-year college and university Departments of Mathematics by type of school: Fall 1990.

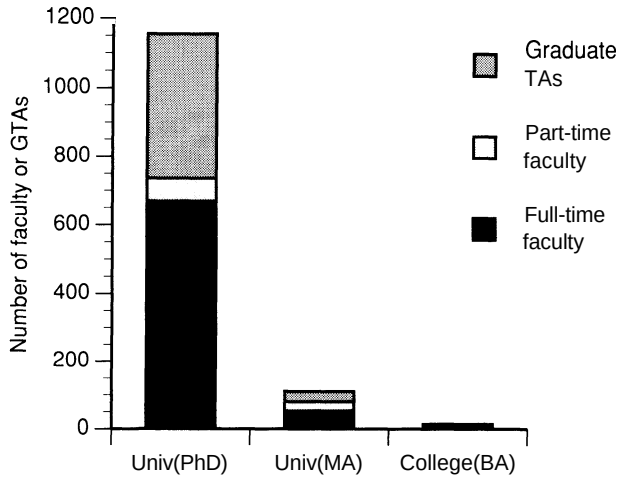

FIGURE F.13.2 Number of full-time faculty, part-time faculty and graduate teaching assistants in four-year college and university Departments of Statistics by type of school: Fall 1990.

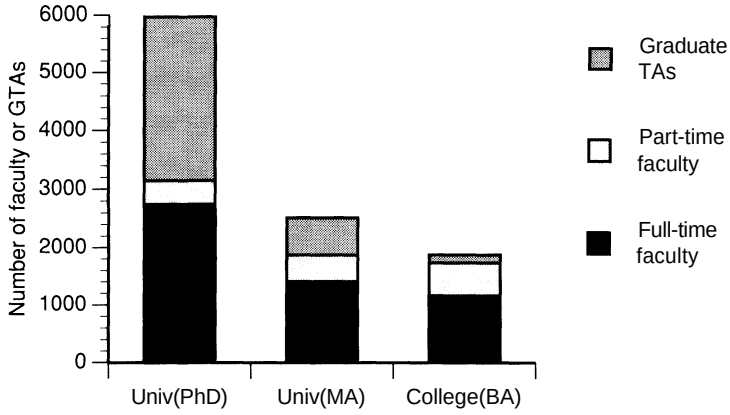

FIGURE F.13.3 Number of full-time faculty, part-time faculty and graduate teaching assistants in four-year college and university Departments of Computer Science by type of school: Fall 1990.

Chapter 4

INTRODUCTORY COURSES IN CALCULUS, STATISTICS, AND COMPUTER SCIENCE

The five tables in this chapter give detailed enrollment and section size in calculus-level courses, instructional formats for mainstream and non-mainstream calculus I, elementary statistics, and computer programming I, and the number of sections in mainstream calculus I and II incorporating various instructional features.

More detailed information on course enrollments is given in Appendix I.

Because of the change in the reporting format, direct comparisons with the 1985 data are not possible. In addition, the corresponding 1985 data aggregated figures for five introductory courses. PhD departments in all disciplines taught a substantial number of sections in the large lecture with quiz format.

The number of sections of calculus I and II requiring graphics calculators, use of computers, and group projects was quite small. A modest number of (mostly BA) departments required a writing component.

For information on four-year college and university mathematics see

Tables C.1, C.2, C.3, C.4, C.5.

For information on four-year college and university statistics see

Table C.4.

For information on four-year college and university computer science see

Table C.5.

TABLE C.1 Enrollment in thousands and average section size in some Calculus level courses in four-year college and university Departments of Mathematics by type of school: Fall 1990.

	Enrollment (thousands)				Average section size			
	Univ (PhD)	Univ (MA)	College (BA)	TOTAL	Univ (PhD)	Univ (MA)	College (BA)	ALL
Mainstream Calculus I	101	39	62	202	40	32	25	32
Mainstream Calculus II	47	17	23	87	41	29	22	31
Mainstream Calculus III, IV etc	45	16	22	83	37	27	20	28
Differential Equations	27	8	5	40	39	27	21	32
Linear Algebra	23	7	13	43	37	24	18	27
Non-mainstream Calculus I	73	25	50	148	46	30	29	36
Non-mainstream Calculus II,III etc	11	2	2	15	44	26	22	36
TOTAL	327	114	177	618				

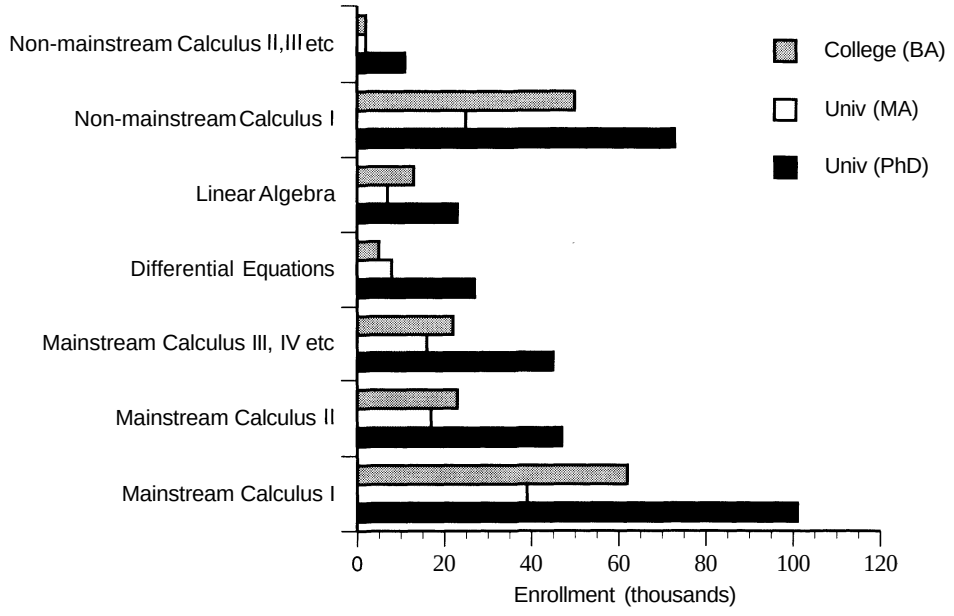

FIGURE C.1.1 Enrollment in some Calculus level courses in four-year college and university Departments of Mathematics by type of school: Fall 1990.

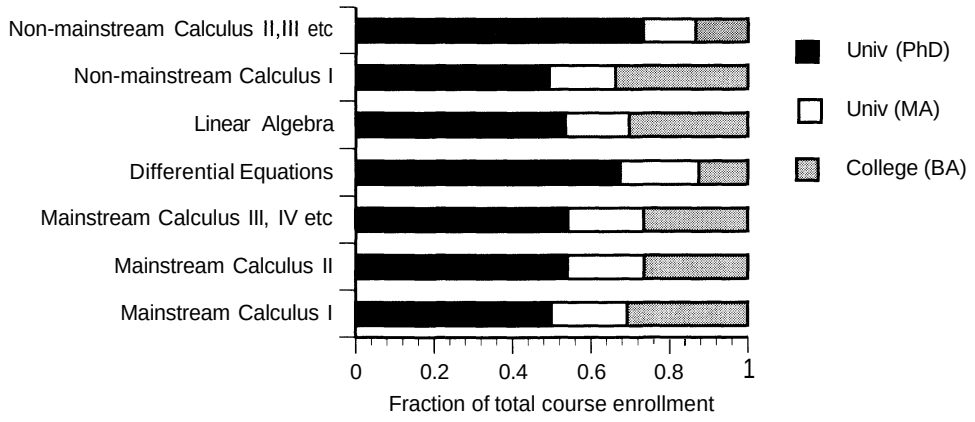

FIGURE C.1.2 Fraction of enrollment in some Calculus level courses in four-year college and university Departments of Mathematics by type of school: Fall 1990.

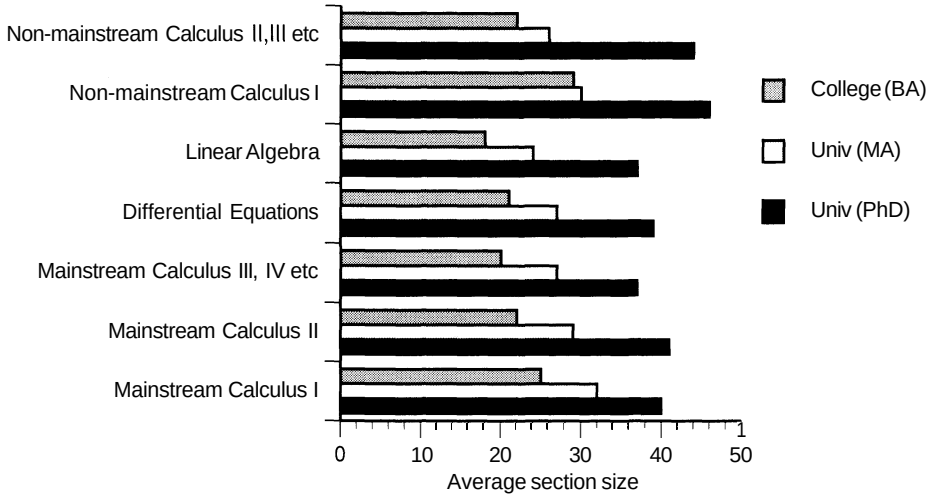

FIGURE C.1.3 Average section size in some Calculus level courses in four-year college and university Departments of Mathematics by type of school: Fall 1990.

TABLE C.1 Enrollment in discrete mathematics, introduction to mathematical logic, and other calculus-level courses are not presented in this table but are included in Tables S.2, E.1, E.2, and E.3 under calculus-level courses, as well as in the specific course enrollments presented in Appendix I.

TABLE C.2 Instructional formats for mainstream and non-mainstream Calculus I in four-year college and university Departments of Mathematics; percent of total sections in each format by type of school: Fall 1990.

	Mainstream Calculus I				Non-mainstream Calculus I			
	Univ (PhD)	Univ (MA)	College (BA)	ALL Math Depts	Univ (PhD)	Univ (MA)	College (BA)	ALL Math Depts
Number of sections	2544	1214	2512	6270	1568	835	1747	4150
Class size								
Less than 40	59%	88%	92%	78%	66%	88%	94%	81%
40 to 80	8%	9%	7%	8%	13%	12%	0%	9%
Greater than 80, no quiz sects	0%	1%	1%	1%	5%	0%	6%	4%
Greater than 80, quiz sects	32%	0%	0%	12%	16%	0%	0%	6%
Other	1%	2%	0%	1%	0%	0%	0%	0%

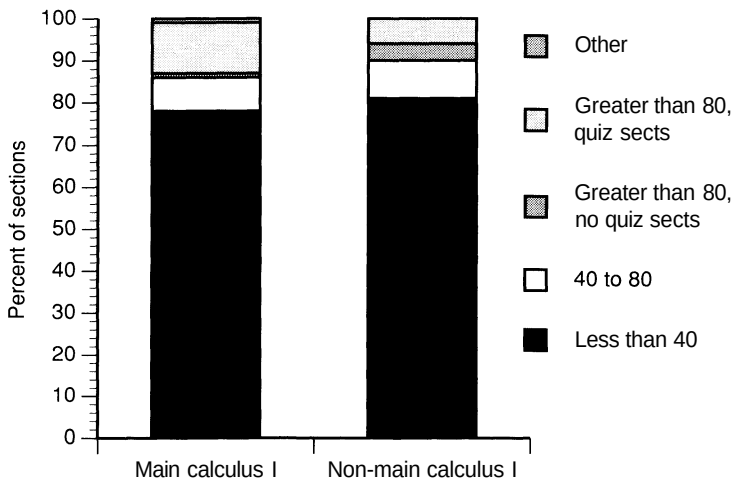

Figure C.2.1 Percent of sections using each instructional format for mainstream and non-mainstream Calculus I in four-year college and university Departments of Mathematics: Fall 1990.

TABLE C.2 Because of the different breakdown of institutions as compared to previous studies, it is not always possible to make comparisons with past survey data. In particular, the corresponding 1985 data were presented in a more summary fashion making comparisons impossible. Because of a much higher average section size, enrollment in large lecture with quizzes at the PhD universities is surely more than half their total calculus course enrollment.

TABLE C.3 Number of sections (percent in parentheses) of Mainstream Calculus I and II requiring extra features in four-year college and university Departments of Mathematics by type of school: Fall 1990.

	Mainstream Calculus I				Mainstream Calculus II			
	Univ (PhD)	Univ (MA)	College (BA)	TOTAL	Univ (PhD)	Univ (MA)	College (BA)	TOTAL
Number of sections	2544	1217	2512	6273	1146	596	1068	2810
Number of sections using:								
Graphics calculator	66 (3%)	37 (3%)	59 (2%)	162 (3%)	31 (3%)	8 (1%)	22 (2%)	61 (2%)
Computer	130 (5%)	99 (8%)	360 (14%)	589 (9%)	37 (3%)	40 (7%)	106 (10%)	183 (7%)
Group projects	37 (1%)	27 (2%)	128 (5%)	192 (3%)	15 (1%)	7 (1%)	35 (3%)	57 (2%)
Writing component	57 (2%)	29 (2%)	519 (21%)	605 (10%)	18 (2%)	3 (1%)	243 (23%)	264 (9%)

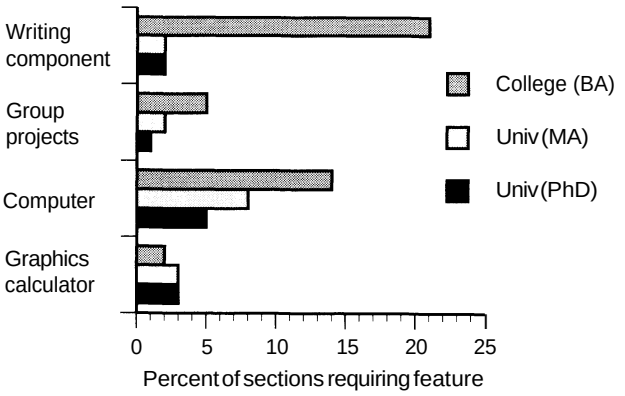

FIGURE C.3.1 Percent of sections of Mainstream Calculus I requiring extra features in four-year college and university Departments of Mathematics by type of school: Fall 1990.

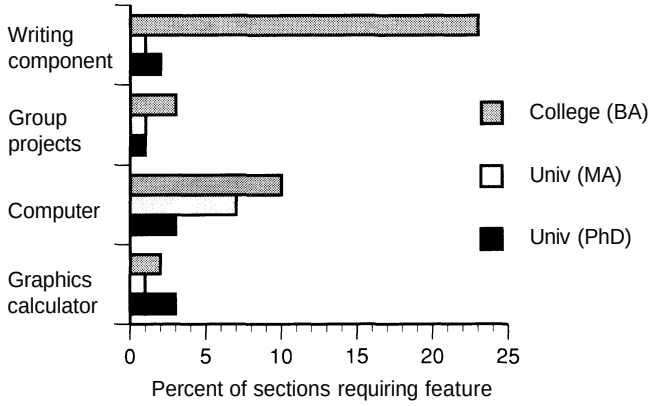

FIGURE C.3.2 Percent of sections of Mainstream Calculus II requiring extra features in four-year college and university Departments of Mathematics by type of school: Fall 1990.

TABLE C.3 Except for the writing component and computer assignments at four-year colleges, all other features were required in no more than 8% of sections.

TABLE C.4 Instructional formats for Elementary Statistics in four-year college and university Departments of Mathematics and Statistics; percent of total sections in each format by type of school: Fall 1990.

	Statistics Departments				Mathematics Departments			
	Univ (PhD)	Univ (MA)	College (BA)	ALL Stat Depts	Univ (PhD)	Univ (MA)	College (BA)	ALL Math Oepts
Number of sections	293	65	7	364	286	818	1497	2601
Class size								
Less than 40	18%	86%	100%	32%	45%	82%	85%	80%
40 to 80	19%	14%	0%	18%	27%	16%	12%	15%
Greater than 80, no quiz sects	10%	0%	0%	8%	8%	2%	3%	3%
Greater than 80, quiz sects	51%	0%	0%	40%	20%	0%	0%	2%
Other	2%	0%	0%	2%	0%	0%	0%	0%

TABLE C.4 This table is new and so comparisons to previous surveys cannot be made. Of course, Tables C.2, C.4, and C.5 give comparisons on the various instructional formats used for introductory courses in the three departments.

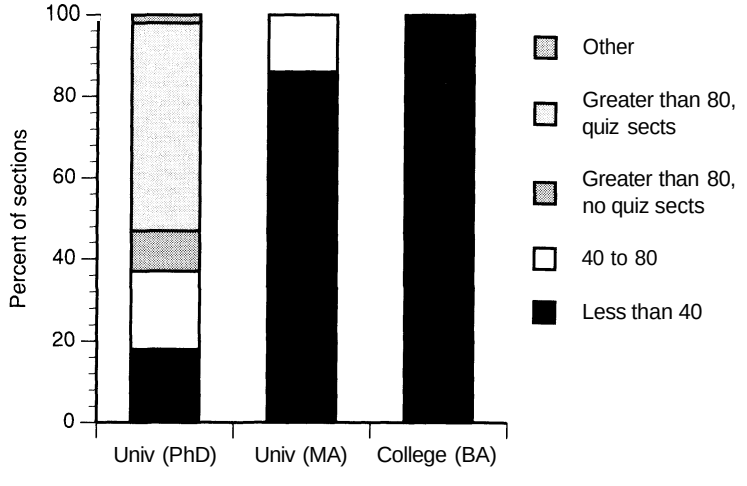

FIGURE C.4.1 Percent of sections using each instructional format for Elementary Statistics in four-year college and university Departments of Statistics by type of school: Fall 1990.

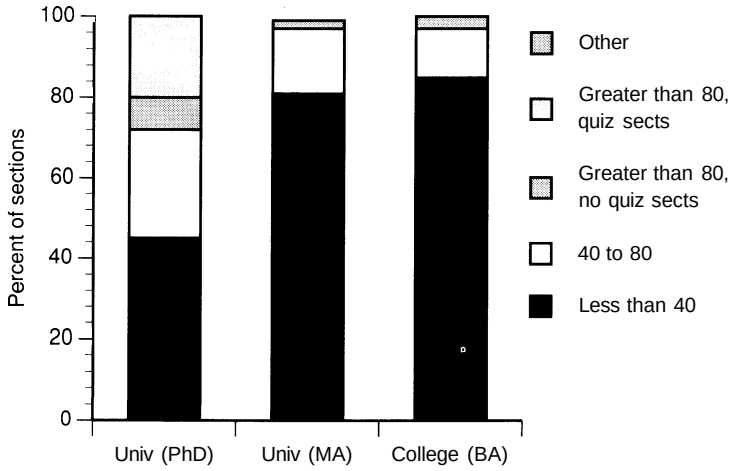

FIGURE C.4.2 Percent of sections using each instructional format for Elementary Statistics in four-year college and university Departments of Mathematics by type of school: Fall 1990.

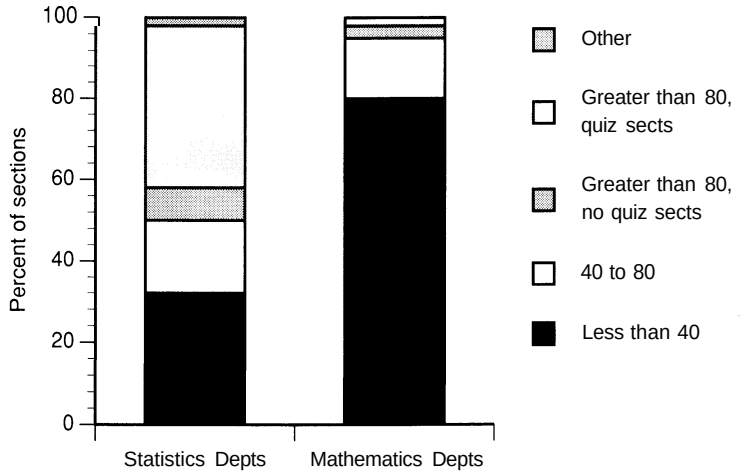

FIGURE C.4.3 Percent of sections using each instructional format for Elementary Statistics in four-year college and university Departments of Mathematics and Statistics: Fall 1990.

TABLE C.5 Instructional formats for Computer Programming I in four-year college and university Departments of Mathematics and Computer Science; percent of total sections in each format by type of school: Fall 1990.

	Computer Science Departments				Mathematics Departments			
	Univ (PhD)	Univ (MA)	College (BA)	ALL CS Depts	Univ (PhD)	Univ (MA)	College (BA)	ALL Math Depts
Number of sections	403	361	361	1125	95	372	888	1355
Class size								
Less than 40	40%	51%	87%	56%	46%	95%	97%	88%
40 to 80	25%	28%	1%	20%	26%	5%	0%	3%
Greater than 80, no quiz sects	8%	0%	0%	3%	0%	0%	3%	2%
Greater than 80, quiz sects	23%	11%	5%	14%	28%	0%	0%	7%
Other	4%	10%	7%	7%	0%	0%	0%	0

TABLE C.5 This table is new.

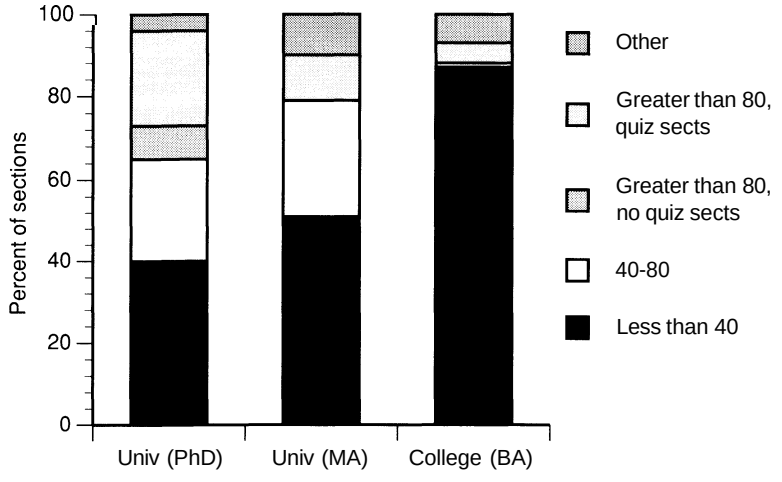

FIGURE C.5.1 Percent of sections using each instructional format for Computer Programming I in four-year college and university Departments of Computer Science by type of school: Fall 1990.

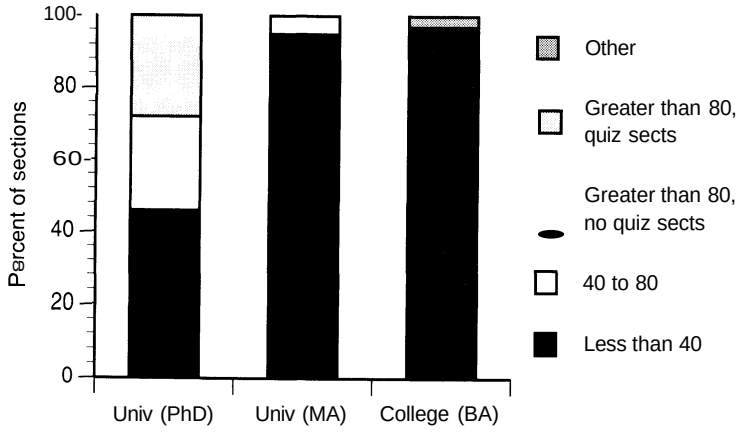

FIGURE C.5.2 Percent of sections using each instructional format for Computer Programming I in four-year college and university Departments of Mathematics by type of school: Fall 1990.

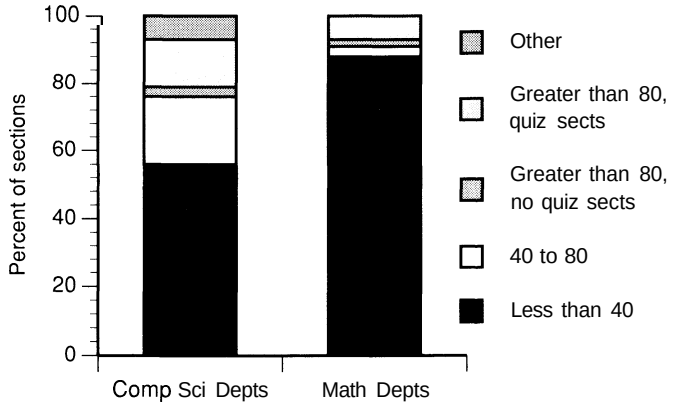

FIGURE C.5.3 Percent of sections using each instructional format for Computer Programming I in four-year college and university Departments of Mathematics and Computer Science: Fall 1990.

Chapter 5

DEPARTMENTAL CHARACTERISTICS

This chapter contains five tables on a variety of topics. Information is presented on various services available to departmental majors in the three disciplines, such as placement exams, honors programs, and graduate school advising. Mathematics requirements of mathematics and statistics tracks (or options) are given. The type of office space available to full-time faculty in the three disciplines, as well as the number of support staff positions and institutional travel funds expended in 1989-90 are presented.

Almost all of the topics in this chapter are new to the 1990 survey. Hence comparisons can be made only among the three disciplines and by type of school. The general theme is one of disparity between disciplines and types of departments on each issue.

For information on four-year college and university mathematics see

Tables D.1, D.2, D.3, D.4, D.5.

For information on four-year college and university statistics see

Tables D.2, D.3, D.4, D.5.

For information on four-year college and university computer science see

Tables D.1, D.3, D.4, D.5.

TABLE D.1 Features available to majors in four-year college and university Departments of Mathematics, Statistics and Computer Science; percent of departments or programs with the feature by type of school: Fall 1990.

	Mathematics Departments				Computer Science Departments				Statistics
	Univ (PhD)	Univ (MA)	College (BA)	ALL MATH DEPTS	Univ (PhD)	Univ (MA)	College (BA)	ALL CS DEPTS	Univ (PhD)
Number of departments	165	236	1020	1421	136	105	238	479	53
Placement exams	62%	70%	45%	51%	60%	67%	92%	77%	38%
ETS advanced placement credit	95%	88%	85%	86%	79%	67%	100%	87%	26%
Dept exam credit	53%	28%	22%	27%	40%	34%	51%	44%	32%
Honors calculus	67%	24%	9%	18%	50%	23%	37%	38%	32%
Dept or institution honors prog	83%	67%	56%	61%	66%	54%	63%	62%	60%
Intern/coop program	44%	60%	49%	50%	83%	76%	51%	66%	26%
Regular problem solving opportunities	69%	63%	25%	37%	23%	31%	90%	58%	19%
Research projects	59%	47%	37%	41%	83%	80%	87%	84%	57%
Senior exams	6%	13%	34%	27%	1%	13%	2%	4%	0%
Senior project or thesis	23%	36%	28%	29%	50%	38%	83%	64%	19%
Special lectures/ colloquium	67%	66%	39%	47%	88%	74%	49%	66%	72%
Study areas	41%	46%	49%	47%	40%	41%	90%	65%	15%
Math or CS club	67%	86%	44%	54%	74%	90%	93%	87%	26%
Regular social activities with faculty	21%	45%	53%	48%	30%	55%	7%	24%	26%
Graduate school advising	90%	92%	96%	94%	89%	67%	92%	86%	79%
Other career advising	82%	92%	96%	94%	86%	90%	100%	94%	59%

TABLE D.1 Placement exams are those administered by the department or institution. Departmental exam credit is college credit for passing departmental or institutional placement exams. In the 1970 CBMS survey, 48% of four-year colleges and university mathematics departments reported using their own placement exams as against 51% in 1990, while in 1970, 90% had advanced placement credit as against the 1990 figure of 86%. The remaining categories were not reported in previous surveys.

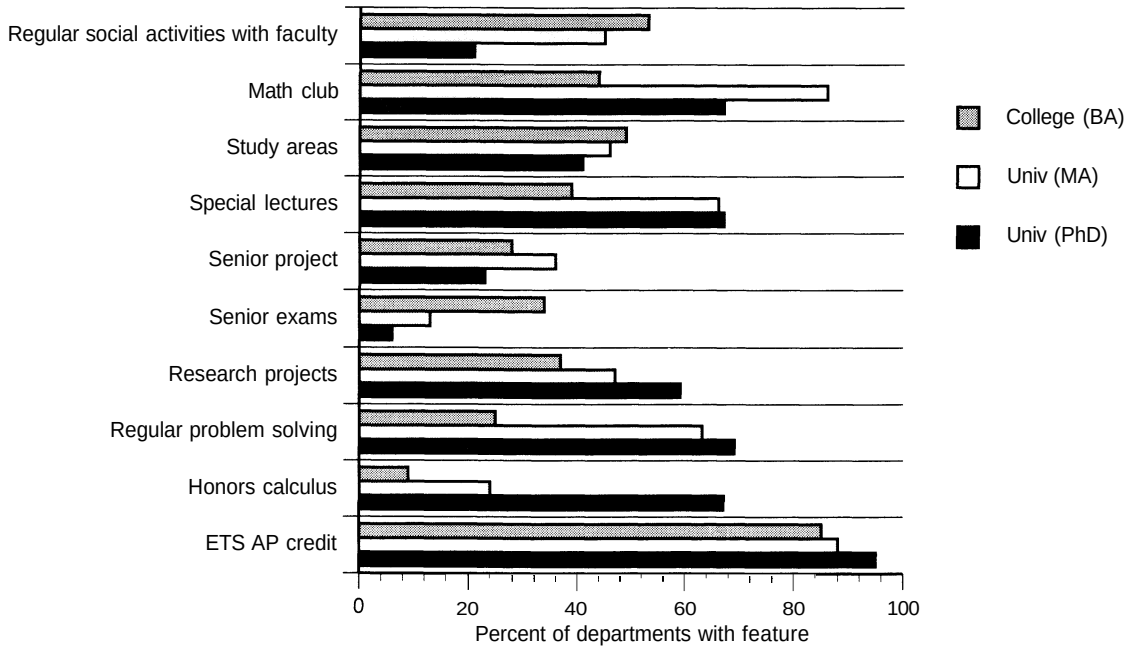

FIGURE D.1.1 Features available to majors in four-year college and university Departments of Mathematics by type of school: Fall 1990.

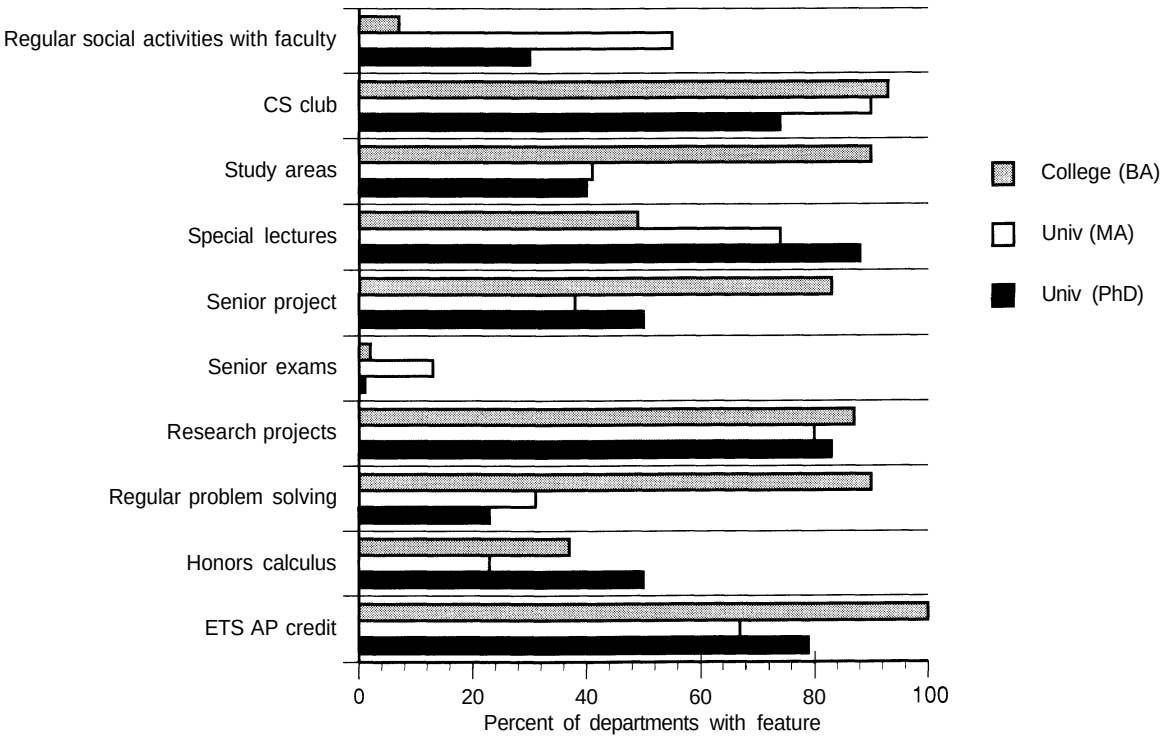

FIGURE D.1.2 Features available to majors in four-year college and university Departments of Computer Science by type of school: Fall 1990.

TABLE D.2 Percent of four year college and university Mathematics options (tracks) that require certain junior-senior courses or other curricular features in Departments of Mathematics by type of school; also for Statistics options (tracks) in Univ(PhD) Stat Depts: Fall 1990.

	Mathematics Departments			ALL Math Depts	Univ (PhD) Stat Depts
	Univ(PhD)	Univ(MA)	College(BA)		
Number of departments	165	236	1020	1421	53
Total number of tracks offered	581	675	1979	3235	83
PERCENT OF TRACKS REQUIRING:					
Analysis/Advanced Calculus	70%	66%	65%	66%	30%
Modern Algebra	56%	70%	78%	72%	6%
Geometry/Topology	14%	33%	42%	35%	6%
Linear Algebra	73%	66%	69%	69%	47%
Problem Solving/Modeling	18%	18%	22%	21%	4%
A sequence of 2 or more courses	79%	65%	62%	65%	59%
At least 6 Jr-Sr semester courses	94%	92%	77%	83%	66%

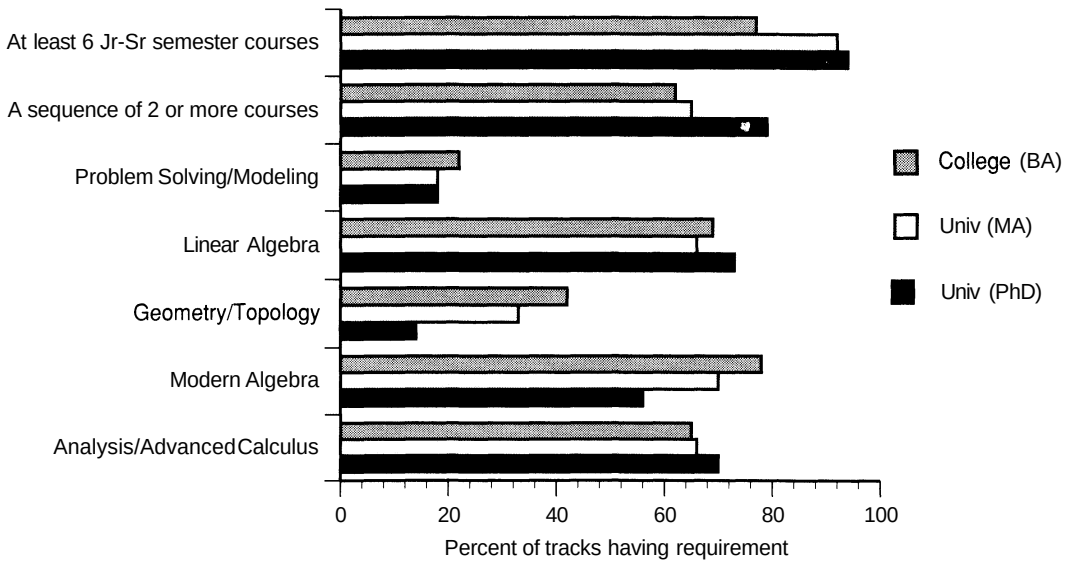

TABLE D.2.1 Percent of four-year college and university Mathematics options (tracks) that require certain junior-senior courses or other curricular features in Departments of Mathematics by type of school: Fall 1990.

TABLE D.2 Information on the percent of options that require, say, all of the first four courses, is not available. Information on computer science programs is presented in Tables CS.1, 2, 3, and 4.

TABLE D.3 Type of office for full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science by type of school: Fall 1990.

	Number of full-time faculty	% with private office	% with 2 person office	% other office
Math depts				
Univ (PhD)	6427	94%	5%	1%
Univ (MA)	5058	78%	17%	5%
College (BA)	7926	83%	10%	7%
ALL MATH	19411	85%	10%	5%
Stat depts				
Univ (PhD)	668	98%	2%	0%
Univ (MA)	53	100%	0%	0%
College (BA)	14	-	-	-
ALL STAT	735	98%	2%	0%
CS depts				
Univ (PhD)	2746	98%	2%	0%
Univ (MA)	1408	98%	2%	0%
College (BA)	1164	83%	9%	8%
ALL CS	5318	95%	3%	2%

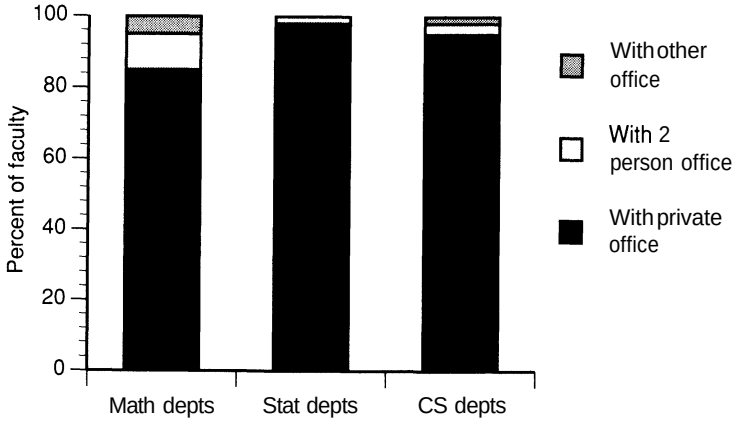

FIGURE D.3.1. Type of office for full-time faculty in four-year college and university Departments of Mathematics, Statistics and Computer Science: Fall 1990.

TABLE D.3 This is the first time this information has been collected.

TABLE D.4 Average number of support staff positions per full-time faculty member in four-year college and university Departments of Mathematics, Statistics and Computer Science by type of school: Fall 1990.

	Univ (PhD)	Univ (MA)	College (BA)	ALL
Departments				
Math depts	0.14	0.09	0.06	0.1
Stat depts	0.28	0.09	-	0.28
CS depts	0.28	0.2	0.14	0.23

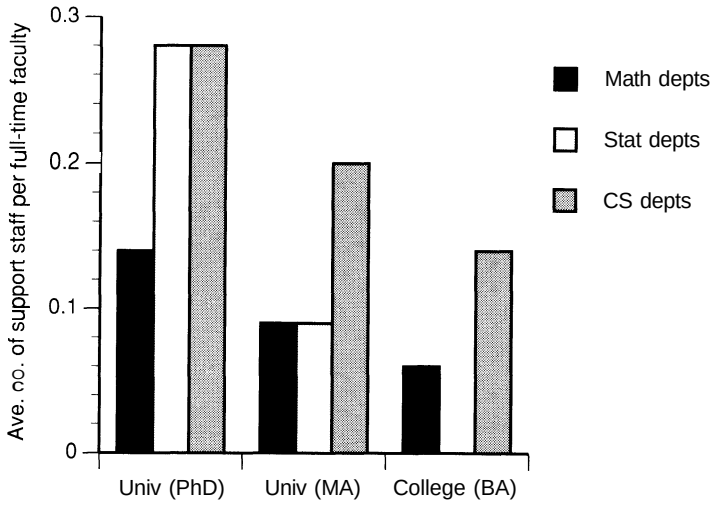

FIGURE D.4.1 Average number of support staff positions per full-time faculty member in four-year college and university Departments of Mathematics, Statistics and Computer Science by type of school: Fall 1990.

TABLE D.4 Support staff are only those positions (or fractions) supported from institutional funds. Those support staff supported from research funds are not included. This table is new.

TABLE D.5 Institutional travel funds expended in 1989-90 per full-time faculty member in four-year college and university Departments of Mathematics, Statistics and Computer Science by type of school.

	Univ (PhD)	Univ (MA)	College (BA)	ALL
Department				
Mathematics	$266	$246	$286	$269
Statistics	$316	$212	-	$302
Computer Science	$601	$385	$434	$507

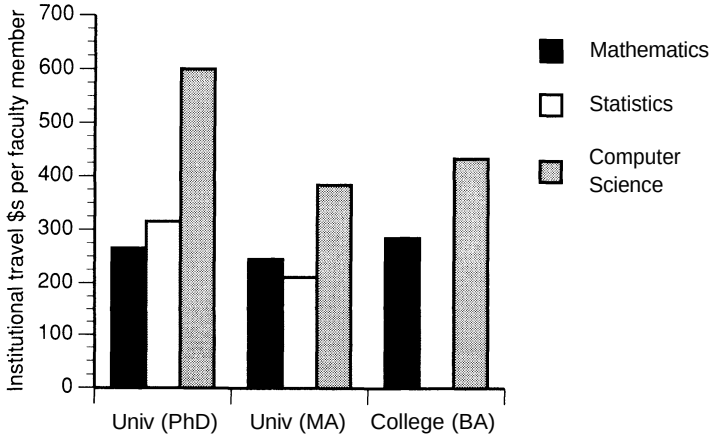

FIGURE D.5.1 Institutional travel funds expended in 1989-90 per full-time faculty member in four-year college and university Departments of Mathematics, Statistics and Computer Science by type of school.

TABLE D.5 Travel funds from research grants or other external sources are not included. This is a new table.

Chapter 6

COMPUTER SCIENCE PROGRAMS

The four tables in this chapter give details on the program for computer science majors, including the mathematics/statistics requirement both in aggregate form and by specific courses, the average number of students per computer station, and the general accessibility of computers.

While direct comparison with previous survey data is not possible, there was a general improvement in the availability and the average number of students per computer station over 1985.

Computer science programs are offered by both mathematics and computer science departments. The data are presented by Univ. (PhD), Univ. (MA) and College (BA) levels and combine information from computer science departments and mathematics departments that offer a computer science program.

For information on four-year college and university computer science see

Tables CS.1, CS.2, CS.3, CS.4.

TABLE CS.1 Number of semester credits in Mathematics or Statistics at or above the Calculus level normally taken by Computer Science majors in four-year colleges and universities by type of school: Fall 1990.

	Univ (PhD)	Univ (MA)	College (BA)	**ALL CS** Programs
Number of CS programs	155	177	466	798
Average credit hours taken in Math and Stat at Calculus level or above	19.1	18	14.4	16.1

TABLE CS.1 Computer science programs are in both mathematics and computer science departments. These 798 programs divide as follows:

	Univ.(PhD)	Univ. (MA)	College (BA)	TOTAL
Math. Depts.	19	72	228	319
Comp. Sci. Depts.	136	105	238	479
TOTAL	155	177	466	798

In this chapter, data were combined for programs in either mathematics or computer science departments by type of institution. The change in classification of institutions from 1985 to 1990 makes comparisons difficult.

TABLE CS.2 Mathematics and statistics courses required by four-year college and university Computer Science programs; percent of programs requiring the course by type of school: Fall 1990.

	Univ (PhD)	Univ (MA)	College (BA)	OVERALL
Number of CS programs	155	177	466	798
Mainstream Calculus I	94%	94%	90%	93%
Mainstream Calculus II	94%	82%	77%	81%
Mainstream Calculus III,IV	61%	36%	21%	32%
Differential Equations	25%	7%	6%	10%
Discrete Math	63%	57%	42%	56%
Linear Algebra	74%	61%	49%	56%
Discrete Structures	8%	14%	4%	7%
Numerical Analysis	14%	7%	35%	25%
Elementary Statistics	3%	20%	6%	9%
Mathematical Statistics	32%	24%	17%	21%
Probability (calculus based)	25%	18%	6%	13%

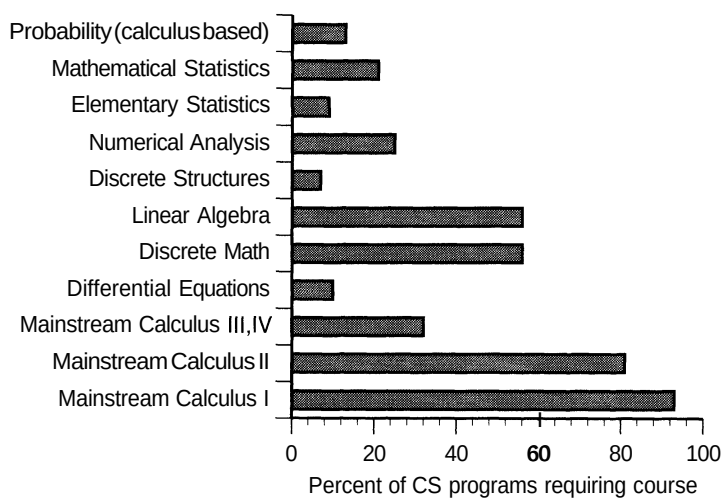

FIGURE CS.2.1 Mathematics and statistics courses required by four-year college and university Computer Science programs: Fall 1990.

TABLE CS.2 This survey does not report on the percent of programs that required various combinations of these courses. A similar table (4-13) appeared in the 1985 survey but the different classification of institution makes comparison difficult. No summary data were presented on this topic in the 1985 survey.

Two-year college instructors teach about 16 hours a week to relatively small classes, and many teach an additional class or two, usually for extra pay, or do work outside the college. A master's degree in the subject is the standard requirement for full-time employment in academic disciplines and a bachelor's degree with relevant experience is the usual requirement for employment in occupational programs. Twenty-five years ago, the majority of two-year college faculty were recruited from the high schools, but this is no longer the case. Although there is regional variation, most two-year college instructors are under no pressure to publish; promotion and tenure typically require adequate teaching and time in rank.

About 38% of all post-secondary mathematics, statistics, and computer science enrollments are in two-year colleges, up from 30% in 1985 (see Table S.1 and Figure S.1.2). In many state colleges and universities, a large percentage of mathematics majors began their studies in two-year colleges. In fact, "nearly 10 percent of U.S. students who receive a doctorate in the mathematical sciences began their undergraduate studies in a two-year college" [Moving Beyond Myths: Revitalizing Undergraduate Mathematics, National Research Council, Washington, DC, 1991, p.4].

TABLE CS.2 Mathematics and statistics courses required by four-year college and university Computer Science programs; percent of programs requiring the course by type of school: Fall 1990.

	Univ (PhD)	Univ (MA)	College (BA)	OVERALL
Number of CS programs	155	177	466	798
Mainstream Calculus I	94%	94%	90%	93%
Mainstream Calculus II	94%	82%	77%	81%
Mainstream Calculus III,IV	61%	36%	21%	32%
Differential Equations	25%	7%	6%	10%
Discrete Math	63%	57%	42%	56%
Linear Algebra	74%	61%	49%	56%
Discrete Structures	8%	14%	4%	7%
Numerical Analysis	14%	7%	35%	25%
Elementary Statistics	3%	20%	6%	9%
Mathematical Statistics	32%	24%	17%	21%
Probability (calculus based)	25%	18%	6%	13%

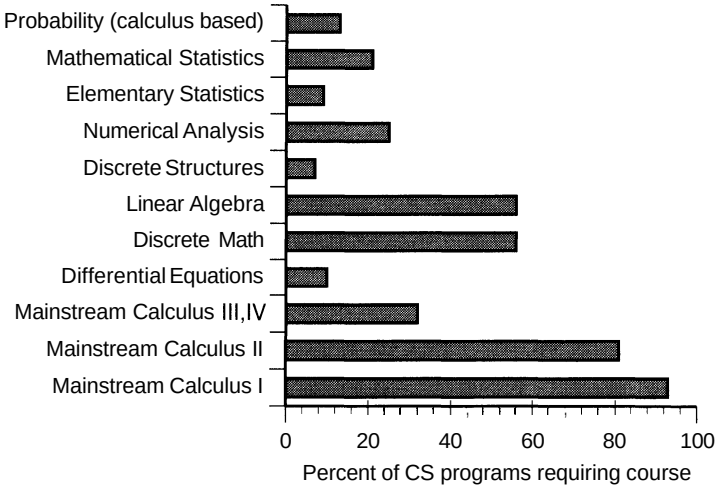

FIGURE CS.2.1 Mathematics and statistics courses required by four-year college and university Computer Science programs: Fall 1990.

TABLE CS.2 This survey does not report on the percent of programs that required various combinations of these courses. A similar table (4-13) appeared in the 1985 survey but the different classification of institution makes comparison difficult. No summary data were presented on this topic in the 1985 survey.

TABLE CS.3 Average student enrollment per computer station in four-year college and university Computer Science programs; percent of programs with each enrollment by type of school: Fall 1990.

	Univ (PhD)	Univ (MA)	College (BA)	ALL CS programs
Number of CS programs	155	177	466	798
Average enrollments per computer station	Percent of CS programs			
Less than 6	37%	31%	67%	53%
6-10	40%	25%	20%	25%
11-15	18%	23%	9%	14%
16-20	4%	9%	0%	3%
More than 20	1%	12%	4%	5%

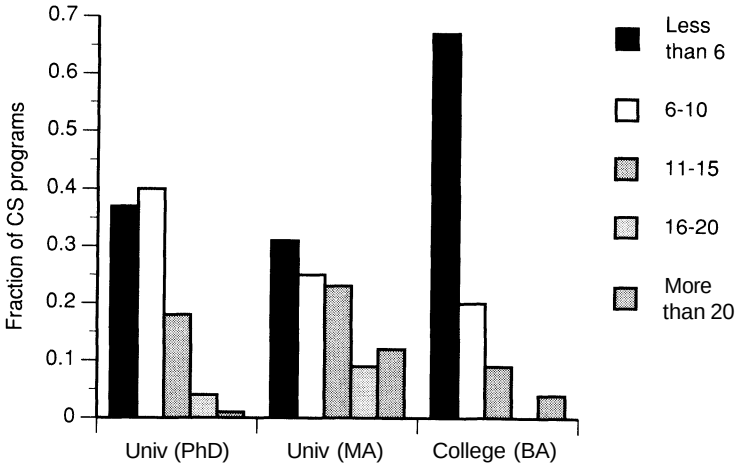

FIGURE CS.3.1 Average student enrollment per computer station in four-year college and university Computer Science programs; fraction of programs with each enrollment by type of school: Fall 1990.

TABLE CS.3 While comparisons between this table and the corresponding Table (4-17) of the 1985 survey are not completely valid, it appears that the percent of average enrollment in the 0–5 and 6-10 categories increased dramatically. For example, in 1985 only 18% of private colleges reported that their average number of students per work station was less than six; in 1990 BA departments reported this percent as 67%.

TABLE CS.4 Accessibility of computer stations both for students and for course work in four-year college and university Computer Science programs by level of courses and by type of school: Fall 1990.

	Number of CS Programs	Accessibility: Poor	Adequate	Good	Very good	Superb
Lower level						
Univ (PhD)	155	5%	18%	34%	28%	15%
Univ (MA)	177	11%	33%	16%	25%	15%
College (BA)	466	0%	32%	20%	31%	17%
ALL CS Programs	798	3%	29%	22%	30%	16%
Middle level						
Univ (PhD)	155	3%	13%	34%	32%	18%
Univ (MA)	177	13%	21%	18%	33%	15%
College (BA)	466	2%	11%	31%	39%	17%
ALL CS Programs	798	4%	14%	29%	36%	17%
Upper level						
Univ (PhD)	155	3%	12%	26%	41%	18%
Univ (MA)	177	17%	16%	13%	37%	17%
College (BA)	466	5%	14%	12%	52%	17%
ALL CS Programs	798	7%	14%	15%	47%	17%

TABLE CS.4 This table does not correspond to any table in previous surveys.

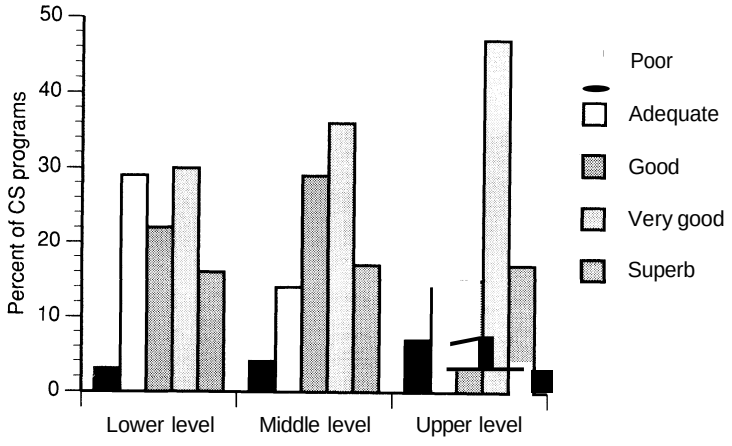

FIGURE CS.4.1 Accessibility of computer stations both for students and for course work in four-year college and university Computer Science Programs by level of course: Fall 1990.

Chapter 7

MATHEMATICAL SCIENCE LIBRARIES

The four tables in this chapter give data on the location of mathematical science libraries, the number of volumes and of journals received, opinions on the overall effectiveness of the libraries, and availability of electronic data bases.

As might be expected, there was an enormous difference between the holdings of libraries at the PhD universities and all other libraries. The library budget was an especially troubling item at both PhD and MA libraries.

The libraries reported on their holdings in the QA (or 510-519) classification. Data were not collected on holdings in computer science or statistics outside this category.

For four-year college and university mathematics see

Tables L.1, L.2, L.3, L.4.

TABLE L.1 Location of Mathematical Sciences library of four-year college and university Departments of Mathematics as a percent by type of school; also percent of these libraries that display current unbound Mathematical Sciences journals separately: Fall 1990.

	Univ (PhD)	Univ (MA)	College (BA)	ALL
Number of depts	165	236	1020	1421
Type of Math Science Library				
Separate MS or MS/CS	33%	3%	8%	10%
Contained within larger unit	55%	97%	92%	89%
Other	12%	0%	0%	1%
Current MS journals displayed separately	81%	52%	51%	55%

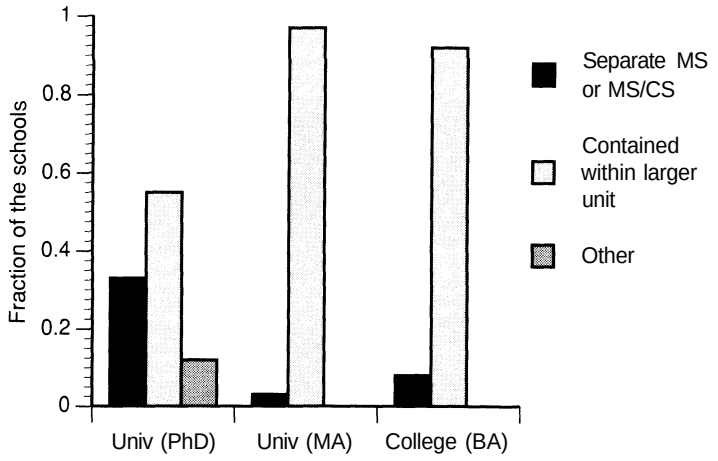

FIGURE L.1.1 Location of Mathematical Sciences library of four-year college and university Departments of Mathematics by type of school: Fall 1990.

TABLE L.1 In 1990, data on PhD Mathematical Sciences Libraries (only) were collected by a special American Mathematical Society committee. Their report appeared in the December 1991 issue of the Notices of the American Mathematical Society and was a more detailed survey. There was general agreement between comparable CBMS and AMS data, except on the availability of the mathematical science full database tapes as reported in Table L.4. This survey's percent is significantly higher than the AMS percent.

The separate display of current journals could be either in the library or in a departmental reading room. The "other" location of the mathematical science library includes such configurations as a mathematical science library combined with engineering, a mixture of an elaborate reading room and a main library and so on.

Data were collected only on the mathematical sciences library and the number of volumes was limited to those in the QA (or 510-519) classification.

TABLE L.2 Volumes in and mathematical sciences journals received by the mathematical sciences library of four-year college and university Departments of Mathematics by type of school: Fall 1990.

	Volumes in Math Sci Library			Math Sci Journals received		
	1st Quartile	Median	3rd Quartile	1st Quartile	Median	3rd Quartile
Math Dept						
Univ(PhD)	15700	29600	35000	136	265	378
Univ(MA)	5000	7500	12200	21	74	125
College(BA)	1200	2800	6000	5	12	40

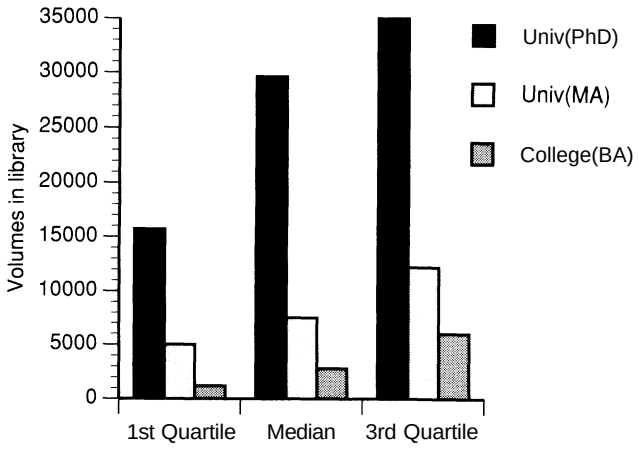

FIGURE L.2.1 Volumes in the mathematical sciences library of four-year college and university Departments of Mathematics by type of school: Fall 1990.

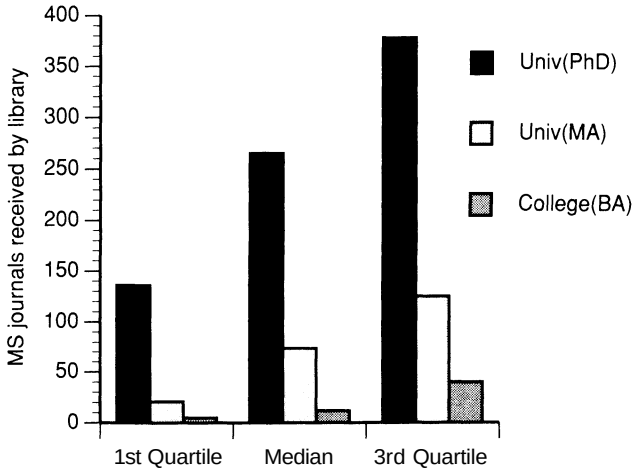

FIGURE L.2.2 Mathematical sciences journals received by the mathematical sciences library of four-year college and university Departments of Mathematics by type of school: Fall 1990.

TABLE L.2 Volumes in the library did not include those in remote storage. The survey showed that, overall, the number of volumes in remote storage was small. While one PhD university reported 24,800 volumes in remote storage, medians and quartiles for stored volumes were all zero except for the 3rd quartile for PhD universities which was 500.

Only currently received mathematical science journals were counted.

TABLE L.3 Overall effectiveness of the Mathematical Sciences library at four-year colleges and universities as judged by the Department of Mathematics by type of school: Fall 1990.

	Collection of books & journals	Physical facilities (incl. space)	Staffing	Hours open	Budget
Univ (PhD)					
Improved	35%	27%	15%	21%	19%
Little change	42%	54%	66%	72%	35%
Deteriorated	23%	19%	19%	7%	46%
Univ (MA)					
Improved	37%	23%	10%	10%	21%
Little change	48%	72%	85%	84%	35%
Deteriorated	15%	5%	5%	6%	44%
College (BA)					
Improved	38%	27%	16%	24%	31%
Little change	53%	70%	79%	71%	51%
Deteriorated	9%	3%	5%	5%	18%
ALL COMBINED					
Improved	38%	27%	15%	22%	28%
Little change	51%	68%	79%	73%	46%
Deteriorated	11%	5%	6%	5%	26%

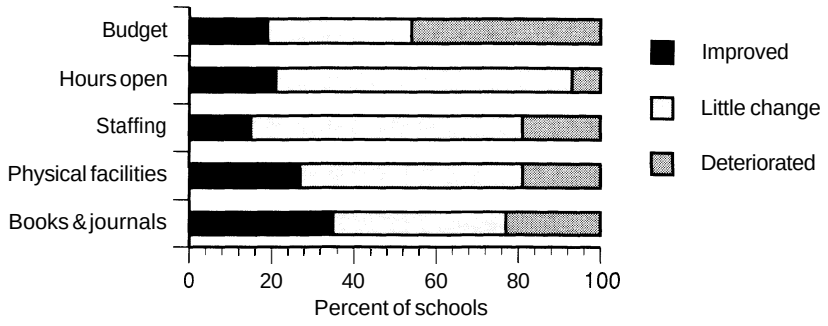

FIGURE L.3.1 Overall effectiveness of the Mathematical Sciences library at Univ (PhD) schools as judged by the Department of Mathematics: Fall 1990.

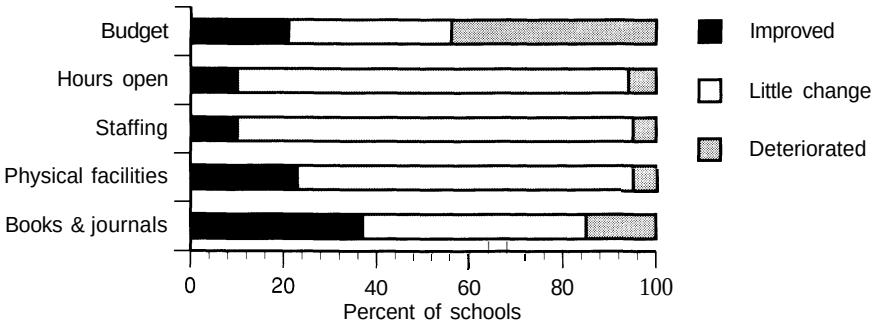

FIGURE L.3.2 Overall effectiveness of the Mathematical Sciences library at Univ (MA) schools as judged by the Department of Mathematics: Fall 1990.

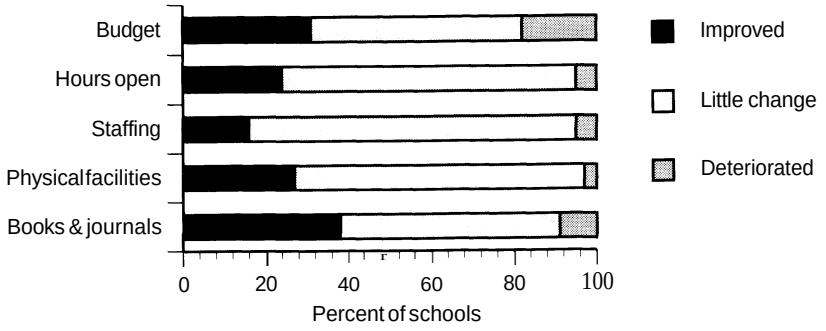

FIGURE L.3.3 Overall effectiveness of the Mathematical Sciences library at College (BA) schools as judged by the Department of Mathematics: Fall 1990.

TABLE L.3 These numbers are in general agreement with those reported in the 1990 AMS survey. This table reports on perceived changes in the mathematical sciences library for the period 1985-90.

TABLE L.4 Electronic products available in four-year college and university Mathematical Sciences libraries by type of school: Fall 1990.

	Univ (PhD)	Univ (MA)	College (BA)	ALL
Number of depts	165	236	1020	1421
Math Science tapes (full database)	16%	10%	4%	6%
Math Science on CD ROM	28%	10%	1%	6%
Science Citation Index on CD ROM	10%	5%	1%	3%

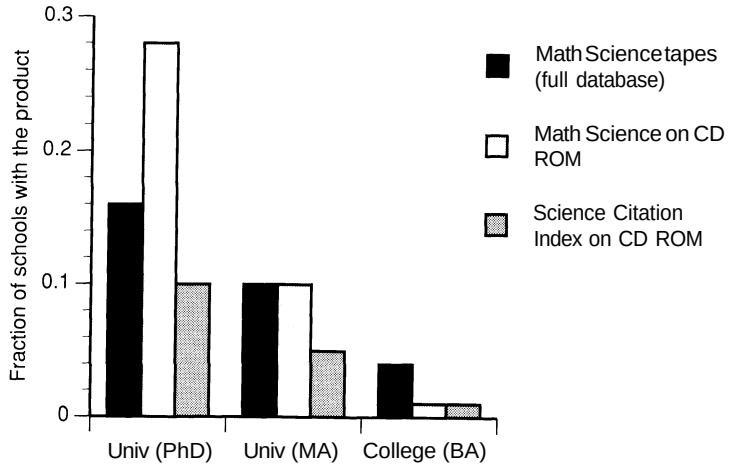

FIGURE L.4.1 Electronic products available in four-year college and university Mathematical Sciences libraries by type of school: Fall 1990.

TABLE L.4 The aforementioned AMS survey reported less than 2% of PhD university libraries with the full mathematical science database tapes, as compared to this survey's 16% figure. All other data are in general agreement. The AMS survey included Canadian PhD departments.

AN OVERVIEW OF TWO-YEAR COLLEGES: THE BOOM CONTINUES

The 1200 community, technical, and junior colleges in the United States enroll almost six million students, four times as many as in 1966. About 65% of these students attend part-time. Two-year colleges now account for over 30% of the full-time equivalent enrollment in colleges and universities (and a much larger percentage of student "bodies") *[1990 Digest of Educational Statistics,* National Center for Education Statistics, U.S. Department of Education, Washington, DC].

This astonishing growth has coincided with the evolution of the "junior" college of 1966 into the "community" college of today. The primary mission of the junior college of twenty-five years ago was to provide a liberal arts education that prepared students for the university. Today, a minority of two-year college students are enrolled in transfer programs and transfer rates have declined. A reliable estimate of the percentage of two-year college students who eventually transfer to a four-year college or university is difficult to obtain. This percentage varies from state to state and has been estimated as fewer than 10% to as high as 30%.

Consideration of transfer rates alone, however, underestimates the importance of two-year colleges in American higher education. For example, a recent study in Washington state found that 48% of the graduates from Washington's regional four-year colleges were community college transfers, as were 29% of the graduates from Washington State University and the University of Washington, and 22% of the graduates from private colleges and universities ["A Study of the Role of Community Colleges in the Achievement of the Bachelor's Degree in Washington State," Washington State Board for Community College Education, Olympia, 1989].

Two-year colleges continue to provide the first two years of baccalaureate programs to students who want low cost, local schooling. In addition, they usually offer vocational and technical programs in fields such as nursing and computer repair; courses for professional certification; courses for adults who want to broaden either their general education or to learn skills as specific as using a spreadsheet or growing fruit trees; and, most notably, instruction in basic subjects traditionally taught in secondary schools.

> This modification of function has affected the institutions' people, processes, and programs. No aspect has been immune. Faculty have had to change teaching practices; the very number of pages they can expect students to read has plummeted. . . . In most colleges, ten sections of remedial reading or writing are offered for every one section of English or American literature. [Arthur M. Cohen, "Mathematics in today's community college," in *New Directions in Two-Year College Mathematics,* Donald J. Albers, Stephen B. Rodi, and Ann E. Watkins (Eds.), Springer-Verlag, New York, 1985, p. 3].

The composition of both the faculty and the students in two-year colleges has also changed since 1966. Today there is a larger percentage of faculty and a larger percentage of students in each of the following categories: women, minority, older, and part-time. A larger percentage of students require remedial work.

Two-year college instructors teach about 16 hours a week to relatively small classes, and many teach an additional class or two, usually for extra pay, or do work outside the college. A master's degree in the subject is the standard requirement for full-time employment in academic disciplines and a bachelor's degree with relevant experience is the usual requirement for employment in occupational programs. Twenty-five years ago, the majority of two-year college faculty were recruited from the high schools, but this is no longer the case. Although there is regional variation, most two-year college instructors are under no pressure to publish; promotion and tenure typically require adequate teaching and time in rank.

About 38% of all post-secondary mathematics, statistics, and computer science enrollments are in two-year colleges, up from 30% in 1985 (see Table S.1 and Figure S.1.2). In many state colleges and universities, a large percentage of mathematics majors began their studies in two-year colleges. In fact, "nearly 10 percent of U.S. students who receive a doctorate in the mathematical sciences began their undergraduate studies in a two-year college" [Moving Beyond Myths: Revitalizing Undergraduate Mathematics, National Research Council, Washington, DC, 1991, p.4].

CHAPTER 8

TWO-YEAR COLLEGE MATHEMATICS PROGRAMS ENROLLMENT, COURSE OFFERINGS, AND INSTRUCTIONAL PRACTICES

This chapter reports estimated enrollment and instructional practices in courses offered in Fall 1990 in the 1018 two-year college mathematics programs in the United States. Also included in this chapter are total enrollment in two-year colleges, average class size, trends in availability of mathematics courses, enrollment in mathematics courses offered outside mathematics programs, and services available to mathematics students. The data are compared with the results of the 1966, 1970, 1975, 1980, and 1985 CBMS surveys. A "mathematics program" includes courses taught by the group of all mathematics and computer science faculty members. For information on the sampling procedure used in this survey, see Appendix II.

Highlights

- Enrollment in two-year college mathematics programs resumed its steep climb after hesitating from 1980 to 1985. Enrollment in mathematics programs increased by 35% from 1985 to 1990, while the total number of two-year college students increased by 24%. Fewer than 1% of two-year college students are mathematics majors.
- Enrollment in remedial courses has climbed from 33% of the total mathematics enrollment in 1970 to 47% in 1985 to 52% in 1990. Remediation was classified as a major problem by 65% of department heads.
- In spite of the increase in remediation, a larger percentage of two-year colleges are able to offer at least one section of advanced courses such as differential equations and of service courses such as finite mathematics.
- Courses showing large percentage increases in enrollment were elementary algebra, intermediate algebra, college algebra, math for liberal arts, non-mainstream calculus, and elementary statistics. Pre-algebra (a course listed for the first time on the 1990 survey) debuts with an enrollment of about 45,000. (In comparison, elementary algebra has an enrollment of about 262,000 and the first semester of mainstream calculus has an enrollment of about 53,000.)
- Courses showing large percentage decreases in enrollment, both inside and outside of mathematics programs, include technical mathematics and data processing.
- Total enrollment in mathematics courses taught outside the mathematics department continues to increase, primarily in arithmetic, computer science/programming, and statistics.

- Class size remains small, averaging about 28 students per section. Standard lecture-recitation formats to classes of 40 or fewer are used by most faculty in 94% of two-year colleges. In another 5% of two-year college mathematics programs, most faculty members lecture to larger classes.

- Use of instructional innovations of the 1970s, such as PSI (personalized system of instruction), modules, and programmed instruction, continues to decline.

- Reform in calculus instruction has yet to take hold. Group projects or writing assignments are components of 5% or fewer of calculus sections.

- Most two-year colleges now have computers available for use in the classroom, for students to use in a math lab, and for the exclusive use of mathematics program faculty. Department heads estimate that, in a typical week, 24% of the full-time faculty use a computer for classroom demonstrations and 23% assign homework requiring a computer.

- Calculators are recommended for use in more than 50% of the sections of each mathematics course, except for remedial courses, analytic geometry, and mathematics for liberal arts.

- More than 86% of two-year colleges operate a math lab or tutorial center. Placement examination, available in about 60% of two-year colleges, is the only other student service offered by more than 20% of two-year colleges.

Enrollment, Class Size, and Course Offerings

Trends in the number of two-year college students, 1966–1990

Following a slight, and uncharacteristic, drop from 1980 to 1985, the number of two-year college students in the United States increased sharply between 1985 and 1990 (see Table TYR.1). Nearly 6,000,000 people are now enrolled in two-year colleges, a 24% increase since 1985.

TABLE TYR.1 Total enrollment in two-year colleges: Fall 1966, 1970, 1975, 1980, 1985, 1990.

	1966	1970	1975	1980	1985	1990
Number of students	1,464,099	2,499,837	4,069,279	4,825,931	4,730,235	5,850,803
Percent part-time	46	48	54	63	65	65

Source: Community, Junior, and Technical College Directory, 1967, 1972, 1976, 1981, 1986, and 1991, AACJC, One Dupont Circle, NW, Washington, DC 20036.

Enrollment in two-year colleges in 1988 constituted about 30% of the full-time equivalent enrollment in colleges and universities. *[1990 Digest of Educational Statistics,* National Center for Education Statistics, U.S. Department of Education, Washington, DC].

The percentage of students who attend part-time rose until 1980, when it stabilized at about 65%.

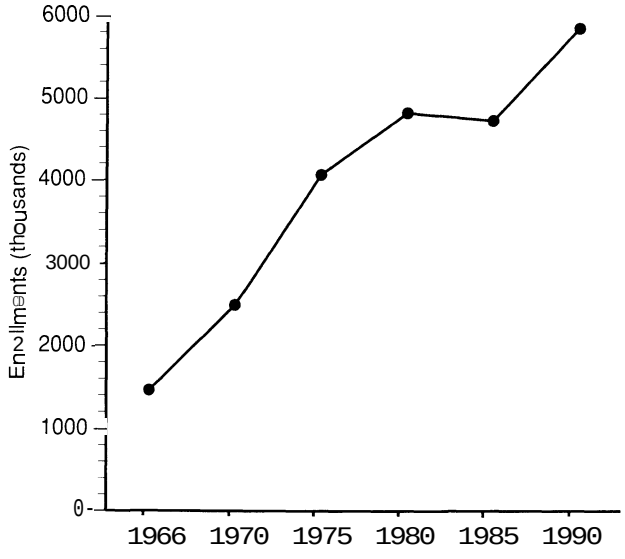

FIGURE TYR.1.1 Total enrollment in two-year colleges: Fall 1966, 1970, 1975, 1980, 1985, 1990.

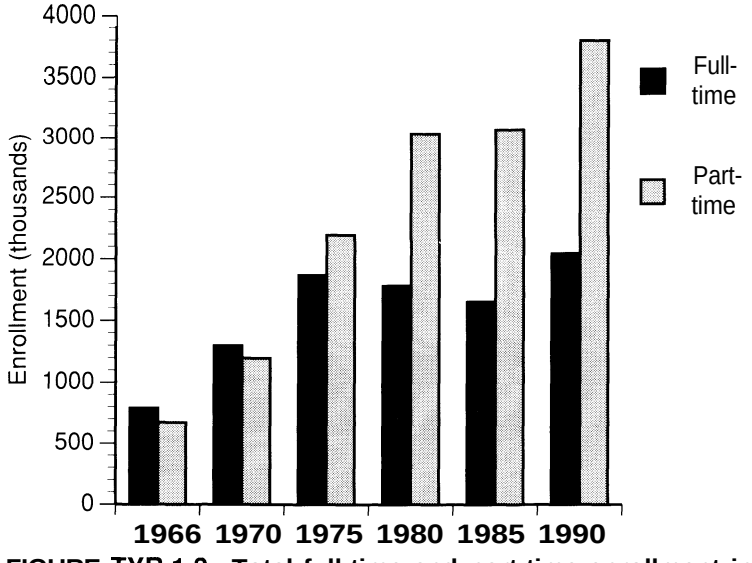

FIGURE TYR.1.2 Total full-time and part-time enrollment in two-year colleges: Fall 1966, 1970, 1975, 1980, 1985, 1990

Trends in enrollment in two-year college mathematics programs, 1966–1990

Enrollment in two-year college mathematics programs resumes its steep climb after hesitating from 1980 to 1985 (see Table TYR.2). While the total number of students in two-year colleges increased by 24% from 1985 to 1990, the enrollment in mathematics programs increased by 35%.

About 38% of all post-secondary mathematics, statistics, and computer science enrollment is in two-year colleges, up from 30% in 1985 (see Table S.1 and Figure S.1.2).

This study found that fewer than 1% of two-year college students are mathematics majors.

TABLE TYR.2 Enrollment in mathematics programs at two-year colleges: Fall 1966, 1970, 1975, 1980, 1985, 1990.

	1966	1970	1975	1980	1985	1990
Enrollment	348,000	584,000	874,000	1,048,000	1,034,000	1,392,000

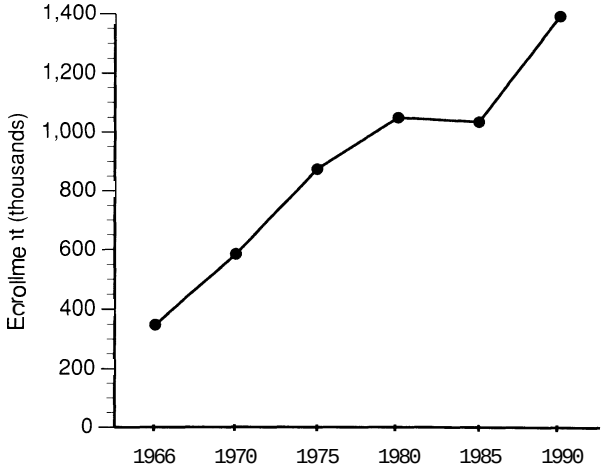

FIGURE TYR.2.1 Enrollment (in thousands) in mathematics programs at two-year colleges: Fall 1966, 1970, 1975, 1980, 1985, 1990.

Trends in enrollment in specific courses

The growth in mathematics program enrollment can be attributed largely to growth in remediation, which accounts for 67% of the enrollment increase from 1985 to 1990, and which, for the first time, comprises more than half of the combined mathematics, statistics, and computer science enrollment and 58% of the enrollment in mathematics courses (see Tables TYR.3 and TYR.4). In comparison, 16% of four-year college and university mathematics enrollment is in remedial courses (see Table S.2).

Courses showing large percentage increases in enrollment over 1985 were elementary algebra (45%), intermediate algebra (73%), college algebra (70%), math for liberal arts (218%), non-mainstream calculus (162%) and elementary statistics (62%). From a much smaller base, advanced programming also had a large percentage increase in enrollment.

Pre-algebra, listed for the first time on the 1990 survey, debuts with an enrollment of about 45,000.

Courses showing large percentage decreases in enrollment were business mathematics, technical mathematics, use of hand calculators, assembly language programming, and data processing. Business mathematics, technical mathematics, and data processing show corresponding decreases in enrollment in courses taught outside of mathematics programs (see Table TYR.8). The decrease in college algebra/trig (Course 9) enrollment appears to be a result of restructuring these courses as precalculus/elementary functions (Course 10), which showed roughly an equivalent increase.

TABLE TYR.3 Enrollment (in thousands) in mathematical sciences and computer science courses in mathematics programs at two-year colleges: Fall 1966, 1970, 1975, 1980, 1985, 1990.

	1966	1970	1975	1980	1985	1990
Remedial level						
1. Arithmetic	15	36	67	121	77	79
2. General mathematics	17	21	33	25	65	68
3. Pre-algebra	na	na	na	na	na	45
4. Elementary algebra	35	65	132	161	181	262
5. Intermediate algebra	37	60	105	122	151	261
6. High school geometry	5	9	9	12	8	9
Precalculus level						
7. College algebra	52	52	73	87	90	153
8. Trigonometry	18	25	30	33	33	39
9. Coll alg & trig(comb)	15	36	30	41	46	18
10. Precalc/elem fns	7	11	16	14	13	33
11. Analytic geometry	4	10	3	5	6	2
Calculus level						
12. Mainstream calc I	40	58	62	73	80	53
13. Mainstream calc II						23
14. Mainstream calc III						14
15. Non-mainstream calc I	na	na	8	9	13	31
16. Non-mainstream calc II	na	na				3
17. Differential equations	2	1	3	4	4	4
Services courses						
18. Linear algebra	1	1	2	1	3	3
19. Discrete mathematics	na	na	na	na	L	1
20. Finite mathematics	3	12	12	19	21	29
21. Math for liberal arts	22	57	72	19	11	35
22. Business math	17	28	70	57	33	26
23. Math for elem teachers	16	25	12	8	9	9
24. Elementary statistics	4	11	23	20	29	47
25. Probability & statistics	1	5	4	8	7	7
26. Technical mathematics	19	26	46	66	31	17
27. Tech math (calc level)	1	3	7	14	4	1
28. Use of hand calculators	na	na	4	3	6	L
Computing						
29. Computers & society	na	na	na	na	na	10
30. Data proc (elem or adv)	na	na	na	na	36	21
31. Elem prog (languages)	3	10	6	58	37	32
32. Advanced programming	na	na	na	na	5	8
33. Database management	na	na	na	na	na	4
34. Assembly lang prog	na	na	na	na	4	2
35. Data structures	na	na	na	na	2	1
36. Other comp. sci courses	2	3	4	37	14	20
37. Other math courses	8	14	32	27	14	23
TOTAL	348	584	874	1048	1034	1393

na means not available and L means some but fewer than 500.
Mainstream calc is for math, physics, sci & engr; non-mainstream for bio, soc & mgmt sci.
Prior to 1990 aggregate sums for Main Calc I, II & III were reported.
Prior to 1990, aggregate sums for Non-Main Calc I & II were reported.

TABLE TYR.4 Enrollment (in thousands) in mathematical sciences and computer science courses by level of courses in mathematics programs at two-year colleges: Fall 1966, 1970, 1975, 1980, 1985, 1990.

Level	1966	1970	1975	1980	1985	1990
Remedial (Courses 1-6)	109 (32%)	191 (33%)	346 (40%)	441 (42%)	482 (47%)	724 (52%)
Precalculus (7-11)	96 (28%)	134 (23%)	152 (17%)	180 (17%)	188 (18%)	245 (18%)
Calculus (12-17)	42 (12%)	59 (10%)	73 (8%)	86 (8%)	97 (9%)	128 (9%)
Computing (29-36)	5 (1%)	13 (2%)	10 (1%)	95 (9%)	98 (10%)	98 (7%)
Statistics (24-25)	5 (1%)	16 (3%)	27 (3%)	28 (3%)	36 (3%)	54 (4%)
Other (18-28,37)	91 (26%)	171 (29%)	266 (31%)	218 (21%)	133 (13%)	144 (10%)
TOTAL	348	584	874	1048	1034	1393

Note: This table was constructed using TABLE TYR.3. Course numbers used in the groupings are also found in TABLE TYR.3. Note that the breakdown into type of course is different from that in Table S.2 and Appendix I for four-year colleges and universities.

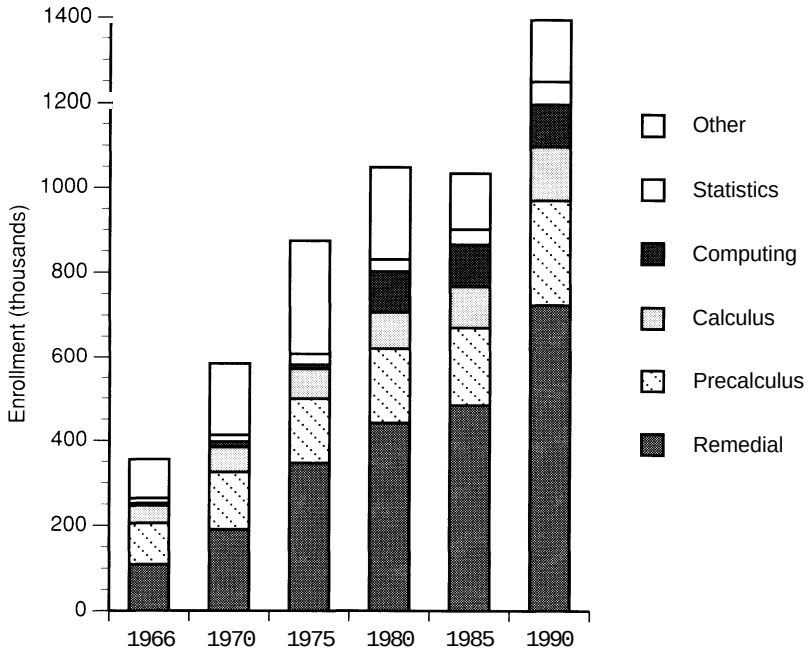

FIGURE TYR.4.1 Enrollment in mathematical sciences and computer science courses by level in mathematics programs at two-year colleges: Fall 1966, 1970, 1975, 1980, 1985, 1990.

Enrollment in statistics (Courses 24 and 25) is now about the same as enrollment in first semester mainstream calculus (Course 12). In fact, counting courses both inside and outside mathematics programs, for every 100 two-year college students who begin a calculus sequence (mainstream, non-mainstream, or outside mathematics programs), there are 78 who enroll in introductory statistics (see also Table TYR.8).

Mainstream calculus includes the calculus courses taught to mathematics, physics, and engineering majors. Non-mainstream calculus includes the "soft" calculus courses most often taught to biology, behavioral science, and business majors.

Average number of students per section

In Fall 1990, the average number of students per section for all mathematics and statistics courses in mathematics programs was 27.8. The average number of students per section in computer science courses was 18.5. Table TYR.5 gives the average number of students per section for selected mathematics courses.

TABLE TYR.5 Average section size for selected two-year college mathematics courses: Fall 1990.

Course	Average section size
Remedial	
Arithmetic	28.3
General mathematics	26.2
Pre-algebra	28.8
Elementary algebra	30.5
Intermediate algebra	29.9
Precalculus Level	
College algebra	28.3
Precalculus/elem.functions	27.3
Calculus Level and Above	
Non-mainstream Calculus I	27.0
Mainstream Calculus I	25.7
Mainstream Calculus II	22.9
Mainstream Calculus III	17.9
Linear algebra	16.5
Differentialequations	21.2
Discrete mathematics	11.9
Other	
Elementary statistics (Course 24)	29.5
Technical math (Course 26)	19.8

Table TYR.6 shows that the average number of students per section is quite a bit smaller in two-year colleges than in four-year colleges and universities. In both two-year colleges and in four-year colleges and universities, the most advanced courses have the smallest average class sizes (see also Table E.3).

TABLE TYR.6 Average section size by level of course in two-year colleges and four-year colleges and universities: Fall 1990.

	Two-Year Colleges	Four-Year Colleges and Universities
Remedial (Courses 1-6)	29	31
Precalculus (Courses 7-11)	27	35
Calculus (Courses 12-17)	24	35
Computer science (Courses 29-36)	18	29
Statistics (Courses 24-25)	29	37

Course numbers are for two-year college courses. See Table TYR.3.

Twenty year trends in availability of mathematics courses

Two-year college mathematics departments have traditionally had difficulty offering the full range of lower division mathematics courses. Table TYR.7 shows that from 1970 to 1990, there was an encouraging improvement in the availability of baccalaureate level courses. For example, the percentage of two-year colleges that offer a linear algebra course at least once in two years has doubled from 17% to 34% and the percentage offering finite mathematics has jumped from 19% to 46%. Discrete mathematics, now offered by 21% of two-year colleges, has arrived as a significant course.

However, many students will still have difficulty completing the first two years of baccalaureate-level mathematics. Linear algebra, discrete mathematics, finite mathematics, mathematics for liberal arts, mathematics for elementary school teachers, elementary programming, and many other computer science courses are offered at fewer than half of all two-year colleges. A further indication of the precarious position of some of the more advanced courses is the average section size shown in Table TYR.5.

The decrease in the availability of technical mathematics courses does not mean that technical mathematics is increasingly being taught outside of mathematics programs. Enrollment in technical mathematics taught outside of mathematics programs decreased from 25,000 in 1980 to 10,000 in 1990 (see Table TYR.8).

TABLE TYR.7 Percentage of two-year college mathematics programs teaching selected mathematical sciences and computer science courses: Fall 1970, 1985, 1990.

	1970	1985	1990
Mathematics			
Differential equations	49%	40%	53%
Linear algebra	17%	24%	34%
Discrete mathematics	na	3%	21%
Finite mathematics	19%	27%	46%
Math for liberal arts	na	25%	35%
Mathematics of finance	13%	5%	na
Business mathematics	38%	34%	42%
Math for elem teachers	48%	31%	32%
Elementary statistics	41%	61%	69%
Probability & statistics	16%	15%	22%
Technical mathematics	41%	42%	36%
Technical math (calc level)	19%	18%	6%
Use of hand calculators	na	4%	6%
Computing			
Data processing (elem or adv)	na	28%	16%
Elem programming (languages)	27%	46%	48%
Advanced programming	na	19%	31%
Assembly lang programming	na	12%	17%
Data structures	na	5%	11%
Other computer sci courses	16%	16%	21%

Mathematics and Computer Science Courses Taught Outside of Mathematics Programs

Trends in enrollment in mathematics and computer science courses taught outside of mathematics programs

Many associate of arts degree programs and technical/occupational programs in two-year colleges teach their own mathematics. The growth in enrollment in these mathematics courses has traditionally outstripped the growth in enrollment in mathematics programs. Comparing Tables TYR.3 and TYR.8, we see that from 1970 to 1985, these courses increased in enrollment by 292%, while growth in mathematics program enrollment increased by 77%. However, from 1985 to 1990, the growth in enrollment in mathematics programs increased by 35%, while the growth in enrollment in mathematics/computer science courses outside mathematics programs increased by only 12%.

Enrollment in these courses is now about 29% as large as enrollment in mathematics programs (compared to 35% in 1985, but only 16% in 1970). The majority of the enrollment in business math, computer science and programming, and data processing is outside of mathematics programs.

TABLE TYR.8 Estimated enrollment (in thousands) in mathematical sciences and computer science courses taught at two-year colleges but outside of mathematics programs at two-year colleges: Fall 1970, 1975, 1980, 1985, 1990.

	1970	1975	1980	1985	1990
Arithmetic	14	27	18	18	42
Elem algebra (high sch)	na	na	na	na	38
Int algebra (high sch)	na	na	na	na	27
College algebra	na	na	na	na	6
Trig or precalc (college)	6	17	29	3	3
Calculus or Diff eqs	L	4	8	L	4
Business math	36	53	70	50	32
Statistics & prob	6	14	12	7	15
Comp science & prog	21	51	92	97	128
Data processing	na	na	na	159	96
Technical math	na	na	25	23	10
Other	9	12	10	4	4
TOTAL	92	178	264	361	405

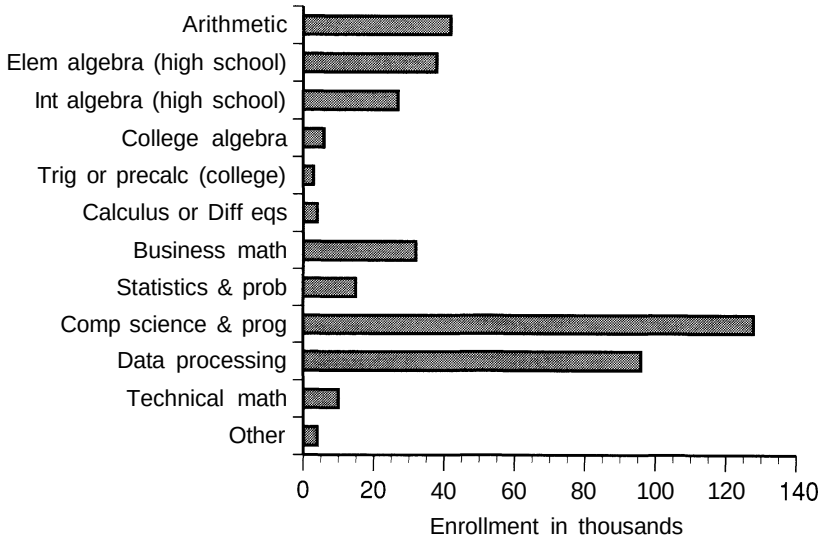

FIGURE TYR.8.1 Estimated enrollment (in thousands) in mathematical sciences and computer science courses taught outside of mathematics programs at two-year colleges: Fall 1990.

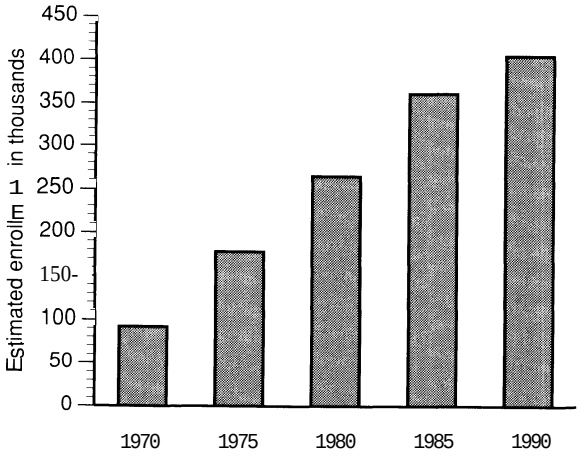

FIGURE TYR.8.2 Estimated enrollment (in thousands) in mathematical sciences and computer science courses taught outside of mathematics programs at two-year colleges: Fall 1970, 1975, 1980, 1985, 1990.

Other divisions that teach mathematics and computer science courses

Table TYR.9 is a further breakdown of the 1990 data in Table TYR.8 by division where the mathematics and computer science courses are taught. Three-fourths of outside enrollment is in business departments and in "other" departments.

Presumably the "other," which now teach arithmetic, elementary algebra, and intermediate algebra to 88,000 students, include learning centers that offer coursework in remedial mathematics.

The enrollment in mathematics and computer science courses outside mathematics programs given in Table TYR.8 and Table TYR.9 is based on estimates provided by the heads of mathematics programs. Consequently, this enrollment is probably not as accurate as that for courses taught inside the mathematics program.

TABLE TYR.9 Estimated enrollment (in thousands) in mathematical sciences or computer science courses taught outside of mathematics programs by division where taught at two-year colleges: Fall 1990.

	Natural Sciences	Occupat programs	Business	Social Sciences	Other	TOTAL
Arithmetic	L	1	4	0	37	42
Elem algebra (high sch)	9	1	L	0	28	38
Int algebra (high sch)	3	1	L	0	23	27
College algebra	4	0	0	0	2	6
Trig or precalc (college)	1	1	0	0	1	3
Calculus or Diff eqs	1	L	2	0	1	4
Business math	1	L	31	0	0	32
Statistics & prob	L	L	10	5	L	15
Comp science & prog	2	45	45	0	36	128
Data processing	L	15	60	0	21	96
Technical math	0	6	2	1	1	10
Other	0	2	2	L	0	4
TOTAL	21	72	156	6	150	405

L: fewer than 500.

Instructional Practices

Instructional formats

In Fall 1990, the standard lecture-recitation system with classes of 40 or fewer was used by most faculty in 94% of two-year college mathematics programs. Table TYR.10 also shows that the instructional innovations of the 1970s that allowed students to pace their learning—personalized system of instruction, audio-tutorial, modules, computer-assisted instruction, programmed instruction—continued to decline in popularity. None of these is used today by a significant percentage of the two-year college mathematics faculty.

Innovations in calculus courses

Table TYR.11 shows that innovations in calculus instruction of the late 1980s had not gained much of a toehold in Fall 1990. The corresponding percentages in Mainstream Calculus I and II for four-year colleges and universities were about double for the writing component but slightly lower for group projects (compare Table TYR.ll with Table C.3).

TABLE TYR.10 Instructional formats used by faculty in mathematics programs at two-year colleges: Fall 1980, 1985, 1990.

	Not being used			Used by some faculty			Used by most faculty		
Instructional Method	1980	1985	1990	1980	1985	1990	1980	1985	1990
Standard lecture-recitation system (class size < 41)	1%	1%	0%	2%	14%	6%	97%	85%	94%
Large lecture classes (>40) with recitation sections	63%	77%	89%	16%	19%	7%	21%	4%	4%
Large lecture classes (>40) with no recitation sections	76%	82%	89%	12%	17%	10%	12%	1%	1%
Organized program of independent study	37%	60%	64%	62%	38%	36%	1%	2%	0%
Courses by television (closed circuit or broadcast)	73%	92%	87%	27%	9%	13%	0%	0%	0%
Courses by film	75%	96%	87%	24%	4%	13%	1%	0%	0%
Courses by programmed instruction	40%	69%	81%	56%	27%	19%	4%	4%	0%
Courses by computer-assisted instruction (CAI)	68%	74%	79%	31%	24%	21%	1%	2%	0%
Modules	42%	69%	82%	54%	25%	17%	4%	6%	1%
Audio-tutorial	55%	74%	86%	43%	24%	14%	2%	2%	0%
PSI (Personalized system of instruction)	51%	76%	85%	46%	20%	15%	3%	4%	0%

TABLE TYR.11 Percent of calculus sections in two-year colleges that assign group projects and that have a writing component: Fall 1990.

Course	% of sections that assign group projects	% of sections that have a writing component
Main. Calculus I	4%	5%
Main. Calculus II	3%	4%
Main. Calculus III	0%	4%
Non-Main. Calc. I	5%	4%
Non-Main. Calc. II	2%	2%

Computer and calculator use by students

The computer has arrived in two-year college mathematics classes, especially in advanced classes. Department heads report that in a typical week 23% of the faculty assign homework requiring use of the computer. Computer assignments are regularly given in 9% of all sections of mathematics (excluding computer science), up from fewer than 7% in 1985. Table TYR.12 gives the percentage of sections of selected courses in which computer assignments are regularly given. The percentages for Mainstream Calculus I and II are quite a bit higher than those in four-year colleges and universities (compare Table TYR.12 with Table C.3).

Calculators are recommended for use in 48% of all mathematics sections (excluding computer science courses), up from 43% in 1985 and from 29% in 1980. More than half of the sections of each course, except for remedial courses, analytic geometry, and mathematics for liberal arts, recommend use of the calculator. Table TYR.12 gives the percentage of sections in selected courses that recommend use of the calculator.

TABLE TYR.12 The percent of sections of selected two-year college courses in which computer assignments are regularly given and in which calculators are recommended: Fall 1990.

Course	% of sections in which computer assignments are regularly given	% of sections in which calculators are recommended
Arithmetic	6%	12%
Elementary algebra	7%	30%
Intermediate algebra	4%	39%
College algebra	5%	54%
Trigonometry	7%	71%
Precalculus	11%	70%
Mainstream Calculus I	13%	72%
Mainstream Calculus II	18%	70%
Mainstream Calculus III	13%	76%
Non-mainstream Calculus I	10%	68%
Differential equations	13%	88%
Linear algebra	40%	76%
Math for liberal arts	5%	39%
Elementary statistics	29%	86%

Use of computers by faculty

Use of computers by faculty, as estimated by mathematics program heads, is now substantial for constructing tests or assignments, but only 10% of the mathematics program faculty use a computer algebra system in a typical week (see Table TYR.13).

TABLE TYR.13 Use of computers by faculty in mathematics programs at two-year colleges (a typical week): Fall 1990.

Activity	Percent of full-time faculty engaged in activity (est. by dept heads)
Use computer for classroom demos	24%
Assign homework requiring computer	23%
Use computer to construct tests or assignments	55%
Use a computer algebra system	10%

Availability of computers

Computers are available in moderate numbers for use by mathematics students and mathematics faculty, but the percentage of two-year colleges with no computers for use in mathematics classrooms is still quite large (see Table TYR.14.B). In fact, "computer facilities for classroom use" is listed as a major problem by 28% of department heads (see Table TYR.41).

TABLE TYR.14.A Average number per college of personal computers, terminals and workstations available to mathematics faculty and students for various uses by size of two-year college: Fall 1990.

	Public Two-Year Colleges				Private
Enrollment	0-1999	2000-7999	8000-14999	15000-	
Number of two-year colleges	298	419	120	54	127
For use of math students in a math lab	14.2	6.5	17.1	18	0
For use of math students at other location	7.7	46	73.1	58.5	31.3
For exclusive use of math faculty	2.6	3.5	8	8.7	0
For use in math classrooms	3.6	1.3	3.4	16.2	0

TABLE TYR.14.B Percent of two-year colleges reporting no computers for each category below concerning the availability of personal computers, terminals and workstations for faculty and students for various uses by size of the two-year college: Fall 1990.

	Public Two-Year Colleges				Private
Enrollment	0-1999	2000-7999	8000-14999	15000-	
Number of two-year colleges	298	419	120	54	127
For use of math students in a math lab	27%	46%	18%	13%	100%
For use of math students at other location	48%	4%	3%	4%	0%
For exclusive use of math faculty	9%	19%	11%	0%	100%
For use in math classrooms	44%	52%	22%	17%	100%

Student Services

Math labs or tutorial centers can be found in 86% of all two-year colleges.

They may contain tutors, computers, audio-visual aids, learning modules, etc. These labs have become a source of employment for students (see Table TYR.15).

TABLE TYR.15 Sources of personnel for mathematics laboratories in mathematics programs at two-year colleges: Fall 1985, 1990.

	Percent of two-year colleges using source	
	1985	1990
Students	48%	73%
Full-time members of mathematics staff	38%	46%
Paraprofessionals	34%	51%
Part-time members of mathematics staff	30%	32%
Members of other departments	19%	18%
Other	3%	5%

Table TYR.16 shows that few services other than math labs and placements tests are available to students taking mathematics classes in two-year colleges. Compare Table TYR.16 with Table D.1 for four-year colleges and universities.

TABLE TYR.16 Percent of two-year colleges offering various services to students: Fall 1990.

Service	% of two-year colleges offering
Math lab or tutorial center	86%
Advisory placement examinations	60%
Mandatory placement examinations	58%
Honors sections	17%
Regular participation in math contests	17%
Lectures/colloquia for students	15%
Active math club	12%
Social activities for majors and faculty	7%

CHAPTER 9

TWO-YEAR COLLEGE MATHEMATICS PROGRAM FACULTY

This chapter describes the number, teaching load, education, professional activities, and age, sex, and ethnicity of the faculty in two-year college mathematics programs (that is, those who teach mathematics and computer science courses) in Fall 1990. Also included is information on mobility into, within, and out of two-year college mathematics program teaching positions, a list of the major problems of mathematics programs, and a section on administration of mathematics programs.

The data are compared with those from the 1966, 1970, 1975, 1980, and 1985 CBMS surveys. A "mathematics program" includes courses taught by the group of all mathematics and computer science faculty members. For information on the sampling procedure used in this survey, see Appendix II.

Highlights

- About 7200 people teach full-time in two-year college mathematics programs in the United States. This is an increase of 15% from 1985 to 1990, compared over the same period to a 35% increase in student enrollment. Over the same period, the number of part-time faculty in two-year college mathematics programs increased by a whopping 84% to about 13,700.

- Part-time faculty teach 42% of the total number of sections and 51% of the sections of remedial mathematics.

- Seventy-three percent of part-time instructors either have full-time employment elsewhere or are graduate students.

- The average teaching load of full-time mathematics program faculty is 14.7 contact hours a week, down from 16.1 hours in 1985.

- Forty-four percent of the full-time faculty teach extra hours for extra pay, averaging 4.7 additional hours for these faculty members.

- The percentage of full-time two-year college mathematics program faculty with a doctorate has risen to 16.5%, although fewer than 2% of new full-time hires in 1989-1990 had doctorates. (In the 1985 CBMS survey, about 14% of new hires had doctorates.) The percentage of full-time faculty members whose highest degree is a bachelor's degree is down to 4% (compared with 27% of the part-time faculty).

- Women comprise about 34% of the full-time faculty in mathematics programs, up from 21% in 1975. (In the 1980s, women were awarded about 35% of the master's degrees in the mathematical sciences.) Women make up about half of all full-time mathematics program faculty members under the age of forty.
- Ethnic minorities comprise about 16% of the full-time mathematics program faculty members (up from 7% in 1975) and about 26% of the full-time mathematics program faculty members under the age of forty.
- The major route into full-time teaching in a two-year college mathematics program is having taught previously in that program, accounting for 47% of new hires.
- Death or retirement account for only a third of those who leave two-year college mathematics program teaching.
- The average age of those teaching full-time in two-year college mathematics programs has increased to 45.4 years.
- The percentage of full-time mathematics program faculty members who participate in selected professional activities, as estimated by department heads, is generally down from 1985.
- Remediation is the only problem classified as major by a majority of department heads (65%), followed by salary levels/ patterns (47%), the need to use temporary faculty for instruction (42%), and student motivation (38%).

The Number and Teaching Load of Full-time and Part-time Mathematics Program Faculty

Trends in the number of full-time and part-time mathematics program faculty members

Table TYR.17 shows that part-time instructors make up 65% of the two-year college mathematics program faculty. The number of part-time instructors increased by 84% from 1985 to 1990 while the number of full-time instructors increased by only 15%. Not surprisingly, 42% of mathematics program heads classify "the need to use temporary faculty for instruction" as a major problem (see Table TYR.41).

Supplementing the part-time faculty, about 44% of the full-time two-year college mathematics program faculty teach extra hours for extra pay. These instructors are included only with the full-time faculty in Table TYR.17 and all other tables and figures.

TABLE TYR.17 Number of full-time and part-time faculty in mathematics programs at two-year colleges: Fall 1966, 1970, 1975, 1980, 1985, 1990.

	1966	1970	1975	1980	1985	1990
Full-time faculty	2677	4879	5944	5623	6277	7222
Part-time faculty	1318	2213	3411	6661	7433	13680

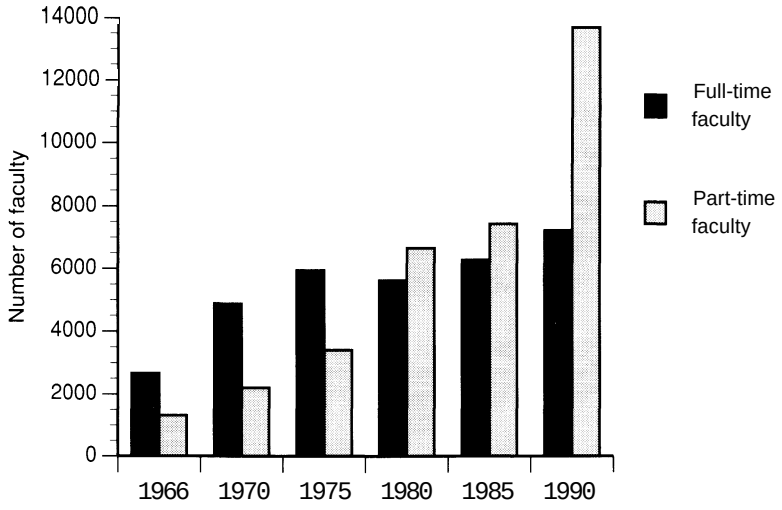

FIGURE TYR.17.1 Number of full-time and part-time faculty in mathematics programs at two-year colleges: Fall 1966, 1970, 1975, 1980, 1985, 1990.

Ratio of the number of part-time faculty to full-time faculty by geographic region

Table TYR.18 gives the ratio of part-time to full-time mathematics program faculty. This ratio is lowest in the southeast and highest in the midwest.

TABLE TYR.18 The ratio of number of part-time faculty to full-time faculty in mathematics programs in two-year colleges by geographic region: Fall 1990.

Ratio	West	Midwest	New England/ Mid-Atlantic	Southeast
Part-time/full-time	1.85	2.14	2.02	1.38

Percentage of sections taught by part-time faculty

Part-time faculty members in two-year college mathematics programs teach 42% of the total number of sections. In 1985, the percentage was 28%. Table TYR.19 shows that the percentage varies with the type of course. About half of the total number of sections are taught either by part-time instructors or full-time instructors teaching extra hours for extra pay.

A smaller percentage of the sections of linear algebra (13%) are taught by part-time faculty than any other mathematics course; a larger percentage of the sections of prealgebra (70%) are taught by part-time faculty than any other mathematics course. A smaller percentage of the sections of database management (10%) are taught by part-time faculty than any other computer science course; a larger percentage of the sections of data processing (72%) are taught by part-time faculty than any other computer science course.

TABLE TYR.19 Percent of sections taught by part-time faculty in two-year college mathematics programs: Fall 1990.

Type of course	Percent of sections taught by part-time faculty
Remedial (Courses 1-6)	51%
Precalculus (Courses 7-11)	30%
Mainstream calculus (Courses 12-14)	17%
Non-main calculus (Courses 15-16)	33%
Advanced math (Courses 17-19)	24%
Service courses (Courses 20-23)	38%
Statistics (Courses 24-25)	33%
Technical math (Courses 26-27)	36%
Computer science (Courses 29-36)	47%

Teaching load of full-time faculty

The average required teaching load of a full-time two-year college mathematics program faculty member is 14.7 contact hours a week, down from 16.1 hours in 1985. In addition, about 44% teach extra hours for extra pay, averaging 4.7 additional hours for these faculty members.

Table TYR.20 gives the percentage of two-year college mathematics programs that have various teaching loads.

Teaching loads for full-time faculty are highest in states in the west and lowest in the New England/Mid-Atlantic states. Compare Table TYR.21 with Table TYR.25, which shows the highest degree of full-time faculty by geographic region.

TABLE TYR.20 Teaching load for full-time faculty members in mathematics programs at two-year colleges: Fall 1990.

Teaching load-contact hours	9	10-12	13-15	16-18	19-21	22
Percent of two-year schools	0.4%	25.2%	57.3%	11.3%	5.4%	0.4%

* Full-time average contact hours: 14.7
* Percent of the full-time faculty who teach extra hours for extra pay: 44%
* Average number of extra hours for extra pay: 4.7

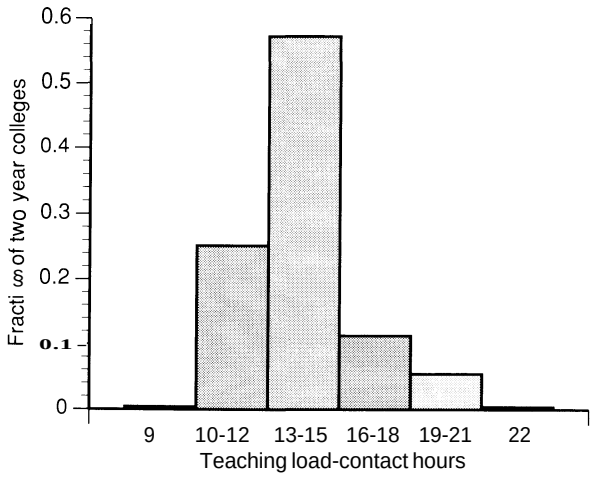

FIGURE TYR.20.1 Teaching load for full-time faculty members in mathematics programs at two-year colleges: Fall 1990.

TABLE TYR.21 Teaching load for full-time faculty members in mathematics programs at two-year colleges by geographic region: Fall 1990.

	Teaching load-contact hours					
	9	10-12	13-15	16-18	19-21	22
Percent of two-year colleges with teaching load in:						
West	0%	0%	70%	27%	0%	3%
Midwest	0%	28%	58%	4%	10%	0%
New England/Mid-Atlantic	3%	56%	36%	5%	0%	0%
Southeast	0%	23%	58%	13%	6%	0%

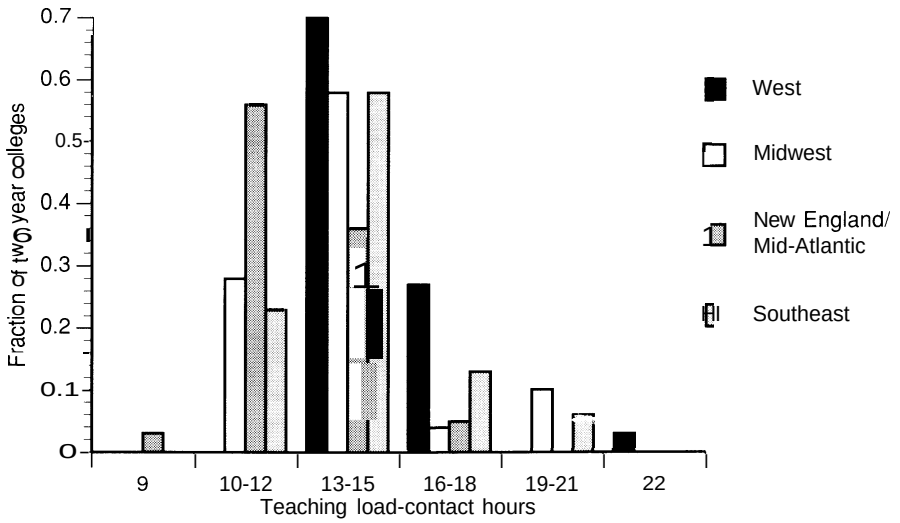

FIGURE TYR.21.1 Teaching load for full-time faculty members in mathematics programs at two-year colleges by geographic region: Fall 1990.

Teaching load of part-time faculty

Part-time faculty members in two-year college mathematics programs teach an average of 6.1 hours a week, up from 5.7 hours a week in 1985.

Table TYR.22 shows that a surprising 19% of mathematics programs have their "part-time" instructors teach an average of 9 hours or more.

TABLE TYR.22 Average weekly teaching load in contact hours for part-time faculty members in mathematics programs at two-year colleges: Fall 1990.

Teaching load-contact hours	3	4	5	6	7	8	9	>9
Percent of two-year colleges	11%	10%	18%	30%	5%	7%	8%	11%

Part-time average contact hours: 6.1

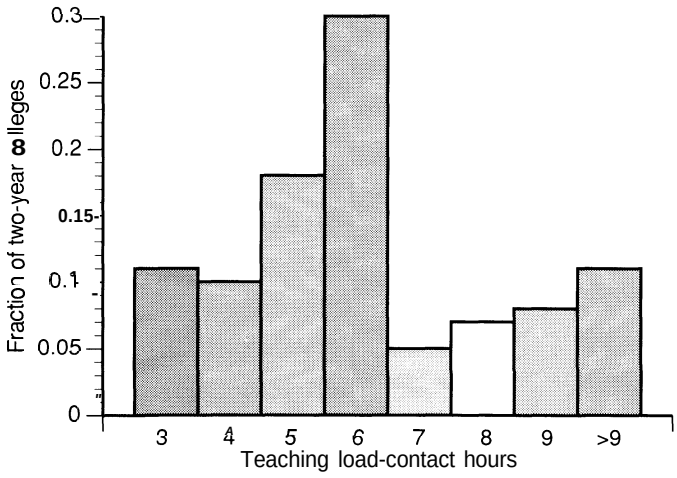

FIGURE TYR.22.1 Average weekly teaching load in contact hours for part-time faculty members in mathematics programs at two-year colleges: Fall 1990.

Education of Full-Time Two-Year College Mathematics Program Faculty

Percentage with doctorates

Table TYR.23 shows the rise over the years to 16.5% in the percentage of full-time two year college mathematics program faculty with a doctorate. By comparison, 77% of all full-time faculty in four-year college and

university departments of mathematics hold a doctorate (see Table F.7) and 8% of part-time two-year college mathematics program faculty hold a doctorate (see Table TYR.27). The rise in the percentage of doctorates from 1985 to 1990 probably cannot be attributed to new hires, suggesting that many faculty earn their doctorates while on the job, a phenomenon also observed in earlier surveys. Fewer than 2% of new full-time hires in 1989-1990 had doctorates (see Table TYR.37) while 18% of the full-time faculty leaving had doctorates (see Table TYR.39). In the 1985 CBMS survey, about 14% of new hires had doctorates. The lower 1989-1990 figure may reflect a higher demand for PhDs that year in universities and four-year colleges.

TABLE TYR.23 Percent of doctorates among full-time faculty in mathematics programs at two-year colleges: Fall 1970, 1975, 1980, 1985, 1990.

	1970	1975	1980	1985	1990
Percent doctorates	4.5%	10.6%	15.0%	13.0%	16.5%

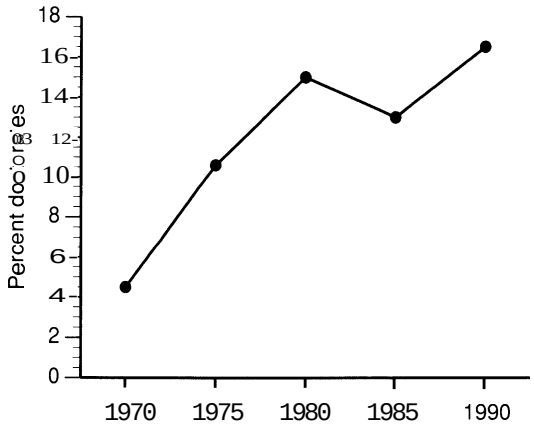

FIGURE TYR.23.1 Percent of doctorates among full-time faculty in mathematics programs at two-year colleges: Fall 1970, 1975, 1980, 1985, 1990.

Highest degree of full-time faculty

The increase from 1970 to 1990 in the percentage of two-year college mathematics program faculty who hold doctorates is balanced by a decrease in the percentage with a master's degree plus one year; Table TYR.24 shows that the percentage with a masters plus one year or a doctorate has remained fairly steady.

The percentage of full-time two-year college mathematics program faculty whose highest degree is a bachelor's degree continues its slow decrease.

TABLE TYR.24 Highest degree of full-time faculty in mathematics programs at two-year colleges: Fall 1970, 1975, 1980, 1985, 1990.

Highest Degree	1970	1975	1980	1985	1990
Doctorate	4%	11%	15%	13%	17%
Masters + 1 year	47%	35%	38%	39%	34%
Masters	42%	47%	42%	43%	45%
Bachelors	7%	7%	5%	5%	4%

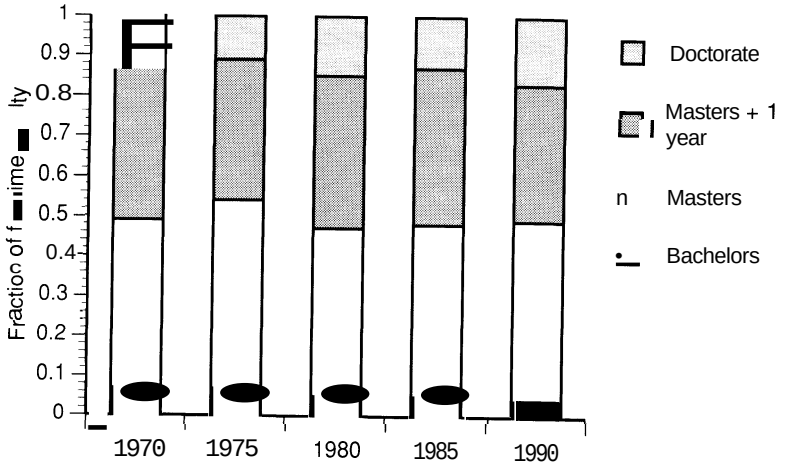

FIGURE TYR.24.1 Highest degree of full-time faculty in mathematics programs at two-year colleges: Fall 1970 1975, 1980, 1985, 1990.

Highest degree of full-time faculty by geographic region

Table TYR.25 gives the highest degree of full-time mathematics program faculty by geographic region. The percentage of full-time mathematics program faculty with a doctorate is highest in the New England/Mid-Atlantic states, where promotion is based more often on professional activities than in other regions of the country. Teaching loads are also lowest in this region (see Table TYR.21).

TABLE TYR.25 Highest degree of full-time faculty in mathematics programs at two-year colleges by geographic region of USA: Fall 1990.

Highest Degree	West	Midwest	New England/ Mid-Atlantic	Southeast
Doctorate	11%	18%	28%	13%
Masters + 1	40%	40%	20%	28%
Masters	44%	40%	51%	52%
Bachelors	5%	2%	1%	7%

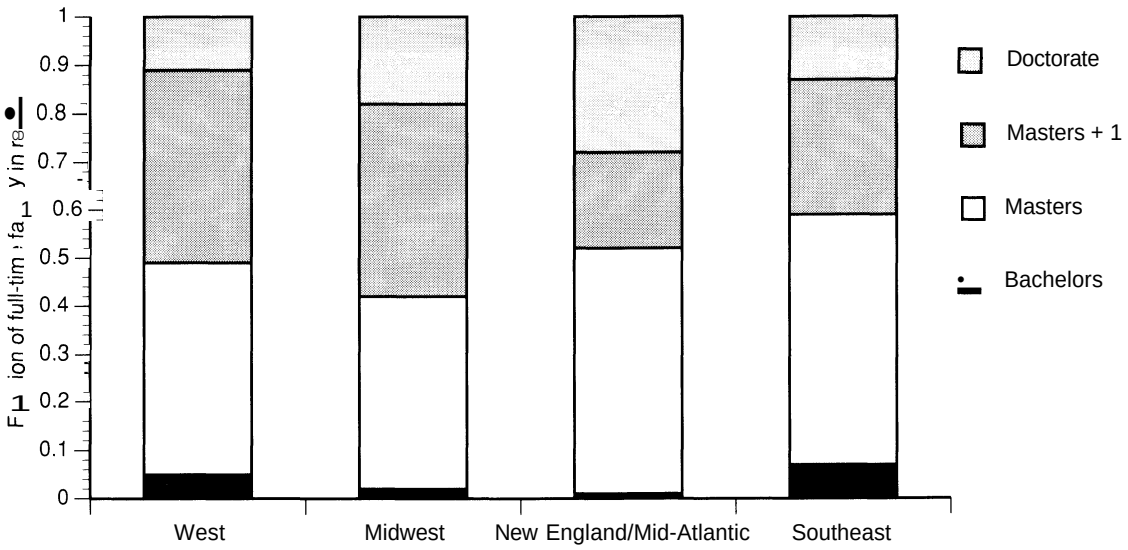

FIGURE TYR.25.1 Highest degree of full-time faculty in mathematics programs at two-year colleges by geographic region of USA: Fall 1990.

Field of highest degree of full-time faculty

The percentage of full-time two-year college mathematics program faculty whose highest degree is in mathematics is up to 68% from 58% in 1985. Otherwise, the matrix of Table TYR.26 is quite similar to that for 1980 and that for 1985.

TABLE TYR.26 Highest degree of full-time faculty in mathematics programs at two-year colleges by field and level of highest degree: Fall 1990.

	Highest degree				
Field	Doctorate	Masters + 1	Masters	Bachelors	TOTAL
Mathematics	8%	26%	31%	3%	68%
Mathematics Education	6%	5%	6%	L	**17%**
Statistics	L	1%	1%	0%	2%
Computer Science	L	1%	2%	1%	4%
Other fields	2%	1%	5%	L	9%
TOTAL	17%	34%	45%	4%	100%

L: Fewer than half of 1 %.

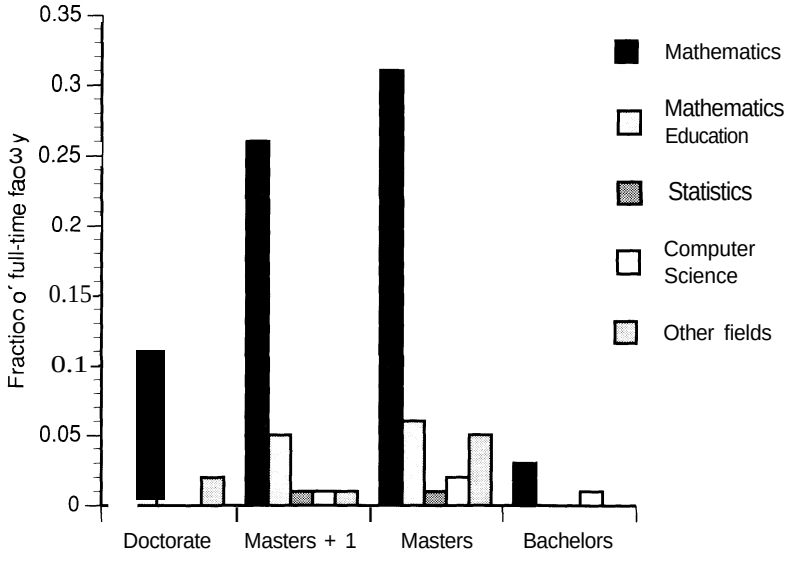

FIGURE TYR.26.1 Highest degree of full-time faculty in mathematics programs at two-year colleges by field and level of highest degree: Fall 1990.

Education of Part-Time Two-Year College Mathematics Program Faculty

Highest degree of part-time faculty

The percentage of part-time two-year college mathematics program faculty with either a doctorate or a master's degree plus one year has dropped since 1970 and the percentage with a bachelor's degree has increased. This may, in part, reflect hiring of bachelor's level part-time instructors to teach remedial courses and to staff math labs. A smaller percentage of part-time than full-time two-year college mathematics program faculty hold doctorates or a masters plus one year and a larger percentage hold a bachelor's degree as their highest degree. (Compare Table TYR.27 with Table TYR.24.)

Table TYR.28, which shows the highest degree of part-time faculty by geographic region, bears little resemblance to the parallel Table TYR.25 for full-time faculty.

TABLE TYR.27 Highest degree of part-time faculty in mathematics programs at two-year colleges: Fall 1970, 1975, 1980, 1985, 1990.

Highest Degree	1970	1975	1980	1985	1990
Doctorate	9%	4%	7%	7%	8%
Masters + 1	31%	30%	18%	15%	15%
Masters	46%	49%	58%	50%	50%
Bachelors	14%	17%	17%	28%	27%

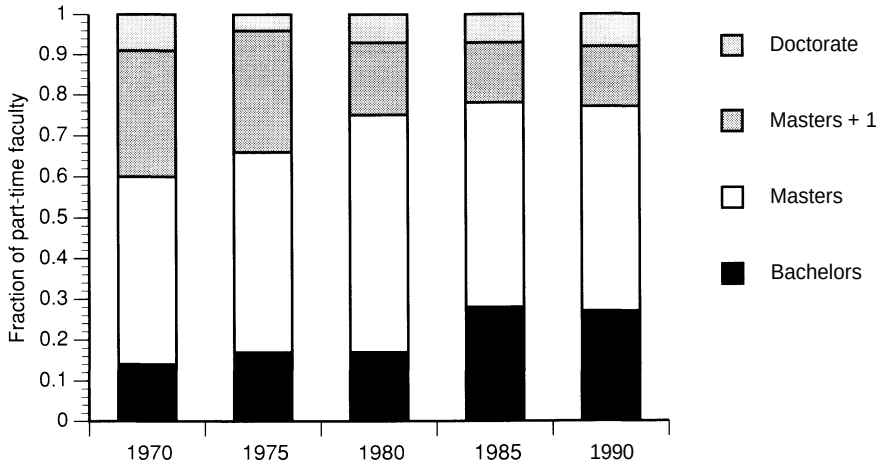

FIGURE TYR.27.1 Highest degree of part-time faculty in mathematics programs at two-year colleges: Fall 1970, 1975, 1980, 1985, 1990.

TABLE TYR.28 Highest degree of part-time faculty in mathematics programs at two-year colleges by geographic region in USA: Fall 1990.

Region	West	Midwest	New England/ Mid-Atlantic	Southeast
Doctorate	5%	10%	6%	11%
Masters + 1	13%	12%	26%	16%
Masters	52%	42%	56%	60%
Bachelors	30%	36%	12%	13%

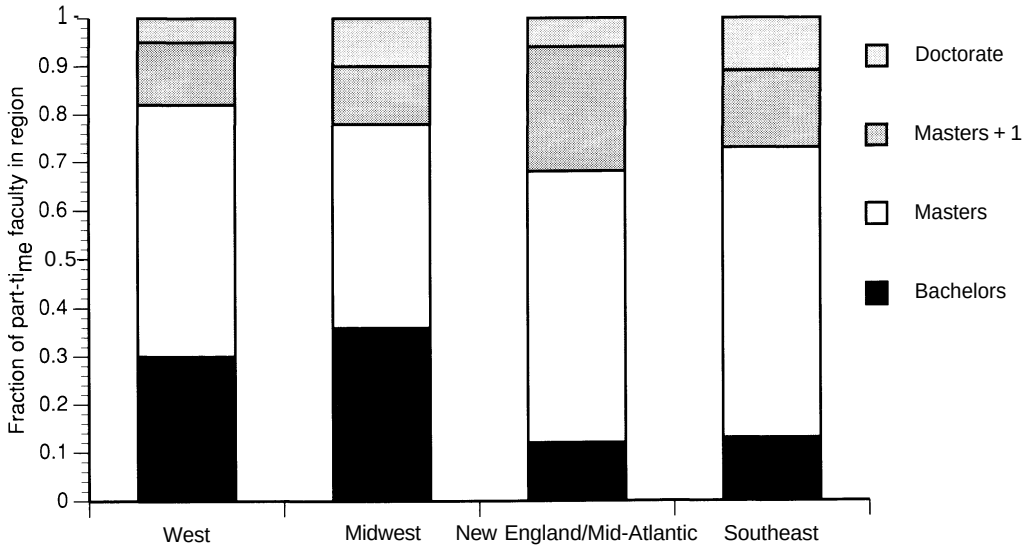

FIGURE TYR.28.1 Highest degree of part-time faculty in mathematics programs at two-year colleges by geographic region in USA: Fall 1990.

Field of highest degree of part-time faculty

The percentage of part-time two-year college mathematics program faculty members whose highest degree is in mathematics is down from 58% in 1985 to 47%. The percentage whose highest degree is in mathematics education is up 2%, in statistics up 1%, in computer science up 2%, and in other fields up 6%. A much smaller percentage of full-time faculty members than part-time faculty members have degrees in fields other than the mathematical sciences. (Compare Table TYR.29 with Table TYR.26 for full-time faculty.)

TABLE TYR.29 Highest degree of part-time faculty in mathematics programs at two-year colleges by field: Fall 1990.

	Highest degree				
Field	Doctorate	Masters + 1	Masters	Bachelors	TOTAL
Mathematics	1%	8%	27%	11%	47%
Mathematics Education	1%	3%	8%	5%	**17%**
Statistics	L	L	1%	L	2%
Computer Science	L	L	2%	4%	7%
Other fields	4%	4%	12%	7%	27%
TOTAL	8%	15%	50%	27%	100%

L: Fewer than half of 1%

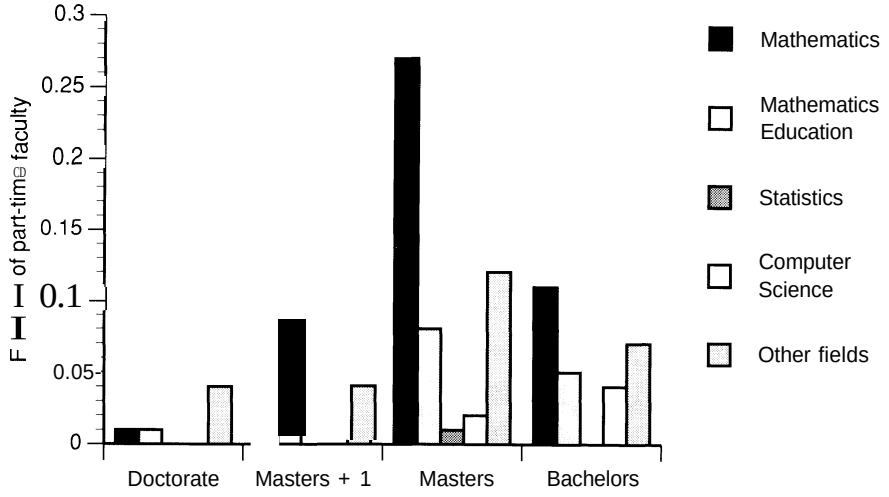

FIGURE TYR.29.1 Highest degree of part-time faculty in mathematics programs at two-year colleges by field: Fall 1990.

Gender, Ethnic Composition, and Age of Full-time Two-Year College Mathematics Program Faculty

Gender of full-time two-year college mathematics program faculty

About 34% of the full-time faculty members in mathematics programs at two-year colleges are women, up from 21% in 1975. In fact, women make up 49% of the full-time mathematics program faculty under the age of 40, a remarkable percentage given that in each of the years from 1970 to 1986, 35% or fewer of the master's degrees awarded in the mathematical sciences went to women [National Research Council, *A Challenge of Numbers: People in the Mathematical Sciences,* National Academy Press, Washington, DC, 1990. Their source: National Center for Education Statistics of the U.S. Department of Education, *Digest of Education Statistics,* 1988, p. 102]. A master's degree is the usual minimum requirement for teaching full-time in a two-year college mathematics program.

TABLE TYR.30 Number of full-time faculty in mathematics programs at two-year colleges: Fall 1975, 1980, 1985, 1990.

	1975	1980	1985	1990	% increase 1975-1990
Men	4696	4217	4331	4767	1.5%
Women	1248	1406	1946	2455	96.7%
TOTAL	5944	5623	6277	7222	21.5%

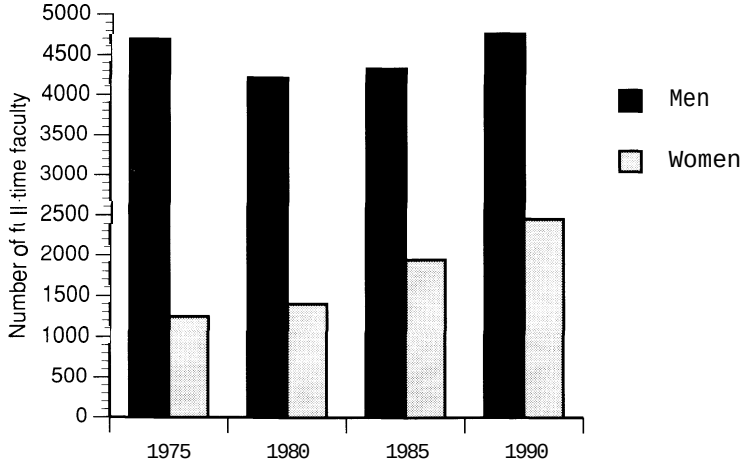

FIGURE TYR.30.1 Number of male and female full-time faculty members in mathematics programs at two-year colleges: Fall 1975, 1980, 1985, 1990.

Number of full-time faculty members who are ethnic minorities

Table TYR.31 shows that ethnic minorities comprise 16% of the full-time two-year college mathematics program faculty members, up from 7% in 1975. Seven percent of the full-time two-year college mathematics program faculty members are Hispanic, 4% are African-American, 4% are Asian/Pacific Islander, and 1% are Native American (see Table TYR.32). Twenty-six percent of the full-time two-year college mathematics program faculty members under the age of 40 are minorities (see Table TYR.33).

TABLE TYR.31 Number of ethnic minority full-time faculty members in mathematics programs at two-year colleges: Fall 1975, 1980, 1985, 1990.

	1975	1980	1985	1990
Number of full-time ethnic minority faculty members	416	450	753	1155
% ethnic minorities among full-time faculty members	7%	8%	12%	16%

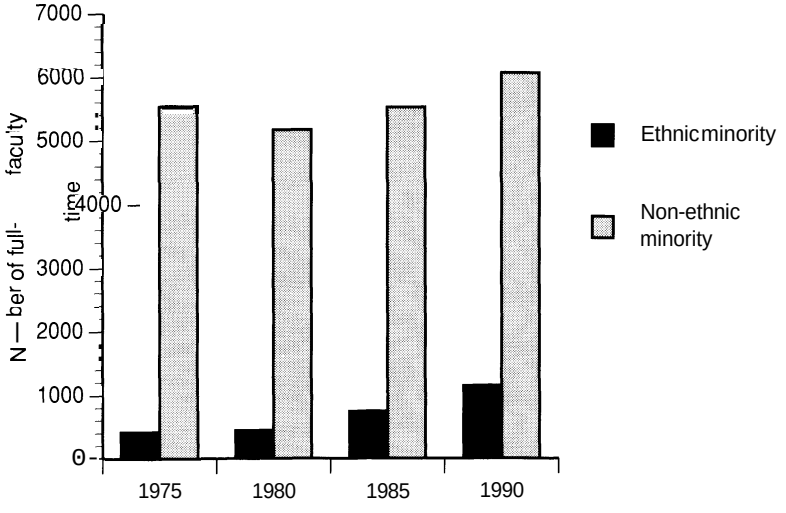

FIGURE TYR.31.1 Number of ethnic minority and non-ethnic minority full-time faculty members in mathematics programs at two-year colleges: Fall 1975, 1980, 1985, 1990.

Trends in the ethnic composition of full-time faculty

Table TYR.32 shows that the increase in the percentage of Hispanics is the largest of any ethnic group. Hispanics now comprise 7% of the full-time mathematics program faculty.

TABLE TYR.32 Ethnic group distribution of full-time faculty in mathematics programs at two-year colleges: Fall 1980, 1985, 1990.

	Percent of total full-time faculty		
Ethnic group	1980	1985	1990
Non-Hispanic White	92%	88%	84%
Asian	3%	3%	4%
Hispanic	1%	4%	7%
Black	3%	4%	4%
Native American	1%	1%	1%

Ethnic composition of full-time faculty and full-time faculty under age 40

Table TYR.33 compares the percentage of full-time two-year college mathematics program faculty and the percentage of full-time faculty under age 40 for various ethnic groups with the percentage of master's degrees in the mathematical sciences awarded to U.S. citizens in that group. A master's degree is the usual minimum requirement for teaching full-time in a two-year college mathematics program.

TABLE TYR.33 Ethnic group distribution of full-time faculty and of full-time faculty under age 40 in mathematics programs at two-year colleges (Fall 1990) and percent of master's degrees in mathematical sciences awarded (1985).

Ethnic Group	Percent of faculty	Percent of faculty under age 40	Percent of U.S. master's degrees *
Non-Hispanic white	84%	74%	87%
Asian/Pacific Islander	4%	6%	8%
Hispanic	7%	12%	2%
Black	4%	8%	2%
Native American	1%	L	L

L: Fewer than half of 1%

* Includes U.S. citizens only. [Source: National Research Council, A Challenge of Numbers: People in the Mathematical Sciences, National Academy Press, Washington, DC, 1990 p.47. Their source: National Center for Education Statistics of the U.S. Department of Education, unpublished data.]

Age distribution of full-time two-year college mathematics program faculty

The average age of two-year college mathematics program faculty is up to 45.4 years, about the same as the faculty in four-year college and university mathematics and statistics departments. The percentage under age 40 slid from 47% in 1975 to 23% in 1990. Table TYR.34 shows the trends in age since 1975. The diagonal arrows indicate the translation of an age group to the corresponding five-year-older group five years later. Clearly, hiring occurs at least up to age 50.

TABLE TYR.34 Age distribution of full-time faculty members in mathematics programs at two-year colleges: Fall 1975, 1980, 1985, 1990.

Age range	Percent of full-time faculty 1975	1980	1985	1990	Number of full-time faculty 1975	1980	1985	1990	Change: 1985-1990
<30	9%	5%	5%	5%	535	281	314	361	361
30-34	18%	15%	11%	8%	1070	843	690	578	264
35-39	20%	24%	18%	10%	1188	1350	1130	722	32
40-44	15%	18%	24%	21%	892	1012	1506	1517	387
45-49	13%	16%	18%	22%	773	900	1130	1589	83
50-54	13%	10%	13%	21%	773	562	816	1517	387
55-59	8%	7%	7%	8%	475	394	439	578	-238
>59	4%	5%	4%	5%	238	281	252	360	-79
TOTAL					5944	5623	6277	7222	

Age distribution of full-time two-year college mathematics program faculty members by gender

Women are more heavily represented in the younger age groups, as might be expected by the recent increase in the percentage of women faculty (see Table TYR.35).

TABLE TYR.35 Percent breakdown of full-time faculty In mathematics programs at two-year colleges by age class and sex; also percent female in each age class and overall: Fall 1990.

Age class	Percent of all full-time faculty Female	Male	Percent female by age class
< 35	7.0%	6.7%	51.1%
35-44	13.7%	18.6%	42.4%
45-54	10.3%	29.9%	25.6%
> 54	3.2%	10.6%	23.2%
OVERALL	34.2%	65.8%	34.2%

Age distribution of full-time two-year college mathematics program faculty members by ethnicity

The age distribution of Asian, Hispanic, African-American, and Native American full-time faculty members in mathematics programs at two-year colleges is shown in Table TYR.36. As with women, they are younger than the faculty as a whole.

TABLE TYR.36 Age distribution of ethnic minority full-time faculty members in mathematics programs at two-year colleges: Fall 1980, 1985, 1990.

Age range	1980	1985	1990
<35	28%	27%	24%
35-44	38%	46%	43%
45-54	30%	20%	29%
>54	4%	7%	4%

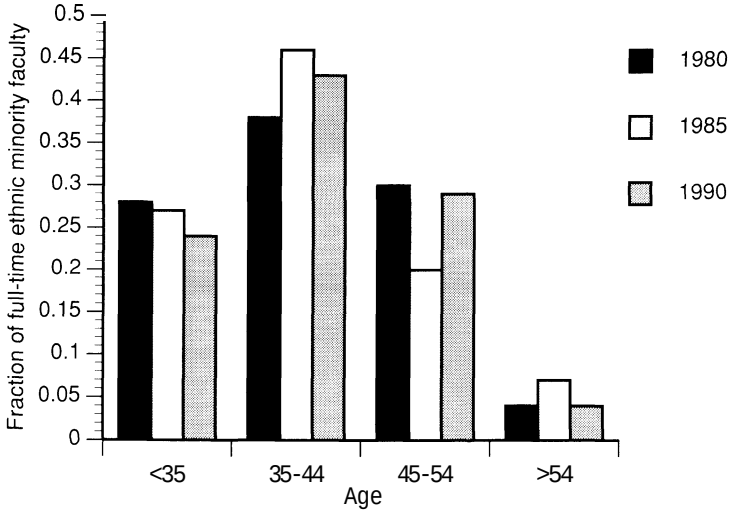

FIGURE TYR.36.1 Age distribution of ethnic minority full-time faculty members in mathematics programs at two-year colleges: Fall 1980, 1985, 1990.

Sources and Destinations of Mathematics Program Faculty in Two-Year Colleges, 1990

Sources of new full-time faculty

More than 700 people were newly hired for full-time teaching (both permanent and temporary) in mathematics programs at two-year colleges in 1990. The main route into full-time two-year college mathematics program teaching is having taught some time previously in that program, accounting for 47% of these new hires.

Table TYR.37 shows where the faculty members newly hired in 1990 spent the previous year (1989-1990). Sixty-two percent were teaching and 29% were in graduate school. Note that fewer than 2% of the new hires had a doctorate.

With the climb in remediation from 33% of the total mathematics program enrollment in 1970 to 52% in 1990 has come a major change in the teaching environment of two-year college mathematics program faculty. One result is that fewer secondary school mathematics teachers now move to two-year colleges in order to teach higher level mathematics.

TABLE TYR.37 Source of new full-time faculty for mathematics programs at two-year colleges: 1989-1990.

	Doctorate			Masters/Bachelors	
Source	Math	Math Ed	Other		TOTAL
Graduate school	0	0	4	208	212
Employed by same 2-yr college in part-time capacity	0	0	°	195	195
Teaching in another 2-year college	0	4	°	73	77
Teaching in a secondary school	0	0	°	64	64
Non-academic employment	0	0	0	56	56
Teaching in a 4-year college or university	4	0	°	117	121
Otherwise occupied or unknown	0	0	°	6	6
TOTAL	**4**	**4**	**4**	719	731

Other employment of part-time faculty

Seventy-three percent of part-time mathematics program faculty members either have full-time employment elsewhere or are graduate students. Table TYR.38 gives the breakdown of places of full-time employment for these part-time faculty members.

TABLE TYR.38 Other employment of part-time faculty in two-year college mathematics programs: Fall 1990.

Other employment of part-time faculty	Percent of part-time faculty
Employed full-time in:	
a high school	30%
a two-year college	9%
a four-year college	3%
industry or other	26%
Graduate student	5%
No full-time employment	27%

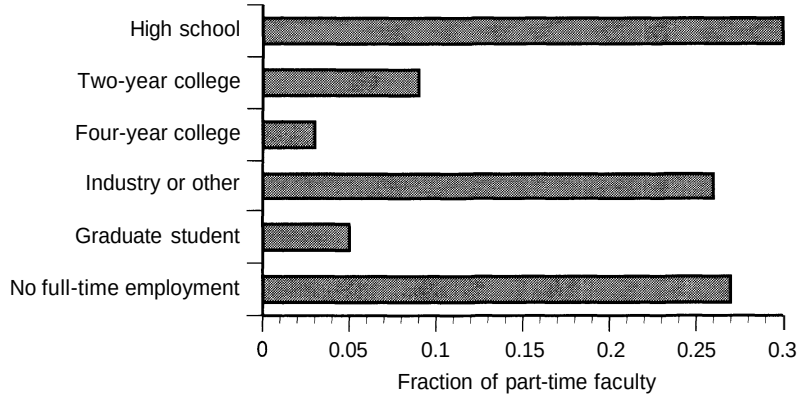

FIGURE TYR.38.1 Other employment of part-time faculty in mathematics programs at two-year colleges: Fall 1990.

Destinations of full-time mathematics program faculty

In 1984-1985, 52% of the full-time mathematics program faculty who left two-year college teaching either died or retired. The number of deaths/retirements in 1984-1985 was unusually large. Table TYR.39 shows that in 1989-1990, only 33% left two-year college teaching because of death or retirement.

From Table TYR.34 we see that faculty members begin to leave in fairly large percentages between ages 50-54 and ages 55-59.

Professional Activities of Two-Year College Mathematics Program Faculty

Table TYR.40 shows that the percentages of the full-time mathematics program faculty who participate in selected professional activities, as estimated by their department heads, are generally down from 1985.

TABLE TYR.39 Outflow of full-time faculty from mathematics programs at two-year colleges: 1989-1990.

	Doctorate			Masters/Bachelors	
Source	Math	Math Ed	Other		TOTAL
Died or retired	0	4	4	76	84
Teaching in a 4-year college or university	0	28	0	44	72
Teaching in a secondary school	0	0	0	0	0
Non-academic employment	0	0	0	53	53
Teaching in a 2-year college	0	0	6	54	60
Otherwise occupied or unknown	0	16	0	24	40
Returned to graduate school	0	0	0	8	8
TOTAL	0	48	10	259	317

TABLE TYR.40 Professional activity of full-time faculty in mathematics programs at two-year colleges: Fall 1990.

Activity	1975	1980	1985	1990
Attending at least one professional meeting per year	47%	59%	70%	67%
Taking additional math or computer science courses during the year	21%	22%	31%	15%
Attending mini-courses or short courses	na	na	31%	27%
Giving talks at professional meetings	9%	15%	16%	15%
Regular reading of articles in professional journals	47%	57%	72%	57%
Writing of expository and/or popular articles	5%	6%	6%	5%
Publishing research articles	na	na	3%	4%
Writing textbooks	15%	10%	4%	6%

Problems of the '90s

Department heads were asked to classify each of the problems in Table TYR.41 as "minor or no problem," "somewhat of a problem," or "major problem." Remediation was the only problem classified as "major" by a majority of mathematics program heads.

TABLE TYR.41 Problems in the teaching environment of mathematics programs at two-year colleges: Fall 1990.

	Rank		Percent classifying problem as major	
Problem	1985	1990	1985	1990
Remediation	2	1	60%	65%
Salary levels/patterns	3	2	53%	47%
The need to use temporary faculty for instruction	1	3	61%	42%
Student motivation	-	4	na	38%
Computer facilities for classroom use	4	5	50%	28%
Departmental support (travel funds, staff, secretary, etc)	5	6	41%	26%
Maintaining vitality of faculty	6	7	39%	22%
Advancing age of tenured faculty	11	7	25%	22%
Classroom/lab facilities	13	9	21%	18%
Office/lab facilities	15	10	19%	16%
Upgrading/maintaining computer facilities	8	11	30%	15%
Lack of curricular flexibility due to transfer requirements	-	12	na	10%
Class size	9	13	27%	10%
Coordinating math courses with secondary schools	15	14	19%	9%
Staffing computer science courses	7	15	34%	8%
Computer facilities for faculty use	9	16	27%	7%
Coordinating math courses for four-year colleges and universities	12	17	22%	6%
Lack of experienced senior faculty	17	18	7%	2%
Library: holdings, access, etc	17	19	7%	1%
Coordinating and/or developing math with vocational/technical programs	14	19	20%	1%
Losing full-time faculty to industry/ government	17	21	7%	0%

Table TYR.41 compares the percentage of mathematics program heads who classify the given problem as "major" in 1990 with the percentage who rated the problem a "5" or a "6" on a six point scale in 1985. The rankings have not changed much. The drop in the percentage of mathematics program heads who classify "the need to use temporary faculty for instruction" as a major problem is surprising in light of the 79% increase in the number of part-time faculty members since 1985 (see Table TYR.17). Perhaps the mathematics program heads no longer consider part-time instructors "temporary."

Administration of Mathematics Programs in Two-Year Colleges

Academic calendar

The most common academic calendar for two-year college mathematics programs is the semester system.

TABLE TYR.42 Academic calendars in two-year college mathematics programs: Fall 1990.

Academic calendar	Percent of two-year college mathematics programs
Semester	84%
Trimester	2%
Quarter	14%
4-1-4	0%
Other	0%

Administrative structure of two-year college mathematics programs

During the 1980s, there was a trend toward reorganizing the two-year college administrative structure so that the mathematics program was administered by a mathematics and science division head rather than by a mathematics or mathematics/computer science department chair. The percentage of two-year college mathematics programs administered under various structures in 1990 can be found in Table TYR.43.

TABLE TYR.43 Administrative structure of two-year college mathematics programs: Fall 1990.

Administrative structure	Percent of two-year college mathematics programs
Mathematics department	36%
Mathematics and computer science department	8%
Mathematics and science division or department	40%
No department structure	3%
Other (mostly department or division with mathematics and other disciplines)	13%

Term of department heads in two-year college mathematics programs

The department heads who filled out this survey have been in their positions for an average of almost 8 years. The position of department head rotates among faculty members in about 28% of two-year college mathematics programs, with two or three years being the typical length of a term.

APPENDIX I
ENROLLMENT NUMBERS IN ALL DEPARTMENTAL COURSES IN FOUR-YEAR COLLEGES SINCE 1970

Enrollment in Mathematics Courses (hundreds)

						1990 Enrollment											
						Math Dept.				Stat. Dept.				Comp. Sc. Dept.			
COURSES	1970	1975	1980	1985	1990	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Math Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Stat Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Com.Sc. Dept.
REMEDIAL																	
1. Arithmetic	40	60	140	150	62	16	30	15	62								
2. Gen. Math (Basic Skills)	190	260	490	310	167	28	64	76	167								
3. High School Elem. Alg.	250	260	740	750	684	138	238	307	684								
4. High School Int. Alg.	500	810	1040	1300	1691	500	594	598	1691								
Subtotal Remedial	980	1390	2410	2510	2604	682	926	996	2604								
PRECALCULUS																	
5. Coll. Alg.	920	800	1600	1500	2015	644	643	729	2015								
6. Trigonometry	310	310	380	370	369	164	151	54	369								
7. Comb. Coll. Alg. & Trig.	1130	790	610	780	353	176	95	82	353								
8. Elem. Function Precalculus	380	290	720	740	720	327	161	232	720								
9. Math for Lib. Arts	740	1030	630	590	534	163	193	178	534								
10. Finite Math	470	740	950	880	803	306	257	235	798	3			3	2			2
11. Bus. Math	180	470	480	370	370	120	220	30	370								
12. Math for Ele. Sch. Teachers	890	680	440	540	623	115	250	258	623								
13. Anal. Geo.	100	40	80	30	58	32	22	4	58								
14. Other Precalc	300	42	140	130	83	8	27	48	83								
Subtotal Precalculus	5420	5192	6030	5930	5928	2055	2019	1850	5923	3			3	2			2

NOTE: Read numbers in braces from top to bottom. For example, on p. 126 $\{^{2}_{0}$ is 20 (in hundreds). The numbers represent total enrollment for all courses included within the upper and lower horizontal lines.

Enrollment in Mathematics Courses (hundreds)

						1990 Enrollment											
						Math Dept.				Stat. Dept.				Comp. Sc. Dept.			
COURSES	1970	1975	1980	1985	1990	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Sub total Math Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Sub total Stat Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Sub total CmpSc Dept.
CALCULUS																	
15. Mainstream Calc I					2013	1008	387	618	2013								
16. Mainstream Calc II	330	340	405	410	878	474	172	232	878								
17. Mainstream Calc III, IV., etc.					837	454	159	224	837								
18. Non-Mainstream Calc I		890	105	129	1480	727	250	503	1480								
19. Non-Mainstream Cal. II, III, etc.					146	106	20	20	146								
20. Differential Equations	310	280	440	450	407	271	82	54	407								
21. Discrete Mathematics	N/A	N/A	N/A	140	177	42	49	83	174					2		1	3
22. Intro. to Math. Logic	N/A	N/A	N/A	N/A	13	10	3	0	13								
23. Linear/ Matrix Alg.	470	280	370	470	429	227	71	126	424	5							
24. Other Calc.	N/A	N/A	N/A	N/A	96	51	23	22	96								
Subtotal Calculus	4130	4490	5900	6370	6476	3370	1216	1882	6468	5			5	2		1	3
ADV. LEVEL																	
25. Trans. (Intro. to Proofs)	N/A	N/A	N/A	N/A	51	21	21	9	51								
26. Mod. Algebra	230	130	100	130	119	47	30	42	119								
27. Num. Theory	40	10	10	30	35	13	7	15	35								

Enrollment in Mathematics Courses (hundreds)

						1990 Enrollment											
						Math Dept.				Stat. Dept.				Comp. Sc. Dept.			
COURSES	1970	1975	1980	1985	1990	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Math Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Stat Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Com.Sc. Dept.
28. Combinatorics	0	0	10	40	27	13	4	5	22	5			5				
29. Graph Theory	0	N/A	N/A	10	12	7	3	2	12								
30. Coding Theory	N/A	N/A	N/A	0	5	3	0	2	5								
31. Actuarial Math.	N/A	N/A	N/A	N/A	15	7	6	2	15								
32. Foundation of Math.	80	10	10	30	6	2	3	1	6								
33. Set Theory	40	20	10	10	6	3	3	0	6								
34. Discrete Structures	N/A	N/A	N/A	70	30	10	7	11	28	1				1			1
35. History of Mathematics	40	20	20	20	21	5	9	7	21								
36. Geometry	130	50	40	70	81	17	24	40	81								
37. Math. for Sec. Sch. Teachers	70	30	10	50	44	14	24	6	44								
38. Mathematical Logic	20	0	20	20	5	4	1	0	5								
39. Adv. Calculus	200	140	110	140	101	47	20	34	101								
40. Adv. Math. for Engr. & Physics	120	90	140	100	104	66	24	10	100	4			4				
41. Vector Anal., Adv. Linear Alg.	50	40	80	140	85	65	13	7	85								
42. Adv. Diff. Equations	N/A	10	10	40	24	17	4	2	23					2		1	3
43. Partial Diff. Equations	20	30	20	50	20	15	3	2	20								
44. Numerical Analysis	N/A	50	100	130	78	41	15	21	77								
45. App. Math. for Engr. & Physics	10	10	20	40	23	12	4	7	23								
46. Complex Variables	70	40	30	50	41	21	7	13	41								
47. Real Analysis	110	60	40	50	63	32	10	21	63								
48. Topology	50	10	10	20	10	6	2	2	10								
49. Senior Sem./Ind. Study in Math.	N/A	N/A	40	20	23	7	5	11	23								
50. Other Mathematics	70	10	60	70	106	50	32	24	106								

Enrollment in Mathematics Courses (hundreds)

						1990 Enrollment											
						Math Dept.				Stat. Dept.				Comp. Sc. Dept.			
COURSES	1970	1975	1980	1985	1990	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Math Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Stat Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Com.Sc. Dept.
62. Int. to Oper. Research		N/A			45	15	4	19	38	1			1		1	5	6
63. Int. to Lin. Programming		N/A	20	60	28	18	4	6	28								
64. Other Oper. Research		N/A			10	0	5	10	5								
Subtotal Advanced Math	1350	760	910	1390	1218	583	289	326	1198	13	0	0	13	1	1	5	7
Mathematics Total	11880	11832	15250	16200	16226	6690	4450	5054	16193	21	0	0	21	5	1	6	12

Enrollment in Statistics Courses (hundreds)

						1990 Enrollment											
						Math Dept.				Stat. Dept.				Comp. Sc. Dept.			
COURSES	1970	1975	1980	1985	1990	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Sub total Math Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Sub total Stat Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Sub total Cm.Sc. Dept.
Statistics Courses																	
ELEM. LEVEL																	
51. Ele. Stat. (no Calc. Prereq.	360	740	870	1150	867	95	190	326	611	201	23	1	225	0	0	31	31
52. Prob. & Stat. (no Calc. Prereq.)	210	250	170	290	307	42	76	128	246	43	18	0	61	0	0	0	0
53. Probability (no Calc. Req.)					13	1	2	6	9	4	0	0	4	0	0	0	0
Subtotal Elem. Level	570	990	1040	1440	1187	138	268	460	866	248	41	1	290	0	0	31	31
UPPER LEVEL																	
54. Math. Stat. (Calculus)	160	140	160	240	169	45	50	38	133	34	0	1	35	1	0	0	1
55. Probability Calculus	110	80	130	150	135	60	27	25	112	21	2	0	23	0	0	0	0
56. Stochastic Processes	0	N/A	N/A	0	7	6	0	0	6	1	0	0	1	0	0	0	0
57. Appl. Stat. Analysis	70	100	80	110	114	14	18	13	45	48	1	1	50	0	0	19	19
58. Design & Anal. of Experiments	10	20	20	10	13	4	5	0	9	3	0	1	4	0	0	0	0
59. Regression (and Correlation)	N/A	N/A	10	10	28	6	7	1	14	12	0	1	13	0	0	1	1
60. Sen. Seminar/ Ind. Studies in Stat.	N/A	N/A	0	0	2	0	0	0	0	2	0	0	2	0	0	0	0
61. Other Statistics	10	80	30	120	84	41	16	4	61	19	1	0	20	0	0	3	3
Subtotal Upper Level	360	420	430	640	552	176	123	81	380	140	4	4	148	1	0	23	24
Statistics Total	920	1410	1470	2080	1739	314	391	541	1246	388	45	5	438	1	0	54	55

Enrollment in Computer Science Courses (hundreds)

						1990 Enrollment											
						Math Dept.				Stat. Dept.				Comp. Sc. Dept.			
COURSES	1970	1975	1980	1985	1990	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Math Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Stat Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Com.Sc. Dept.
Computer Science Courses																	
LOWER LEVEL																	
65. Computers & Society	N/A	N/A	N/A	N/A	690	18	74	244	336					67	180	106	353
66. Intro. to Software Packages	N/A	N/A	N/A	N/A	729	15	91	175	281					281	244	100	448
67. Issues in Comp. Sci.	N/A	N/A	N/A	N/A	86	0	0	9	9					55	3	19	77
68. Com. Prog. I (CS1 '78 or CS1 '84)	380	500	1540	1290	797	30	95	208	333					240	141	83	464
69. Com. Prog. II (CS2 '78)	N/A	130	320	280	230	5	24	46	75					79	46	30	155
70. Adv. Prog. & Data Str. (CS2 185)	N/A	N/A	N/A	150	163	8	17	25	50					62	28	23	113
71. Database Man. Systems	N/A	N/A	N/A	70	82	0	4	25	29					6	15	32	53
72. Discrete Mathematics	N/A	N/A	N/A	120	89	4	4	25	33					37	5	14	56
73. Other lower level service courses	N/A	N/A	N/A	900	523	9	108	77	194					210	86	33	329
Subtotal Lower Level	380	630	1860	3500	3388	89	417	834	1340					1000	604	444	2048
MIDDLE LEVEL																	
74. Intro. to Comp. Systems (CS3)	260	130	160	180	74	3	6	9	18					18	20	18	56
75. Assembly Lang. Prog.	N/A	N/A	N/A	240	157	6	19	34	59					45	27	26	98
76. Intro. to Comp. Organization	30	30	120	140	90	4	11	8	23					34	20	13	67
77. Intro. to File Processing (CS5)	N/A	30	70	100	55	0	4	18	22					13	15	5	33
Subtotal Middle Level	290	190	350	660	376	13	40	69	122					110	82	62	254
UPPER LEVEL																	
78. Oper. Sys. & Comp. Arch.	N/A	N/A	70	40	51	2	1	9	12					17	6	16	39
79. Operating Systems	N/A	N/A	N/A	110	97	4	10	10	24					37	18	18	73
80. Computer Architecture	N/A	N/A	N/A	60	60	3	7	9	19					31	5	5	41

Enrollment in Computer Science Courses (hundreds)

						1990 Enrollment											
						Math Dept.				Stat. Dept.				Comp. Sc. Dept.			
COURSES	1970	1975	1980	1985	1990	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Math Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Stat Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Com.Sc. Dept.
81. Compiler Design	10	10	N/A	40	41	4	3	4	11					17	10	3	30
82. Computer Graphics	N/A	N/A	N/A	N/A	50	3	6	5	14					26	8	2	36
83. Data Structures (CS7)	20	30	120	240	95	5	7	22	34					40	17	4	61
84. Survey of Prog. Languages	50	70	60	90	48	1	5	7	13					12	10	13	35
85. Computers & Society (CS9)	N/A	N/A	160	10	22	0	1	14	15					0	4	3	7
86. Oper. Sys. & Comp. Arch. II (CS10)	N/A	N/A	20	20	11	0	1	3	4					4	2	1	7
87. Principles of Data. Design	N/A	10	40	70	66	2	9	11	22					23	10	11	44
88. Artificial Intelligence (CS12)	N/A	10	10	50	53	4	7	4	15					28	7	3	38
89. Other topics in A.I. (e.g., vis. neural nets)	N/A	N/A	N/A	N/A	7	0	1	1	2					2	2	1	5
90. Expert Systems	N/A	N/A	N/A	N/A	7	0	1	1	2					2	2	1	5
91. Discrete Structures	10	30	90	40	24	3	2	3	8					9	1	6	16
92. Algorithms (CS13)	10	10	20	50	42	3	4	7	14					23	3	2	28
93. Software Design & Dev. (CS14)	N/A	N/A	20	80	54	0	4	5	9					29	11	5	45
94. Principles of Prog. Languages	20	20	10	60	71	2	6	17	25					30	7	9	46
95. Other topics in Prog. Lang. (e.g., vis. lang.)	N/A	N/A	N/A	N/A	11	0	2	7	9					2	0	0	2
96. Auto. Comp. & Formal Lang. (CS16)	0	10	20	40	39	3	4	0	7					19	8	5	32
97. Automata Theory	N/A	N/A	N/A	20	11	0	0	1	1					8	1	1	10

Enrollment in Computer Science Courses (hundreds)

						1990 Enrollment											
						Math Dept.				Stat. Dept.				Comp. Sc. Dept.			
COURSES	1970	1975	1980	1985	1990	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Math Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Stat Dept.	Univ. (PhD)	Univ. (MA)	Coll. (BA)	Subtotal Com.Sc. Dept.
98. Numerical Math. Anal. (CS17)	80	10	50	40	31	4	4	9	17					11	2	1	14
99. Numerical Methods	30	30	N/A	20	16	0	1	0	1					9	5	1	15
100. Num. Math. Linear Alg. (CS18)	N/A	N/A	10	20	9	3	1	4	8					1	0	0	1
101. Computer Networks	N/A	N/A	N/A	30	29	0	2	0	2					14	9	4	27
102. Modeling & Simulation	N/A	N/A	N/A	10	11	4	2	0	6					2	1	2	5
103. Parallel Arch. or Algorithms	N/A	N/A	N/A	6	3	0	0	0	0					1	1	1	3
104. Other topics in graphics (e.g., geo.met.)	N/A	N/A	N/A	0	0	0	0	0	0					0	0	0	0
105. Semantics & Verification	0	0	0	0	0	0	0	0	0					0	0	0	0
106. Complexity	N/A	N/A	N/A	3	0	0	0	0	0					1	0	2	3
107. Computational Linguistics	N/A	N/A	N/A	0	1	0	0	0	0					0	0	1	1
108. Senior Sem./ Ind. Study in CS	N/A	40	20	40	30	1	3	3	7					8	6	9	23
109. Other Computer Science	160	250	280	180	156	11	27	7	45					52	29	30	111
Subtotal Upper Level	390	530	1000	1420	1155	62	122	162	346					464	186	159	809
Total Computer Science	1060	1350	3210	5580	4919	164	579	1065	1808					1574	872	665	3111

APPENDIX II
SAMPLING AND ESTIMATION PROCEDURES

Sampling Procedure

The sampling frame was constructed using *The 1990 Mathematical Sciences Professional Directory* published by The American Mathematical Society and it consisted of those two-year colleges, four-year colleges, and universities in the U.S.A. including the District of Columbia that taught undergraduate mathematics courses. There was a total of 2439 such institutions. During the two years preceding the beginning of this study, the AMS data base was made as complete as possible. Enrollments of the schools were taken from *The HEP 90 Higher Education Directory.*

Institutions were classified according to the highest degree offered by the Department of Mathematics and were titled four-year universities (PhD), four-year universities (MA), four-year colleges (BA) and two-year colleges. This is the same classification used by the AMS/MAA Data Committee, (except for the addition of the two-year colleges), in conducting the annual surveys of Mathematics Departments published in *The Notices of The American Mathematical Society.* In all but one of the previous surveys, the sampling frame was based on a classification of schools used by the Center for Educational Statistics. The classification used for this survey both produces better data for the study of The Mathematical Sciences and Computer Science and produces data comparable with the annual Data Committee surveys.

Two-year colleges and four-year colleges were treated separately. Two-year colleges were divided into 10 strata based on control (public or private) and institutional enrollment. Four-year colleges were divided into 20 strata according to control (public or private), the classification (PhD, MA, and BA) and institutional enrollment. Standard sampling techniques were used to determine the sample size for each stratum and then random samples were drawn from each stratum. Since enrollment was used in the stratification, large schools were sampled much more heavily than small schools. Table 1 gives a short summary of the population and sample sizes.

Two separate questionnaires were used; one for two-year colleges and one for four-year institutions. Questionnaires were mailed to the Mathematics Department or Program at each sampled school. In addition, at the four-year schools all other known Statistics, Computer Science or additional Mathematical Sciences departments (such as Applied Mathematics or Operations Research) were mailed the questionnaire. Only 14 other Mathematical Sciences departments were found at the sampled schools. Copies of the two questionnaires are found in Appendices IV and V.

TABLE 1. Short summary of strata, number of schools in each strata and number of schools in the sample drawn from each strata.

	Number of strata	Population (No. of schools)	Sample (No. of schools)
Universities (PhD)	7	165	89
Universities (MA)	5	236	102
Four-year colleges (BA)	8	1020	123
Two-year colleges	10	1018	212
TOTAL	**30**	**2439**	**526**

TABLE 2. Number of Statistics and Computer Science Departments in the population and in the sample.

	Population	Sample
Statistics		
Universities (PhD)	53	32
Universities (MA)	5	4
Four-year colleges (BA)	2	2
TOTAL STATISTICS	**60**	**37**
Computer Science		
Universities (PhD)	136	75
Universities (MA)	107	52
Four-year colleges (BA)	240	36
TOTAL COMPUTER SCIENCE	**483**	**163**

Population sizes were estimated from the sampled schools

Table 2 summarizes the population and sample sizes for the separate Computer Science and Statistics Departments at four-year colleges and universities.

All projected enrollments in mathematics, statistics, operations research and computer science courses in four-year schools are based on the enrollments in the departments sampled in this survey. No attempt was made to collect data on enrollments in courses that were taught by other departments at the institutions. A limited attempt was made to estimate such enrollments at two-year colleges.

Estimation Procedures

Course enrollments and other information in this report are projected national figures for all institutions in the frame described above. In nearly all cases the statistics are for Fall 1990.

Projections were made using standard procedures for stratified random samples. For example, for Course A, if stratum *i* has *fy* schools in it of which n_i schools respond with an enrollment for Course A, and *Ei* is the total enrollment in Course A reported by these n_i schools, then the estimated total enrollment in Course A in stratum *i* is given by:

$$(N_i/n_i) * E_i.$$

Totals of interest are then computed by adding estimates for appropriate strata.

The procedure used to handle separate departments at the same institution varied with the question. For example, when projecting course enrollments, data from all departments at each school were combined before projections were made. On the other hand, most information on faculty was kept separate for the departments at each school.

Response rates and related information

The response rates are given in Table 3. A summary table by department in four-year schools is given in Table 4. The response rates are down slightly from the 1985-86 survey. However responding schools were spread fairly uniformly across the strata. In addition, sample sizes were larger than in the past so that actual number of respondents was higher than in any previous survey in this series which dates back to 1965-66.

TABLE 3. Population sizes, respondents, and response rates by type of school and department.

	Number of departments	Number in the sample	Respondents	Response rates
Universities (PhD)				
Mathematics	165	89	69	78%
Statistics	53	32	20	63%
Computer Science	136	75	42	56%
Universities (MA)				
Mathematics	236	102	79	77%
Statistics	5	4	3	75%
Computer Science	107	52	21	40%
Four-year colleges (BA)				
Mathematics	1020	123	69	56%
Statistics	2	1	1	100%
Computer Science	240	36	12	33%
Two-year colleges				
Mathematics programs	1018	212	102	48%

TABLE 4. Population sizes, sample sizes, respondents, and response rates by type of department in four-year schools.

	Number of departments	Number in the sample	Respondents	Response rate
Mathematics departments	1421	314	217	69%
Statistics departments	60	37	24	65%
Computer science departments	483	163	75	46%
TOTAL	1964	514	316	61%

TABLE 5. Comparison of actual enrollment of all schools in the population and this same enrollment estimated from responding schools in the sample by type of school.

	Estimated enrollment	Actual enrollment	Error
Universities (PhD)	3,049,266	3,038,912	0.34%
Universities (MA)	2,096,895	2,181,683	-3.89%
Four-year colleges (BA)	2,400,873	2,418,322	-0.72%
TOTAL four-year schools	7,547, 034	7,638,917	-1.20%
Two-year colleges	4,691,622	4,630,968	1.31%

The sampling frame had enrollments for all schools. These enrollments for the responding schools were used to project total enrollments for all schools in the population. Actual enrollments were found by adding enrollments for all schools. Table 5 contains a comparison of these results.

A list of all responding departments is included in Appendix III.

APPENDIX III
LIST OF RESPONDENTS TO THE SURVEY

Universities with PhD Programs in Mathematics

Arizona State University	Mathematics Electrical & Computer Science
Auburn University	Foundations, Analysis & Topology Computer Science & Engineering Algebra, Combinatorics & Analysis
Bowling Green State University	Computer Science
Brigham Young University	Mathematics Statistics
Carnegie Mellon University	Mathematics School Computer Science Statistics
Catholic University of America	Mathematics
Clarkson University	Mathematics & Computer Science
Clemson University	Mathematical Sciences Computer Science
Colorado State University	Computer Science
Cornell University	Mathematics Biometrics Unit Operations Research & Industrial Engineering
Dartmouth College	Mathematics & Computer Science
Drexel University	Mathematics & Computer Science
Idaho State University	Mathematics
Illinois Institute of Technology	Mathematics

Illinois State University	Mathematics
Marquette University	Mathematics, Statistics & Computer Science
Memphis State University	Mathematical Sciences
Michigan State University	Mathematics Computer Science Statistics & Probability
Mississippi State University	Mathematics & Statistics Computer Science
New Mexico State University	Mathematical Sciences
New York University/Courant Institute	Mathematics
North Carolina State University	Mathematics Statistics Mathematics & Science Education
North Dakota State University	Statistics Mathematics
Northeastern University	Mathematics Computer Science
Northwestern University	Mathematics Electrical Engineering & Computer Science Engineering Science & Applied Mathematics Industrial Engineering & Management Science
Ohio State University/Columbus	Mathematics Computer & Information Science Statistics
Pennsylvania State University/University Park	Mathematics Computer Science Statistics
Polytechnic University	Mathematics
Rensselaer Poly Institute	Mathematical Sciences
Rutgers University/New Brunswick	Mathematics Statistics
Southern Methodist University	Mathematics Computer Science & Engineering
Stanford University	Mathematics
SUNY at Binghamton	Mathematical Sciences Computer Science
SUNY at Buffalo	Computer Science Statistics Industrial Engineering

SUNY at Stony Brook	Mathematics Computer Science & Engineering Applied Mathematics & Statistics
Syracuse University	Mathematics Computer & Information Science
Temple University	Computer Science Management Science & Operations Research
Texas A & M University	Mathematics Computer Science Statistics
Texas Technology University	Mathematics
Tufts University	Mathematics Computer Science
University Alabama/Tuscaloosa	Mathematics Computer Science
University Alaska/Fairbanks	Mathematical Sciences
University Arizona	Mathematics Computer Science Statistics
University Calif/Berkeley	Electrical Engineering & Computer Science Industrial Engineering & Operations Research
University Calif/Davis	Division of Statistics
University Calif/Irvine	Mathematics
University Calif/Los Angeles	Mathematics
University Calif/San Diego	Mathematics Computer Science & Engineering
University Calif/Santa Barbara	Mathematics Statistics & Applied Probability
University Chicago	Mathematics
University Cincinnati	Mathematical Sciences Computer Science
University Colorado/Boulder	Mathematics Computer Science Program in Applied Mathematics
University Conn/Storrs	Mathematics Statistics
University Hawaii	Mathematics
University Idaho	Mathematics & Statistics Computer Science

University Illinois Urbana-Champaign	Mathematics Computer Science Statistics
University Maryland/Baltimore County	Computer Science
University Maryland/College Park	Mathematics Computer Science
University Michigan	Mathematics Statistics
University Minnesota/Minneapolis	School of Mathematics Computer Science
University North Carolina/Chapel Hill	Operations Research
University Nebraska/Lincoln	Computer Science & Engineering Biometry
University New Hampshire	Mathematics
University New Mexico	Mathematics & Statistics Computer Science
University North Texas	Mathematics Computer Science
University Notre Dame	Mathematics
University Oklahoma	Mathematics Electrical Engineering & Computer Science
University Rhode Island	Computer Science & Statistics
University South Florida	Mathematics Computer Science & Engineering
University Southern California	Mathematics Computer Science
University Texas/Arlington	Mathematics
University Texas/Austin	Mathematics Computer Science
University Washington	Mathematics Computer Science & Engineering Statistics
University Wisconsin/Madison	Mathematics Statistics
University Wisconsin/Milwaukee	Mathematical Sciences
University Wyoming	Mathematics
Washington State University	Pure & Applied Mathematics Computer Science

Wayne State University	Mathematics Computer Science
Yale University	Mathematics Statistics Operations Research

Universities with Master's Programs in Mathematics

Angelo State University	Mathematics Computer Science
Arkansas State University	Computer Science, Mathematics & Physics
Ball State University	Computer Science
Bemidji State University	Mathematics & Computer Science
Boston College	Mathematics
Calif Poly State University/Pomona	Computer Science & Statistics Statistics
Calif Poly State University/San Luis Obispo	Mathematics Computer Science
Calif State University/Fresno	Mathematics
Calif State University/Fullerton	Computer Science
Calif State University/Long Beach	Mathematics
Calif State University/Northridge	Mathematics
Calif State University/Sacramento	Mathematics & Statistics
Central Mich University	Mathematics
City College (CUNY)	Mathematics
Clark University	Mathematics & Computer Science
Cleveland State University	Mathematics Computer & Information Science
East Texas State University	Mathematics
Florida International University	Mathematics
Fordham University	Mathematics
George Mason University	Computer Science Operations Research & Applied Statistics
Georgia Southern University	Mathematics & Computer Science
Georgia Southwestern College	Mathematics
Georgia State University	Mathematics & Computer Science
Henderson State University	Mathematics & Computer Science

Hood College	Mathematics & Computer Science
Indiana State University	Mathematics & Computer Science
Indiana University of Pennsylvania	Mathematics Computer Science
Jacksonville State University	Mathematics, Computer & Information Science
Kean College of New Jersey	Mathematics & Computer Science
Kearney State College	Mathematics & Statistics Computer Science & Information Systems
Louisiana Technology University	Mathematics & Statistics Computer Science
Mankato State University	Mathematics, Astronomy & Statistics Computer Science
Marlboro College	Mathematics
Miami University/Oxford	Mathematics & Statistics
Millersville University of Pennsylvania	Mathematics
Minot State University	Mathematics & Computer Science
Mississippi College	Mathematics & Computer Science
New Jersey Institute of Technology	Computer & Information Science Mathematics
North Georgia College	Mathematics & Computer Science
Northeast Missouri State University	Division Mathematics & Computer Science
Northern Arizona University	Mathematics
Pacific Lutheran University	Mathematics & Computer Science
Plymouth State College	Mathematics
Portland State University	Mathematical Sciences
Purdue University/Calumet Campus	Mathematical Sciences
Rhode Island College	Mathematics & Computer Science
Roosevelt University	Mathematical Sciences
Salem State College	Mathematics
San Francisco State University	Mathematics
Seattle Pacific University	Mathematics
Seton Hall University	Mathematics & Computer Science
South Dakota School Mines & Technology	Mathematics & Computer Science
Southeast Missouri State University	Mathematics Computer Science

Southern University/Baton Rouge	Mathematics Computer Science
Southwest Missouri State University	Mathematics
St Cloud State University	Mathematics & Statistics Computer Science
Saint Xavier College	Mathematics & Computer Science
SUNY/College at Buffalo	Mathematics
SUNY/College at Geneseo	Mathematics
SUNY/College at New Paltz	Mathematics & Computer Science
University Akron	Mathematical Sciences
University Central Florida	Mathematics Statistics
University Colorado/Colorado Spr	Mathematics
University Dayton	Mathematics Computer Science
University Houston/Clear Lake	Mathematics
University Louisville	Mathematics
University Maine/Orono	Mathematics
University Nebraska/Omaha	Mathematics & Computer Science
University Nevada/Las Vegas	Computer Science Mathematical Sciences
University New Orleans	Mathematics Computer Science
University North Dakota	Mathematics Computer Science
University Southern Mississippi	Mathematics
University Vermont	Mathematics & Statistics Statistics Program
Villanova University	Mathematical Sciences
Virginia Commonwealth University	Mathematical Sciences
Virginia State University	Mathematics
West Chester University of Pennsylvania	Mathematics & Computer Science
Western Carolina University	Mathematics & Computer Science
Western Illinois University	Mathematics Computer Science
Western Oregon State College	Mathematics

Western Washington University	Mathematics Computer Science
Wilkes University	Mathematics & Computer Science
Wright State University/Dayton	Mathematics & Statistics

Colleges with No Graduate Programs in Mathematics

Alfred University	Division Mathematics & Computer Science
Andrews University	Mathematical Sciences
Athens State College	Mathematics & Physics
Baptist College at Charleston	Mathematics
Baruch College (CUNY)	Statistics & Computer Information Systems
Bentley College	Mathematical Sciences
Bloomsburg University of Pennsylvania	Mathematics & Computer Science
Boise State University	Mathematics
Bowie State College	Mathematics
Butler University	Mathematical Sciences
Calif State University/Chico	Computer Science
Calif State University/Dominguez	Mathematics
Cardinal Stritch College	Mathematics & Computer Science
Colby Sawyer College	Science
College of Charleston	Mathematics
College of Idaho	Mathematics
College of Mount Saint Joseph	Mathematics
College of Wooster	Mathematical Sciences
Concordia College, New York	Mathematics
Dakota State University	College Natural Sciences
DePauw University	Mathematics & Computer Science
Eastern College	Mathematics
Embry Riddle Aero University	Mathematics & Physical Science
Frostburg State University	Mathematics Computer Science
Gallaudet University	Mathematics & Computer Science
Hobart & William Smith College	Mathematics & Computer Science
Indiana University/Kokomo	Mathematics & Information Science

Indiana University/South Bend	Mathematics & Computer Science
Kennesaw State College	Mathematics
La Salle University	Mathematical Sciences
Lander College	Division Mathematics & Computer Science
Livingston University	Division Natural Science & Mathematics Computer Science
Loyola Marymount University	Mathematics
Mercer University	Mathematics
Merrimack College	Mathematics & Computer Science
Metropolitan State University	VP Academic Affairs
Milligan College	Mathematics Computer Science
Moorhead State University	Mathematics Computer Science
Northeastern State University/OK	Mathematics & Computer Science
Northern State University	Faculty Mathematics & Natural Science
Northwestern College	Mathematics and Computer Science
Oberlin College	Mathematics
Olivet Nazarene University	Mathematics
Ottawa University	Mathematics & Physics
Pepperdine University	Natural Science Division
Providence College	Mathematics & Computer Science
Queens College/CUNY	Mathematics Computer Science
Radford University	Mathematics & Statistics
Reed College	Mathematics
Rochester Institute of Technology	Mathematics Qualitative & Applied Statistics
Rose-Hulman Institute of Technology	Computer Science
Seton Hill College	Mathematics & Computer Science
Slippery Rock University of Pennsylvania	Mathematics
Saint Peters College	Mathematics
Stetson University	Mathematics & Computer Science
SUNY/College at Oswego	Mathematics Computer Science

Texas Christian University	Mathematics
University Hartford	Mathematics, Physics & Computer Science
University Hawaii at Hilo	Mathematics
University La Verne	Mathematics & Physics
University Pittsburgh/Johnstown	Mathematics Computer Science
University San Diego	Mathematics & Computer Science
University Tennessee/Chattanooga	Mathematics
University Tennessee/Martin	Mathematics & Computer Science
University Wisconsin/Stevens Point	Mathematics & Computer Science
Ursuline College	Mathematics
Virginia Military Institute	Mathematics & Computer Science
Weber State College	Mathematics Computer Science
Webster University	Mathematics & Computer Studies
Wellesley College	Mathematics
Western Maryland College	Computer Science
William Jewell College	Mathematics & Computer Studies
Williams College	Mathematics

Two-year Colleges

Anne Arundel Community College	Mathematics
Anoka-Ramsey Community College	Mathematics
Arizona Western College	Mathematics/Science
Ashland Community College	Mathematics/Natural Science/Computer Science
Austin Community College	Mathematics/Physical Science
Bakersfield College	Mathematics
Barton County Community College	Mathematics
Belleville Area College	Mathematics
Blinn College	Mathematics
Calhoun Community College	Mathematics
Cod Community College	Mathematics/Engineering/Technology
College	Mathematics

Chabot College	Science/Mathematics
Charles County Community College	Mathematics/Physics/Engineering
City College of San Francisco	Mathematics
Clark College	Mathematics
Clark County Community College	Mathematics
College of Lake County	Engineering/Mathematics/Physical Science
College of Marin	Mathematics
College of the Redwoods	Mathematics
Community College of Denver	Science/Technology
Cuesta College	Physical Science/Mathematics
De Anza College	Physical Science/Mathematics/Engineering
De Kalb College	Mathematics/Computer Science/Engineering
Des Moines Area Community College	Mathematics
Diablo Valley College	Mathematics/Computer Science
East Arkansas Community College	Mathematics
El Reno Junior College	Mathematics
Elizabeth Seton College	Mathematics
Essex Community College	Mathematics/Computer Science
Fullerton College	Mathematics/Computer Science
Glendale Community College	Mathematics
Grossmont College	Mathematics
Gulf Coast Community College	Mathematical Sciences
Harrisburg Area Community College	Mathematics/Engineering/Technology
Hopkinsville Community College	Mathematics/Science
Hostos Community College/CUNY	Mathematics
Houston Community College	Mathematics
Illinois Central College	Mathematics
Inver Hills Community College	Mathematics
Jefferson Community College	Natural Science/Mathematics
John Tyler Community College	Natural Science/Mathematics
Kapiolani Community College	Mathematics/Science
LaGuardia Community College	Mathematics
Lane Community College	Mathematics/Data processing

Lansing Community College	Mathematics/Computer Science
Lorain County Community College	Science/Mathematics
Los Angeles Trade-Technical College	Mathematics/Science
Los Medanos College	Mathematics
Louisiana State University/Alexandria	Mathematics
Macomb Community College	Mathematics
Mission College	Mathematics
Monroe Community College	Mathematics & Computer Science
Morton College	Mathematics
Mount San Antonio	Mathematics/Astronomy/Computer Science
Napa Valley College	Mathematics
Nashville State Technical Institute	Mathematics/Natural Science
Northeastern Junior College	Mathematics
Northwest Technical College	General Studies
New York City Technical College/CUNY	Mathematics
Ohlone College	Mathematics
Palm Beach Junior College	Business/Mathematics
Parkland College	Mathematics/Computer Science
Pasadena City College	Mathematics
Phoenix College	Mathematics
Portland Community College	Mathematics
Purdue Univ/North Central	Mathematics
Rancho Santiago College	Mathematics
Rock Valley College	Mathematics/Humanities
Rockland Community College	Mathematics
Rose State College	Engineering/Science
San Diego Mesa College	Mathematics
Sandhills Community College	Mathematics
Santa Fe Community College	Mathematics
Santa Monica College	Mathematics
Santa Rosa Junior College	Mathematics
Sauk Valley Community College	Business/Technology/Natural Science
Shasta College	Engineering/Technology

Skyline College	Mathematics
Southeastern Illinois College	Mathematics
Southern Seminole Junior College	Mathematics
Saint Augustine College	Mathematics
Saint Bernard Parish Community College	Mathematics
Saint Charles County Community College	Mathematics
Saint Petersburg Junior College	Mathematics
State Technical Institute/Memphis	Mathematics/Science
Suffolk County Community College	Mathematics
Sumter Area Technical College	Mathematics
Tacoma Community College	Mathematics
Tarrant County Junior College	Mathematics
Triton College	Mathematics/Computer Science
Umpqua Community College	Mathematics
Union County College	Mathematics
University Pittsburgh/Titusville	Mathematics
University Wisconsin Centers/Barron County	Mathematics
University Wisconsin Centers/Marathon County	Mathematics
University Wisconsin Centers/Marshfield County	Mathematics
University Wisconsin Centers/Waukesha County	Mathematics
Utah Valley Community College	Mathematics
Victoria College	Mathematics
Westark Community College	Mathematics/Science/Engineering
William Rainey Harper College	Mathematics/Science

APPENDIX IV
FOUR-YEAR COLLEGE SURVEY

Conference Board of the Mathematical Sciences

SURVEY OF UNDERGRADUATE PROGRAMS
in the
MATHEMATICAL SCIENCES AND COMPUTER SCIENCE
1990

GENERAL INSTRUCTIONS

You are asked to report on programs in the mathematical sciences (including applied mathematics, statistics, operations research) and computer science under the cognizance of your department. This questionnaire is being sent to each department in the mathematical sciences or computer science on your campus. It is **not** being routinely sent to computer centers or to non-departmental groups or programs.

Do **not** include data for branches or campuses of your institution that are geographically or budgetarily separate.

Because departments vary in course offerings and faculty composition, some questions (or parts of questions) may not be applicable to your department. Please read the instructions carefully and complete all pertinent questions. In some departments information for this survey might be obtained from other sources, e.g., undergraduate officer or librarian.

If you have any questions, please call Monica Foulkes at 1-800-321-4267.

Please return your completed questionnaire by November 1, 1990, to:

CBMS Survey
Attn: Monica Foulkes
American Mathematical Society
PO Box 6248
Providence, RI 02940-6248

Please do not write in this space

1. Name of your institution: _____

   Name of your department: _____

2. A. Your department offers programs leading to the following degrees (check all boxes that apply):

	None	Bachelor's	Master's	Doctor's
Mathematical sciences	☐	☐	☐	☐
Computer science	☐	☐	☐	☐

   B. Your academic calendar is:

   ☐ Semester ☐ Trimester ☐ Quarter ☐ 4-1-4 ☐ Other (specify)

3. Regular Undergraduate Program Courses, Fall 1990

Instructions for question 3:

- The undergraduate courses in column (1) in the following tables are listed in four groups corresponding roughly to a division into mathematics, statistics, operations research, and computer science. Within each group the courses are listed in approximate "catalog order" for your convenience in locating a listing that is a reasonable approximation to your offerings. If some of your courses do not fit our descriptions, or you have different levels of the same course, find the best approximation and enter your total fall 1990 enrollment and number of sections. Please do not double count. Additional spaces are provided to permit you to write in names of courses that do not fit reasonably under some listed title.
- Enter in column (2) the total number of students enrolled for fall 1990 and in column (3) the total number of sections of the course in the fall of 1990. If a course is not being taught in the fall of 1990 enter "0" (zero) in column (2). For advanced courses there is an additional column on frequency of offering. For some calculus-level courses and computer science courses there are additional columns asking for further information.

Please do not write in this space

Name of Course (or equivalent) (1)	Total Number of Students Enrolled Fall 1990 (2)	Total Number of Sections (3)
3.A. MATHEMATICS		
Remedial level		
1. Arithmetic		
2. General Mathematics (basic skills, operations)		
3. Elementary Algebra (high school)		
4. Intermediate Algebra (high school)		
Precalculus-level		
5. College Algebra		
6. Trigonometry		
7. College Algebra & Trigonometry, combined		
8. Elementary Functions, Precalculus Mathematics		
9. Mathematics for Liberal Arts		
10. Finite Mathematics		
11. Business Mathematics (including Introduction to Calculus)		
12. Mathematics for Elementary School Teachers		
13. Analytic Geometry		
14. Other Precalculus		

3. Regular Undergraduate Program Courses, Fall 1990 (Continued)

Please do not write in this space

Name of Course (or equivalent) (1)	Total Number of Students Enrolled Fall 1990 (2)	Total Number of Sections (3)	Of the number in column (3) how many sections - assign group projects (4)	use graphing calculators (5)	include writing components (6)	require computer assignments (7)
Calculus-level						
15. Mainstream* Calculus I						
16. Mainstream* Calculus II						
17. Mainstream* Calculus III (and IV, etc.)						
18. Non Mainstream Calculus I						
19. Non Mainstream Calculus II (and III, etc.)						
20. Differential Equations						
21. Discrete Mathematics						
22. Introduction to Mathematical Logic						
23. Linear Algebra or Matrix Theory						
24. Other Calculus-level						

Advanced Level (1)	(2)	(3)	If not offered in fall 1990, was it offered in 1989-90 or is it scheduled for spring 1991? Yes (4)	No
25. Transition (Introduction) to Proofs			☐	☐
26. Modern Algebra			☐	☐
27. Number Theory			☐	☐
28. Combinatorics			☐	☐
29. Graph Theory			☐	☐
30. Coding Theory			☐	☐
31. Actuarial Mathematics			☐	☐
32. Foundations of Mathematics			☐	☐
33. Set Theory			☐	☐
34. Discrete Structures			☐	☐

* A calculus course is mainstream if it leads to the usual upper division mathematical science courses.

3. Regular Undergraduate Program Courses, Fall 1990 (Continued)

Please do not write in this space

Name of Course (or equivalent) (1)	Total Number of Students Enrolled Fall 1990 (2)	Total Number of Sections (3)	If not offered in fall 1990, was it offered in 1989-90 or is it scheduled for spring 1991? (4) Yes	No
35. History of Mathematics			☐	☐
36. Geometry			☐	☐
37. Mathematics for Secondary School Teachers (methods, etc.)			☐	☐
38. Mathematical Logic			☐	☐
39. Advanced Calculus			☐	☐
40. Advanced Mathematics for Engineering and Physics			☐	☐
41. Vector Analysis, Advanced Linear Algebra			☐	☐
42. Advanced Differential Equations			☐	☐
43. Partial Differential Equations			☐	☐
44. Numerical Analysis			☐	☐
45. Applied Mathematics, Mathematical Modeling			☐	☐
46. Complex Variables			☐	☐
47. Real Analysis			☐	☐
48. Topology			☐	☐
49. Senior Seminar/Independent Study in Mathematics			☐	☐
50. Other Mathematics			☐	☐
3.A TOTAL NO. OF MATHEMATICS SECTIONS				

3. Regular Undergraduate Program Courses, Fall 1990 (Continued)

Please do not write in this space

Name of Course (or equivalent) (1)	Total Number of Students Enrolled Fall 1990 (2)	Total Number of Sections (3)	Of the number in column (3) how many sections require regular computer assignments? (4)
3.B. STATISTICS			
Elementary Level			
51. Elementary Statistics (no Calculus prerequisite)			
52. Probability and Statistics (no Calculus prerequisite)			
53. Probability (no Calculus required)			
Upper Level			If not offered in fall 1990, was it offered in 1989-90 or is it scheduled for spring 1991? Yes (4) No
54. Mathematical Statistics (Calculus)			☐ ☐
55. Probability (Calculus)			☐ ☐
56. Stochastic Processes			☐ ☐
57. Applied Statistical Analysis			☐ ☐
58. Design and Analysis of Experiments			☐ ☐
59. Regression (and Correlation)			☐ ☐
60. Senior Seminar/Independent Studies in Statistics			☐ ☐
61. Other Statistics			☐ ☐
3.B TOTAL NO. OF STATISTICS SECTIONS			
3.C. OPERATIONS RESEARCH			
62. Introduction to Operations Research			☐ ☐
63. Introduction to Linear Programming			☐ ☐
64. Other Operations Research			☐ ☐
3.C TOTAL NO. OF OPERATIONS RESEARCH SECTIONS			

3. Regular Undergraduate Program Courses, Fall 1990 (Continued)

In columns (4) - (8) answer YES or NO for each scheduled course.

[a] **A closed laboratory** is a regularly scheduled laboratory session (usually from 1 to 3 hours/week) during which students work on lab projects under direct supervision of a lab instructor.

[b] **An open laboratory** is used by students at their convenience (usually with assistance available).

[c] 78 refers to courses described in Curriculum 78, *Communications* of the Association for Computing Machinery, Vol. 22, No. 3 (March 1979) 147-166.

[d] **'84** refers to courses described in *Communications* of the Association for Computing Machinery, Vol. 27, No. 10 (October 1984) 998-1001.

[e] **'85** refers to courses described in *Communications* of the Association for Computing Machinery, Vol. 28, No. 8 (August 1985) 815-818.

Please do not write in this space

Name of Course (or equivalent) (1)	Total Number of Students Enrolled Fall 1990 (2)	Total Number of Sections (3)	Required Closed[a] Lab (4)		Required Open[b] Lab (5)		Do students in this course use: Micro? (6)		Mini/ Main-frame? (7)		Sci Work Station? (8)	
			Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
3.D. COMPUTER SCIENCE												
Lower Level												
65. Computers and Society												
66. Introduction to Software Packages												
67. Issues in Computer Science												
68. Computer Programming I (CS1 '78[c] or CS1 '84[d])												
69. Computer Programming II (CS2 '78[c])												
70. Advanced Programming & Data Structures (CS2 '85[e])												
71. Database Management Systems												
72. Discrete Mathematics												
73. Other lower level service courses												
Middle Level												
74. Introduction to Computer Systems (CS3)												
75. Assembly Language Programming												
76. Introduction to Computer Organization												
77. Introduction to File Processing (CS5)												

3. Regular Undergraduate Program Courses, Fall 1990 (Continued)

Name of Course (or equivalent) (1)	Total Number of Students Enrolled Fall 1990 (2)	Total Number of Sections (3)	Required Closed[a] Lab (4)		Required Open[b] Lab (5)		Do students in this course use: Micro? (6)		Mini/ Main-frame? (7)		Sci Work Station? (8)		Please do not write in this space
			Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
3.D. COMPUTER SCIENCE (CONTD.)													
Upper Level													
78. Operating Systems and Computer Architecture													
79. Operating Systems													
80. Computer Architecture													
81. Compiler Design													
82. Computer Graphics													
83. Data Structures (CS7)													
84. Survey of Programming Languages													
85. Computers and Society (CS9)													
86. Operating Systems and Computer Archit. II (CS10)													
87. Principles of Database Design													
88. Artificial Intelligence (CS12)													
89. Other topics in A.I. (e.g. visual, neural nets)													
90. Expert Systems													
91. Discrete Structures													
92. Algorithms (CS13)													
93. Software Design and Development (CS14)													
94. Principles of Programming Languages													
95. Other topics in program-ing Lang. (e.g. visual lang.)													
96. Automata, Computability & Formal Languages (CS16)													
97. Automata Theory													

3. Regular Undergraduate Program Courses, Fall 1990 (Continued)

Name of Course (or equivalent) (1)	Total Number of Students Enrolled Fall 1990 (2)	Total Number of Sections (3)	Required Closed[a] Lab (4) Yes / No	Required Open[b] Lab (5) Yes / No	Do students in this course use: Micro? (6) Yes / No	Mini/ Main-frame? (7) Yes / No	Sci Work Station? (8) Yes / No
3.D. COMPUTER SCIENCE (CONTD.)							
98. Numerical Mathematics: Analysis (CS17)							
99. Numerical Methods							
100. Numerical Mathematics: Linear Algebra (CS18)							
101. Computer Networks							
102. Modeling and Simulation							
103. Parallel Architecture or Algorithms							
104. Other topics in graphics (e.g. geometric modeling)							
105. Semantics & Verification							
106. Complexity							
107. Computational Linguistics							
108. Senior Seminar/Independent Study in CS							
109. Other Computer Science							
3.D TOTAL NO. OF COMPUTER SCIENCE SECTIONS							

Please do not write in this space

4. Last Year's Enrollment.

Responses to this question will be used to project total enrollment for this academic year, 1990-91, by the pattern of enrollment for the previous academic year, 1989-90.

The total student enrollment in your undergraduate courses was:

_____ for fall 1989

_____ for entire academic year 1989-90

5. Instructional Formats.

In the table below are listed four courses from the list in question 3, with the number in parentheses below the course title the same as in question 3. For each course please **enter the number of sections taught during the fall of 1990** in each of the formats listed in the column headings. The total for each course should equal the number of sections of this course reported in question 3. If a course was not offered by your department during fall 1990, leave blank.

Please do not write in this space

	Number of sections of course being taught in fall 1990 in each format					
	Small class (less than 40)	Large class (40 to 80)	Lecture without quiz sections (over 80)	Lecture with quiz sections (over 80)	Other format	Total
Mainstream Calculus I (15)						
Non mainstream Calculus I (18)						
Elementary Statistics (51)						
Computer Programming I (68)						

6. Mathematical Sciences and Computer Science Faculty, Fall 1990.

Some departments may have faculty in each of the following categories; others may not. For faculty members with joint appointments, include them if your department is primary. Please enter each member of your faculty (full or part-time) in one section only of 6.A, 6.B, 6C or 6.E, as relevant.

A. Full-time faculty teaching only departmental mathematical sciences courses.

Report the **number of full-time faculty** in your department who regularly teach only departmental mathematical sciences courses, including statistics (but not including computer science), by doctor's degree or other degree. Report all full-time faculty, including those on leave, whether tenured, tenure-eligible, fixed term, etc. Do not include visitors.

Doctor's degree _____ Other degrees _____

B. Full-time faculty teaching only departmental computer science courses.

Report the **number of full-time faculty** in your department who regularly teach only departmental computer science courses by highest degree earned and subject field in which it was earned. Report all full-time faculty, including those on leave, whether tenured, tenure-eligible, fixed term, etc. Do not include visitors.

Highest degree \ Subject field of degree	Mathematical sciences	Computer science	Other fields
Doctor's degree			
Other degrees			

6. Mathematical Sciences and Computer Science Faculty, Fall 1990 (Contd.)

Please do not write in this space

C. Full-time faculty teaching both departmental mathematical sciences and computer science courses.

Report the number of full-time faculty in your department who regularly teach both mathematical sciences and computer science courses by highest degree earned and subject field in which it was earned. Report all full-time faculty, including those on leave, whether tenured, tenure-eligible, fixed term, etc. Do not include visitors.

Highest degree \ Subject field of degree	Mathematical sciences	Computer science	Other fields
Doctor's degree			
Other degrees			

D. For the full-time faculty reported in 6.A, 6.B, and 6.C above, **how many** have:

a private, fully enclosed office? _____

a two-person, fully enclosed office? _____

other? _____

E. Faculty teaching part-time.

Report the **number** of faculty teaching part-time in your department. Do not include teaching assistants.

	Male	Female
i. Faculty teaching only departmental mathematical sciences courses in fall 1990, part-time		
ii. Faculty teaching only departmental computer science courses in fall 1990, part-time		
iii. Other part-time faculty		

F. Part-time Computer Science Faculty, as reported in question 6.E.ii above.

Report the **number of faculty teaching computer science part-time** in your department by highest degree and subject field in which it was earned.

(If the number is zero, check here: _____)

Highest degree \ Subject field of degree	Mathematical sciences	Computer science	Other fields
Doctor's degree			
Other degrees			

6. Mathematical Sciences and Computer Science Faculty, Fall 1990 (Contd.)

Please do not write in this space

G. Of the part-time computer science faculty reported in 6.F above, **how many** were

i. employed full-time by your university or college? _____

ii. employed full-time by some other university or college? _____

iii. employed full-time by a high school? _____

iv. employed full-time but not in an educational institution? _____

v. not employed full-time anywhere? _____

H. Number of current graduate teaching assistants in your department: _____

7. Report the **total number of sections** in each of the main groupings of courses in question 3 (Mathematics, 1-50; Statistics, 51-61; Operations Research, 62-64; Computer Science, 65-109) that were taught by your faculty as reported in 6.A, 6.B, 6.C, and 6.E, respectively.

Also include all sections taught by graduate students teaching their own courses.

	Total number of sections taught in			
	Mathematics courses #1-50	Statistics courses #51-61	Operations research courses #62-64	Computer science courses #65-109
By full-time faculty teaching only mathematical sciences courses (6.A)				
By full-time faculty teaching only computer science courses (6.B)				
By full-time faculty teaching both mathematical sciences and computer science courses (6.C)				
By part-time faculty (6.E)				
By teaching assistant teaching own course				
TOTALS*				

* Column totals should be the same as those obtained in 3.A, 3.B, 3.C and 3.D, respectively.

8. Faculty: Age and Tenure Status.

Report separately the **number of male and female full-time faculty,** as reported in questions 6.A, 6.B and 6C, whose birth date falls **within** the calendar period specified.

	Date of birth / Sex	Before 1924	1924-30	1931-35	1936-40	1941-45	1946-50	1951-55	1956-60	After 1960
A. Tenured faculty	Male									
	Female									
B. Untenured faculty	Male									
	Female									

8. C. Faculty: Sex and Racial/Ethnic Group.

Please report the **number of your full-time faculty** given in 6.A, 6.B and 6.C who are:

Please do not write in this space

	Male	Female
American Indian/Alaskan native		
Asian/Pacific Islander		
Black, not of Hispanic origin		
Mexican American, Puerto Rican or other Hispanic		
White, not of Hispanic origin		

9. Teaching Load.

For fall 1990, report the expected (or typical) weekly teaching load in **classroom contact hours** for your full-time mathematical sciences and computer science faculty given in 6.A, 6.B and 6.C (excluding thesis supervision).

	Mathematical Sciences (other than statistics)	Statistics	Computer Science
A. Professors (Assistant, Associate, Full)			
B. Instructors and Lecturers			

10. Retirements and Deaths.

For the period September 1, 1989 to August 31, 1990, report the **number** of your regular departmental faculty who:

retired from full-time service_____ died_____

11. Departmental Bachelor's Degrees.

A. Report the **number of bachelor's degrees** with majors in a mathematical or computer science awarded by your department between July 1, 1989 and June 30, 1990: _____

B. Of the number in 11.A, report the **number** who **majored in:**

	Male	Female
Mathematics (including Applied)		
Mathematics Education		
Computer Science		
Statistics		
Actuarial Mathematics		
Operations Research		
Joint Computer Science & Mathematics		
Joint Mathematics and Statistics		
Joint Computer Science & Statistics		
Other		

C. Of the number in 11.A, report **how many** completed the requirements for secondary level certification in your state: _____

Please do not write in this space

Department Support.

12. Report the number of departmental support staff positions currently supported from institutional funds: _____

13. Report the total departmental travel funds expended from institutional funds during the last full fiscal year: $ _____

14. Services to departmental majors.

Please indicate which of the following are available to your departmental majors. Check YES or NO for each item.

		Available to departmental majors		
		Yes	No	
A.	Departmental or institutional math placement exams for entering (intended) majors	☐	☐	A
B.	Honors calculus sections for (intended) majors	☐	☐	B
C.	College credit for high scores on the advanced placement exams given by Educational Testing Service	☐	☐	C
D.	College credit for high scores in departmental or institutional placement exams	☐	☐	D
E.	Intern/cooperative program	☐	☐	E
F.	Special lectures/colloquium	☐	☐	F
G.	Special study areas	☐	☐	G
H.	Active mathematics and/or computer science club	☐	☐	H
I.	Regularly offer opportunity to solve problems, prepare for mathematical contest in modeling, actuarial exams, etc., with direct faculty involvement	☐	☐	I
J.	Departmental or institutional honors program	☐	☐	J
K.	Research projects	☐	☐	K
L.	Comprehensive (senior) exam(s)	☐	☐	L
M.	Senior project or thesis	☐	☐	M
N.	Regular program of social activities involving majors and faculty	☐	☐	N
O.	Graduate school advising	☐	☐	O
P.	Other career advising	☐	☐	P

15. Information on mathematical sciences major programs in your department.

This question pertains **ONLY** to mathematical sciences majors, not computer science or joint majors. Please interpret "require" and "requirements" to include courses taken by contract or by general consensus, even though occasional exceptions occur.

A. How many distinct options (or tracks, etc.) do you offer for mathematical sciences majors in your department? _____

B. Of these options,

i. how many require at least six courses (semester length or equivalent) at the advanced junior-senior level? _____

ii. how many require a junior-senior level course in analysis/advanced calculus? _____

iii. how many require a junior-senior level course in modern algebra? _____

iv. how many require a junior-senior level course in geometry/topology? _____

v. how many require a junior-senior level course in linear algebra? _____

vi. how many require a junior-senior level course in problem solving and/or modeling? _____

vii. how many require at least one sequence of two (or more) courses? _____

Mathematical Sciences Library.

Please do not write in this space

Questions 16-22 are to be answered **ONLY** by the mathematics (or mathematical sciences) department, and are NOT to be answered by any other department(s), e.g., statistics, computer science, operations research.

For questions 16-22 "mathematical sciences library" means the main mathematical sciences collection used by the mathematical sciences faculty and are those titles with QA (Library of Congress) or 510-519 (Dewey) designation.

16. Description of mathematical sciences library.

A. Check the box that best describes your mathematical sciences library:

- ☐ i. Part of a separate mathematical sciences and/or computer science library.
- ☐ ii. Contained within a larger library unit.
- ☐ iii. Other (describe):_____

B. If you checked box (ii) or (iii) above, do you have a departmental reading room? Yes ☐ No ☐

C. Are all (or most) current unbound mathematical sciences journals displayed separately (either in a library or reading room)? Yes ☐ No ☐

17. The catalog of the mathematical sciences library is: (Check all boxes that apply)

A. in manual card form only ☐

B. partly manual and partly online ☐ with access from faculty offices ☐

C. completely online ☐ with access from faculty offices ☐

D. in other form such as microform (describe) ☐ _____

18. Electronic products available inhouse in the mathematical sciences library are: (Check all boxes that apply)

A. MathSci tapes (full database) ☐ with access from faculty offices ☐

B. MathSci on CD ROM ☐ with access from faculty offices ☐

C. Science Citation Index on CD ROM ☐ with access from faculty offices ☐

19. Report the **number of currently received mathematical sciences journal titles** in the mathematical sciences library. _____

20. Report the **approximate number of volumes** in the mathematical science holdings (QA or 510-519) that are:

A. shelved in the mathematical sciences library _____

B. in remote storage _____

21. In a typical full (seven day) week in this academic year, approximately **how many total hours** is the mathematical sciences library open to students? _____

22. For the last five years, which **best describes** the overall effectiveness of the mathematical sciences library in these areas?

	Improved	Little change	Deteriorated
A. collection of books and journals	☐	☐	☐
B. physical facilities (including space)	☐	☐	☐
C. staffing	☐	☐	☐
D. hours of opening	☐	☐	☐
E. budget	☐	☐	☐

Please do not write in this space

Questions 23-26 are to be answered **ONLY** by departments having a computer science major.

23. Of the number of students taking departmental courses using computers in fall 1990, report the **average number** of student enrollments per computer station (inc. terminals, pc's etc.) by checking the appropriate box:

0-5	6-10	11-15	16-20	21 or more
☐	☐	☐	☐	☐

24. Of the non computer science courses listed in question 3A, 3B, and 3C, **encircle** (by code numbers in question 3) those required for computer science majors:

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48

49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64

25. Report the **total number** of mathematical sciences credit hours (semester hours or equivalent) at the calculus level and above normally taken by computer science majors. _____

26. Please **rate the accessibility** of computer stations (including terminals, pc's etc.) both for students in your classes and for homework assignments. Check the appropriate box for each level of class given in question 3.D:

Class	Poor	Adequate	Good	Very good	Superb
Lower level (#65-73)	☐	☐	☐	☐	☐
Middle level (#74-77)	☐	☐	☐	☐	☐
Upper level (#78-109)	☐	☐	☐	☐	☐

27. The approximate number of hours required to complete this questionnaire was: _____

If you have found some question(s) difficult to interpret or answer, please let us know. We welcome comments or suggestions for future surveys.

_____

_____

Information supplied by: _____

Title and Department: _____

Institution and Campus: _____

_____
Street City State Zip

Telephone: ( ) _____ Date: _____

Please return completed questionnaire by November 1, 1990, to:
American Mathematical Society, Attn: M. Foulkes, P.O. Box 6248, Providence, RI 02940-6248

Thanks to all who helped in completing this survey; I appreciate the time spent.

Donald C. Rung

APPENDIX V
TWO-YEAR COLLEGE SURVEY

Conference Board of the Mathematical Sciences

SURVEY OF PROGRAMS
in
MATHEMATICS AND COMPUTER SCIENCE
in
TWO-YEAR COLLEGES
1990

GENERAL INSTRUCTIONS

This questionnaire should be completed by the person who is directly in charge of the mathematics program at your institution.

You are asked to report on **ALL** the courses and faculty in your institution which fall under the general heading of the mathematical or computer sciences. For some colleges this may involve courses and faculty in statistics, applied mathematics and computer science that are mathematical in nature, but are taught outside the mathematics department. If your institution does not have a departmental or divisional structure, consider the group of all mathematics and computer science professors to be the "mathematics department" for the purpose of this questionnaire.

Question 3 below refers to courses taught in the "mathematics department" as explained above. Question 4 refers to mathematics and/or computer science courses taught outside the "mathematics department".

Please include data on part-time and evening students and faculty as well as data on occupational and terminal programs. Include non-credit and remedial courses. Do NOT, however, include data concerning campuses jurisdictionally separate from yours, if such exist.

If you have any questions, please call Monica Foulkes at 1-800-321-4267.

Please return your completed questionnaire by November 1, 1990, to:

CBMS Survey
Attn: Monica Foulkes
American Mathematical Society
PO Box 6248
Providence, RI 02940-6248

Please do not write in this space

1. A. Name of your institution: _____

If this two-year institution is part of a larger organization, identify this relationship: _____

B. Your academic calendar is:

☐ Semester ☐ Trimester ☐ Quarter ☐ 4-1-4 ☐ Other (specify)

2. How is the mathematics program administered at your institution?

☐ Mathematics department
☐ Mathematics and Computer Science department
☐ Mathematics and Science department or division
☐ No department structure
☐ Other (specify): _____

3. Courses in the Mathematical and Computer Sciences offered by your mathematics department in the Fall 1990.

Instructions for question 3:

A. The courses in column (1) in the following table are listed with typical course titles (which may not necessarily coincide with the titles you use). Additional spaces (36 and 37) are provided to permit you to write in names of courses which do not fit reasonably under some listed title. Please use your best judgment as to how courses should be listed.

For the purpose of this survey, consider as a single course instruction in a particular area of mathematics which you offer as a sequence of two or more parts (e.g., calculus).

B. For each course in column (1) that is offered during fall 1990, write in column (2) the total number of students who enrolled in the course in the fall term of 1990. If a course is not being taught in the fall of 1990, enter "0" (zero) in column (2).

C. In column (3) give the total number of sections of the course in fall 1990.

D. In column (4) give the total number of sections of this course taught by faculty teaching part-time in your department.

E. In column (5) give the total number of sections of this course for which a hand calculator is recommended.

F. In column (6) give the total number of sections of this course in which computer homework assignments are regularly given.

G. Courses 17 through 37 contain an additional column concerning availability of the course.

NOTE: There should be entries in each of columns (2) through (6), as well as column (7) for courses 17 through 37.

Name of Course (or equivalent) (1)	Total Number of Students Enrolled Fall 1990 (2)	Total Number of Sections (3)	Number of sections taught by part-time faculty (4)	No. of sections in which hand calculators are recommended (5)	No. of sect. in which computer assignments are regularly given (6)	Please do not write in this space: No. of Sections which assign group projects (7)	No. of Sections which include writing components (8)
1. Arithmetic							
2. General Mathematics (basic skills, operations)							
3. Pre-algebra							
4. Elementary Algebra (high school)							
5. Intermediate Algebra (high school)							
6. High School Geometry							
7. College Algebra							
8. Trigonometry							
9. College Algebra and Trigonometry, combined							
10. Precalculus/Elementary Functions							
11. Analytic Geometry							
12. Mainstream* Calculus I (math, physics, sci & engineering)							
13. Mainstream* Calculus II (math, physics, sci & engineering)							
14. Mainstream* Calculus III (math, physics, sci & engineering)							
15. Non Mainstream Calculus I (biological, sociological & management sciences)							
16. Non Mainstream Calculus II (biological, sociological & management sciences)							

* A calculus course is mainstream if it leads to the usual upper division mathematical science courses.

3. Courses in the Mathematical and Computer Sciences offered by your mathematics department in the Fall 1990 (Contd.)

Please do not write in this space

Name of Course (or equivalent) (1)	Total Number of Students Enrolled (2)	Total Number of Sections (3)	Number of sections taught by part-time faculty (4)	No. of sections in which hand calculators are recommended (5)	No. of sect. in which computer assignments are regularly given (6)	If not offered in fall 1990, was it offered in 1989-90 or is it scheduled for spring 1991? Yes (7) No
17. Differential Equations						☐ ☐
18. Linear Algebra						☐ n
19. Discrete Mathematics						n n
20. Finite Mathematics						n n
21. Mathematics for Liberal Arts						n n
22. Business Mathematics (including Introduction to Calculus)						n n
23. Mathematics for Elementary School Teachers						n n
24. Elementary Statistics						n n
25. Probability (and Statistics)						n n
26. Technical Mathematics						n n
27. Technical Mathematics (Calculus level)						n n
28. Use of Hand Calculators						n n
29. Computers and Society						n n
30. Data Processing, Elementary or Advanced						n n
31. Elementary Programming (BASIC, Fortran, Pascal, Cobol)						n n
32. Advanced Programming						n n
33. Database Management						n n
34. Assembly Language Programming						n n
35. Data Structures						n n
36. Other Computer Science Courses						n n
						n n
37. Other Mathematics Courses						n n
						n n

4. Outside Enrollments - Fall 1990.

This question identifies courses in mathematics or computer science taught in divisions or departments of your institution, including units concerned primarily with remedial mathematics, **OTHER THAN** that division or department having primary responsibility for mathematics.

Enter in the relevant boxes an estimate of the total course enrollments for **fall 1990.** Please consult schedules to give good estimates of numbers of enrollments. Please enter "0" (zero) in each box for which there are no courses given.

Please do not write in this space

Course	Enrollment in courses given by division specializing in:				
	Natural Sciences	Occupational Programs	Business	Social Sciences	Other
1. Arithmetic					
2. Elementary Algebra (high school)					
3. Intermediate Algebra (high school)					
4. College Algebra					
5. Trigonometry or Precalculus College Math.					
6. Calculus or Differential Equations					
7. Business Mathematics					
8. Statistics/Probability					
9. Computer Science & Programming					
10. Data Processing					
11. Technical Mathematics					
12. Other					

5. Mathematics Faculty.

A. FULL-TIME FACULTY:

Indicate in the table below the numbers of your full-time mathematical and computer sciences faculty members teaching courses reported in question 3 above, according to their highest degrees and subject fields in which these were earned:

Highest Degree \ Subject Field	In Mathematics	In Statistics	In Computer Science	In Mathematics Education	In another field
Ph.D.					
Ed.D.					
Dr. Arts					
Master's degree, plus 1 year					
Master's degree					
Master's degree (special program) e.g., MAT, MST					
Bachelor's degree					

TOTAL NUMBER OF FULL-TIME FACULTY: _____

5. Mathematics Faculty (Contd.)

Please do not write in this space

B. What is the expected (or typical) weekly teaching load in classroom contact hours for members of your full-time faculty? _____

C. How many of your full-time faculty teach extra hours for extra pay? _____

D. What is the average overload (in contact hours) for those faculty? _____

E. PART-TIME FACULTY:

In the table below, indicate the numbers of your faculty who teach part-time in your department by highest degrees and subject fields.

Highest Degree \ Subject Field	In Mathematics	In Statistics	In Computer Science	In Mathematics Education	In another field
Ph.D.					
Ed.D.					
Dr. Arts					
Master's degree, plus 1 year					
Master's degree					
Master's degree (special program) e.g., MAT, MST					
Bachelor's degree					

TOTAL NUMBER OF PART-TIME FACULTY: _____

F. What is the average weekly teaching load in contact hours of part-time faculty? _____

G. Of your part-time faculty reported in 5.E, how many are:

Employed Full-time in							
High School	Another Two-year College	Another Department of your own College	Four-year College	Industry or Other	Graduate Students	Not Graduate Students & Not Employed Full-time Anywhere	Total Number of Part-time Faculty
a	b	c	d	e	f	g	t

NOTE: You should have t = a + b + c + d + e + f + g
= the number reported in 5.E

6. Computer Access and Usage

A. How many personal computers, terminals and workstations are available for use of mathematics students in a mathematics lab? _____

B. How many personal computers, terminals and workstations are available for use of mathematics students in other locations on campus? _____

C. How many personal computers, terminals and workstations are available for the exclusive use of mathematics faculty? _____

D. How many personal computers, terminals and workstations are available for use in mathematics classrooms? _____

6. Computer Access and Usage (Contd.)

Please do not write in this space

E. In a typical week, how many of your full-time faculty:

i. use a computer for classroom demonstrations? _____

ii. assign homework requiring use of a computer? _____

iii. use a computer to construct tests or homework assignments? _____

iv. use a computer algebra system? _____

7. Instructional Formats.

Please indicate the extent to which the following formats are employed at your institution. Place a check in the appropriate column.

	Is not being used	Is used by some faculty	Is used by most faculty
1. Standard lecture - recitation system (Class size under 40)			
2. Large lecture classes (over 40) with recitation sections			
3. Large lecture classes (over 40) with no recitation			
4. Organized program of independent study			
5. Courses by television (closed circuit or broadcast)			
6. Courses by film			
7. Courses by programmed instruction			
8. (CAI) Courses by computer-assisted instruction			
9. Modules			
10. Audio-tutorial			
11. (PSI) Personalized Systems of Instruction			
12. Other			

8. Services for Students.

A. MATH LABS

i. Does your institution operate a math lab or tutorial center? Yes ☐ No ☐

ii. Was your lab established after 1985? Yes ☐ No ☐

iii. Personnel of the math lab include (check all relevant categories):

Full-time members of the mathematics staff ☐

Part-time members of the mathematics staff ☐

Students ☐

Members of another department ☐

Paraprofessionals ☐

Other _____ ☐

Please do not write in this space

8. Services for Students (Contd.)

B. OTHER STUDENT SERVICES

Below is a list of services which might be available to your mathematics majors or more generally to students taking mathematics courses. Please check YES or NO for each item.

i. Honors sections	Yes ☐	No ☐
ii. Active mathematics club	Yes ☐	No ☐
iii. A program of social activities for mathematics majors and faculty	Yes ☐	No ☐
iv. Regularly offer opportunities for students to compete in math contests	Yes ☐	No ☐
v. Mandatory placement exams	Yes ☐	No ☐
vi. Advisory placement exams	Yes ☐	No ☐
vii. Special lectures/colloquia for students	Yes ☐	No ☐

C. NUMBER OF MATHEMATICS MAJORS

Please indicate the number of mathematics majors: _____

9. Faculty Employment and Mobility.

A. How many of your full-time faculty members were newly appointed on a full-time basis this year? _____

Of this number, **during the previous year 1989-90**, how many were:

With Doctorate (Math)	With Doctorate (Math Ed)	With Other Doctorate	With No Doctorate	
				i. enrolled in graduate school
				ii. teaching in a 4-year college or university
				iii. teaching in another 2-year institution
				iv. teaching in a secondary school
				v. employed by you part-time
				vi. employed in nonacademic position
				vii. otherwise occupied or unknown

B. How many of your new appointments had previously taught in your department on either a part-time or a full-time basis? _____

C. Of the full-time faculty **in 1989-90** who are no longer part of your full-time faculty, how many:

With Doctorate (Math)	With Doctorate (Math Ed)	With Other Doctorate	With No Doctorate	
				i. died, or retired
				ii. are teaching in a 4-year college or univ.
				iii. are teaching in a 2-year institution
				iv. left for a nonacademic position
				v. returned to graduate school
				vi. left for secondary school teaching
				vii. are otherwise occupied or unknown

10. Age, Sex and Ethnic Group of Full-time Faculty.

Please do not write in this space

Record the number of full-time faculty members in each category:

	AGE							
	Under 30 (Born after 1960)	30-34 (Born 1956-60)	35-39 (Born 1951-55)	40-44 (Born 1946-50)	45-49 (Born 1941-45)	50-54 (Born 1936-40)	55-59 (Born 1931-35)	60 and over (Born before 1931)
Bachelor's								
Master's								
Doctor's								
Men								
Women								
American Indian/Alaskan native								
Asian/Pacific Islander								
Black (not of Hispanic origin)								
Mexican American, Puerto Rican or other Hispanic								
White (not of Hispanic origin)								

11. Professional Activities

Estimate **the number** of full-time members of your department who, in the past year,

A. attended at least one professional meeting _____ A

B. took additional mathematics or computer science courses _____ B

C. attended minicourses or short courses _____ C

D. gave talks at professional meetings _____ D

E. regularly read articles in professional journals _____ E

F. wrote expository and/or popular articles _____ F

G. published research articles _____ G

H. wrote textbooks _____ H

12. Problems of the 90's.

Below are some concerns cited by many departments. Please rate each of the concerns given below by **placing a check in the appropriate box.**

	Minor or no problem	Somewhat of a problem	Major problem	
A. Losing full-time faculty to industry/government	☐	n	n	A
B. Maintaining vitality of faculty	☐	n	☐	B
C. Advancing age of tenured faculty	n	n	n	C
D. Lack of experienced senior faculty	n	n	n	D
E. Staffing computer science courses	n	n	n	E
F. The need to use temporary faculty for instruction	n	n	n	F
G. Salary levels/patterns	n	n	n	G
H. Class size	n	☐	n	H

12. Problems of the 90's (Contd.)

Please rate by checking the appropriate box.

	Minor or no problem	Somewhat of a problem	Major problem	Please do not write in this space
I. Student motivation	☐	☐	☐	I
J. Remediation	☐	☐	☐	J
K. Library: holdings, access, etc.	☐	☐	☐	K
L. Departmental support sources (travel funds, staff, secretary, etc.)	☐	☐	☐	L
M. Computer facilities for faculty use	☐	☐	☐	M
N. Upgrading/maintenance of computer facilities	☐	☐	☐	N
O. Computer facilities for classroom use	☐	☐	☐	O
P. Office/lab facilities	☐	☐	☐	P
Q. Classroom/lab facilities	☐	☐	☐	Q
R. Coordinating and/or developing mathematics courses for vocational/technical programs	☐	☐	☐	R
S. Coordinating mathematics courses with high schools	☐	☐	☐	S
T. Coordinating mathematics courses with 4-year colleges and universities	☐	☐	☐	T
U. Lack of curricular flexibility because of transfer requirements	☐	☐	☐	U
V. Other, specify: _____	☐	☐	☐	V

Information supplied by: _____

Title: _____

Academic field: _____

Address: _____

Telephone: _____
Area code Number Extension

1. How long have you been in charge of the mathematics program? _____

2. Is the chairmanship rotating? Yes ☐ No ☐

   If yes, what is the frequency of rotation? _____

3. If you have found any of the above questions difficult to interpret or to answer, let us know. We welcome comments or suggestions for future surveys.

Please return completed questionnaire by November 1, 1990, to:
American Mathematical Society, Attn: M. Foulkes, P.O. Box 6248, Providence, RI 02940-6248

Thanks to all who helped in completing this survey; we appreciate the time spent.

Donald J. Albers Donald C. Rung

Reference

This survey presents a detailed portrait of the undergraduate programs and faculty in the disciplines of mathematics, statistics and computer science. Information is presented on such topics as enrollment, faculty, course offerings, and library holdings. Data are given on groups of departments aggregated by the highest mathematics degree offered. There is a separate section on two-year colleges. Thus data are organized according to the traditional divisions: PhD, MA, and BA granting departments; at the two-year level some data are presented according to geographic region, as well.

This is the latest in a series of surveys begun in 1965 and appearing every five years, all sponsored by the Conference Board of the Mathematical Sciences.

The data are organized into a series of tables, each accompanied by illustrative figures and a brief text. Whenever possible, data from the previous surveys are included with the present data to give a unique retrospective on the three disciplines. This report contains detailed information not found in any other survey and is presented in an easy-to-understand format. The overall results and general trends are contained in a summary chapter, with succeeding chapters amplifying the summary data.

This report is a most useful primer to both the casual reader and to those charting future directions in these three disciplines.

Survey Sponsor

The Conference Board of the Mathematical Sciences
1529 Eighteenth Street, NW
Washington, DC 20036

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