22nd ANNUAL AMS SURVEY   1978

Second Report

A first report on the 1978 Survey appeared in the October 1978 NOTICES, pp. 390-420. It included a report of the salary survey and a first report of the survey of new 1977-1978 doctorates. This second report includes an update of the fall 1978 employment status of new doctorates, an analysis of faculty mobility, and a report on fall 1978 enrollments, class sizes, and teaching loads, as well as a report on the two-year college survey.

The 22nd Annual AMS Survey was made under the direction of the Society's Committee on Employment and Educational Policy (CEEP), whose members in 1978 were Lida K. Barrett

(chairman), Alan J. Goldman, Arthur P. Mattuck, Hugo Rossi, Martha K. Smith, and Robert J. Thompson. A Data Subcommittee of CEEP consisting of Lida K. Barrett, Lincoln K. Durst, Wendell H. Fleming (chairman), Arthur P. Mattuck, and Donald J. Albers as a consultant for two-year colleges, designed the questionnaires with which the data were collected. The committee is grateful to members of the AMS staff, especially Marcia A. Almeida, for the diligence and efficiency with which the data were collected and compiled. Comments or suggestions regarding this program may be directed to the subcommittee.

Employment of Mathematical Sciences Doctorates, Faculty Mobility, Enrollment Trends, Fall 1978

by Wendell H. Fleming

This is one of a series of annual reports on trends in the job market for Ph.D.'s in the mathematical sciences. The report begins with an update of the fall 1978 employment status of new 1977-1978 doctorates. This is followed by a discussion of trends in the academic job market for mathematicians in four-year colleges and universities, based on 1978 AMS Survey data on faculty mobility, and concludes with information on enrollments and staff size. An accompanying article is concerned with two-year colleges.

The past year 1978 was the best among recent years for the employment of mathematical science Ph.D.'s. Among the contributing factors was a strong job market in the business-industry sector. There was also some increase in the

number of teaching positions, mainly in departments which offer at most masters degrees—Groups M and B in the classification below. (However, the percentage increase in number of full-time faculty members was less than the percentage increase in course enrollments.) Another factor was the continuing decline in the number of "pure mathematics" doctorates. The Survey data indicate that nearly all new 1977-1978 Ph.D.'s, and also nearly all untenured faculty members terminated after academic year 1977-1978 found either another teaching position for fall 1978 or nonacademic employment. On the other hand, the number of junior faculty members competing for permanent positions continues to exceed the number of such openings.

In this article departments in mathematical sciences in U.S. and Canadian universities and four-year colleges are classified as below. The first six groups consist of departments that have doctoral programs, of which Groups I-V are U.S. departments. (The numbers indicate how many departments were queried in the 1978 Survey.)

Group I: the top 27 ACE ranked mathematics departments.
Group II: the other 38 ACE rated mathematics departments.
Group III: 90 mathematics departments not included in the ACE study.
Group IV: 66 statistics, biostatistics and biometry departments.
Group V: 117 other mathematical science departments (includes 71 in computer science).
Group VI: 35 Canadian departments in the mathematical sciences.
Group M: 379 departments with masters' programs (of which 16 are Canadian departments).
Group B: 1,066 departments which offer at most bachelors' degrees (of which 35 are Canadian departments).

Notes: Group B includes about 100 departments with no degree programs. Both M and B include some departments in universities which have doctoral programs in other areas, in some cases in other areas of the mathematical sciences.

Response rates varied from one group to another, with the largest response rate from Groups I, II, and III. Of an estimated total of about 17,850 full-time U.S. mathematical sciences faculty members, over 10,000 are members of departments which responded to the survey.

For an account of the ACE ratings referred to above see "A Rating of Graduate Programs" by Kenneth D. Roose and Charles J. Andersen, American Council on Education, Washington, D.C., 1970, 115 pp. The information on mathematics was reprinted by the Society and may be found on pages 338-340 of the February 1971 issue of the NOTICES.

FALL 1978 EMPLOYMENT STATUS OF 1977–1978 NEW DOCTORATES

Table 1 contains the fall 1978 employment status by type of employer and field of degree for 952 new mathematical science doctorates who received the degree between July 1, 1977 and June 30, 1978. This updates the corresponding table on p. 396 of the October 1978 NOTICES, using more recent information provided by departments and recipients of the degrees. The first row "University" in Table 1 refers to those 1977-1978 new doctorates employed by departments in Groups I-V. The second row "College" refers to those employed by U.S. departments in Groups M and B.

The total of 952 degrees included in Table 1 does not include 63 doctorates reported late; see Supplementary List, January 1979 NOTICES, pp. 76-77. Trends in the number of new doctorates, in various fields and in the kinds of positions they take were reported in the October 1978 NOTICES, pp. 398-399. Among the more striking trends is a continuing decline in the number of "pure mathematics" doctorates. The percentage of the new mathematical science doctorates who take jobs in business and industry is steadily increasing. On the other hand, the percentage who are employed as mathematics teachers in Groups M and B departments is steadily decreasing, despite the fact that these departments have experienced growth both in course enrollments and in the number of faculty positions. One apparent reason is that Groups M and B departments do not usually offer the kind of research-oriented environment found in doctorate-granting departments. In addition, many Groups M and B departments currently seek new faculty members with expertise in such applied fields as statistics and computer science. Generally colleges cannot compete with industry for such individuals in terms of salary.

TABLE 1

1978–1979 EMPLOYMENT STATUS OF NEW DOCTORATES IN THE MATHEMATICAL SCIENCES

Type of Employer	Algebra and Number Theory	Analysis and Functional Analysis	Geometry and Topology	Logic	Probability	Statistics	Computer Science	Operations Research	Applied Mathematics	Mathematics Education	Other	Total
University	43	57	31	7	15	48	27	3	29		20	280
College	40	31	19	5	6	20	12	1	14	1	11	160
Two-year college and high school		3	2		2				3	1	2	13
Other academic departments or research institutes	3	4	3	1	1	29	10	7	7	1	5	71
Government	1	4	1	1		19	5	3	8		2	44
Business and industry	9	15	7	2	2	25	49	17	28		12	166
Canada	7	11	4	2	3	8	15	1	6		5	62
Foreign	17	30	10	5	2	24	12	3	11	1	5	120
Not seeking employment	2	2	1	1	1				1			8
Not yet employed	1	2				1	2					6
Unknown	2	5	2	2	1	0	4		6			22
Total	125	164	80	26	33	174	136	35	113	4	62	952

The first five columns (Algebra and Number Theory, Analysis and Functional Analysis, Geometry and Topology, Logic, Probability) are grouped under the heading PURE MATHEMATICS.

Size of the Full-Time U.S. Mathematical Sciences Faculty. Table 2 shows the estimated number of full-time doctorate-holding and non-doctorate faculty members in fall 1978, for each of Groups I,..., B in the U.S.

Table 2 is an update of earlier estimates. It is based for the most part on department-by-department counts of size of faculty. The estimates for Groups I-IV and M are considered reliable, for Group B slightly less reliable, and least reliable for Group V. The last line of Table 2 shows estimated changes in the number of full-time faculty members between fall 1977 and fall 1978. These estimates are based on 1978 AMS Survey data. They indicate about a 2% increase in the number of doctorate-holding faculty members and an increase in the total (doctorate and nondoctorate) faculty of between 1.5% and 2%. These percentages are slightly greater than in other recent years, but less than the percentage increase in mathematics course

enrollments between fall 1977 and fall 1978 reported below. The pressure of enrollment increases in elementary mathematics courses since 1974 has been a positive factor in the academic job market during the late 1970s.

Most of the estimated increase of 300 mathematics faculty positions shown in Table 2 occurred in Groups M and B departments, especially in Group M. There was essentially no change in the number of full-time faculty members in Groups I-III between fall 1977 and fall 1978.

According to CBMS Survey estimates, in 1970-1971 there were about 17,000 full-time mathematical sciences faculty members in the U.S., of whom about 11,000 held doctorates and 6,000 did not (cf. February 1977 NOTICES, p. 105). The number of faculty members without doctorates fell steadily during the 1970s, but now has apparently stabilized at around 3,800. This represents about 21% of all mathematical sciences faculty members in the U.S.

TABLE 2

Estimated Number of Full-Time Mathematical Sciences Faculty Members in

U.S. Four-Year Colleges and Universities, Fall 1978

Group	Doctorate-Holding	Nondoctorate	Total
I	1,200	(< 5)	1,200
II	1,510	50	1,560
III	2,370	270	2,640
Total I, II, III	5,080	320	5,400
IV	750	50	800
V	1,120	80	1,200
M	3,950	1,500	5,450
B	3,150	1,850	5,000
Total U.S.	14,050	3,800	17,850
Estimated change from Fall 1977	+300	0	+300

Part-Time Faculty (excluding teaching assistants). Part-time members of the faculty represent only a small proportion of the total in four-year colleges and universities, but the number is increasing. On a full-time equivalent basis, part-time faculty members amount to only 5% of the full-time faculty in Groups I-III, about 15% in Groups IV and V, and slightly over 10% in Groups M and B. The higher percentage reported in Groups IV and V can probably be attributed partly to the frequency of split appointments between Statistics or Computer Science and other departments, as well as the use on a part-time basis of adjunct appointments of people who also hold nonacademic positions. Nearly half of the part-time faculty members in Groups I-V have doctorates, but only a quarter of those in Groups M and B have doctorates. A substantial increase in the number of part-time faculty mem-

bers from fall 1977 to fall 1978 was reported. For Groups I-III, the increase was over 20%, and occurred mainly in Group III. This is substantially higher than increases reported in previous years. Apparently additional part-time faculty members are being hired to cover teaching assignments in elementary courses, for which additional qualified teaching assistants cannot be found. About a 12% increase in the number of part-time faculty members was reported for Groups M and B, from fall 1977 to fall 1978. Similar increases were reported for Groups M and B for the three previous years, indicating a substantial overall increase in the number of part-time faculty members since fall 1974. For further discussion of part-time employment of Ph.D.'s, see the October 1978 NOTICES, p. 421.

Mathematical Sciences Faculty, Canada.
Table 3 gives an estimate of the number of full-
time mathematical sciences faculty members in
departments in Canadian four-year colleges and
universities in Groups VI, M, and B, in fall 1978.

TABLE 3

Group	Estimated Number of Full-Time Faculty Members
VI	900
M	250
B	200
Total Canada	1,350

While the data are less complete for Canadian
departments, it appears that about 90% of Group
VI faculty members have doctorates. In Canadian
Group M departments the percentage is slightly
lower, and roughly 70% of Canadian Group B
faculty members have doctorates. The total num-
ber of faculty members in Canadian departments
has remained stable recently.

Newly Hired Faculty Members, Fall 1978.
It is estimated from AMS Faculty Mobility
Survey data that roughly 1,650 full-time faculty
members were newly hired for fall 1978 by
mathematical sciences departments in the U.S.

This includes about 1,150 doctorate-holding and
500 nondoctorate faculty members. Of the 1,650
newly hired, roughly 500 doctorates and 100 non-
doctorates moved from faculty positions in other
four-year colleges or universities. The remain-
ing 1,050 new faculty members came directly
from graduate school, from outside the U.S. or
from other sources. Almost all of those newly
hired are nontenured. About 80 individuals, in-
cluding about 10 without doctorates, were hired
with immediate tenure; most of them moved from
tenured positions elsewhere.

Table 4 gives estimates of the number of
fall 1978 nontenured faculty members hired from
various sources, as well as the number continuing
from the 1977-1978 academic year in the same
department.

Included on the left side of Table 4 as
"continuing in the same department" are those
who received a doctoral degree during 1977-1978
without changing jobs (perhaps about 100 in num-
ber, mostly in Groups M and B departments).
According to Table 4 slightly over a quarter of
fall 1978 nontenured doctorates were newly hired.
This includes both new 1977-1978 Ph.D.'s coming
immediately from graduate school, and also
Ph.D.'s from previous years moving from other
positions. Of the 1,250 nondoctorates without
tenure shown at the bottom of Table 4, over 85%
are in Groups M and B departments. About 425
nondoctorates were newly hired for fall 1978 in
Groups M and B, compared to only about 250
newly hired for fall 1976 two years earlier.

TABLE 4

Sources of Nontenured Faculty Members, Fall 1978

Full-Time, U.S. (Estimated)

	Doctorate-Holding Faculty				Nondoctorate Faculty
	Total	Groups I-III	Groups IV, V	Groups M, B	All Groups
Newly hired from Graduate School	440	170	90	180	250
Another college or university faculty	450	130	40	280	90
Nonacademic employment	80	15	15	50	40
Outside U.S.	50	20	10	20	10
Other sources[1]	60	25	5	30	100
Total newly hired	1,080	360	160	560	490
Continuing in same dept. from 1977-1978	2,940	910	490	1,540	760
Total nontenured faculty members, fall 1978	4,020	1,270	650	2,100	1,250

[1]Part-time to full-time in the same department, from postdoctoral or two-year college position, etc.

Faculty Members Leaving Full-Time Positions. About 1,350 individuals left full-time faculty positions held during 1977-1978, including about 600 who moved to another four-year college or university mathematical science department. Table 5 shows an estimate of the fall 1978 status of the other 750. The estimates in Tables 4 and 5 were obtained by extrapolating from Faculty Mobility data provided by departments. Of the estimated total of 17,850 full-time U.S. mathematical sciences faculty members in Table 2, over 10,000 are members of departments which responded. The response rate was best from Groups I-III departments (119 departments of 155). There are some indications that the extrapolated estimates may be slightly high for Groups M and B departments.

The numbers in parentheses in the right-hand column of Table 5 refer to those leaving who were tenured.

The number of faculty members leaving for nonacademic positions has steadily increased recently. The number 370 in Table 5 is about 35% higher than the corresponding number two years ago. The fact that about 65 tenured faculty members are included among those moving to nonacademic jobs indicates that nonacademic employment is becoming more widely regarded as an attractive alternative to teaching. One probable reason is better salaries offered in industry. After subtracting the 120 in Table 4 hired from nonacademic positions, one still has a current net outflow of 250 per year to business, industry, and government.

Tables 1 and 5 indicate that nearly all mathematical science Ph.D.'s seeking employment in the U.S. for fall 1978 found it, with a fair number moving from academic to non-academic positions. A combination of factors made 1978 a favorable year. The nonacademic job market was stronger than in previous years, and there was a 1.5% to 2% increase in the number of faculty positions. In addition, there were somewhat fewer new Ph.D.'s seeking employment.

Tables 4 and 5 show a rough balance between the numbers of faculty members newly hired from outside the U.S. and those leaving the U.S. The job market for mathematicians is international. There might in the future be a net flow from the U.S., should (for example) increasing numbers of mathematicians of foreign birth now in the U.S. find more attractive positions in the countries of their origin. The data, however, indicate that this is not currently a significant consideration in the U.S. job market for mathematicians.

Tables 1 and 5 indicate that fewer than 20 doctorates in the mathematical sciences took positions in two-year colleges and high schools (this does not include some with doctorates in mathematics education). A recent report by Robert McKelvey, et al., "An inquiry into the graduate training needs of two-year college teachers of mathematics," published by the Rocky Mountain Mathematics Consortium indicates that this number might be increased, were some doctoral programs in mathematics better oriented toward the needs of two-year colleges. (A summary of the findings of this report is being prepared for possible publication in the NOTICES.)

It should be emphasized that Table 5 refers to U.S. departments in all Groups I, II, ..., B. For Groups I-III departments, about 70 faculty members left through retirement or death between fall 1977 and fall 1978. About 50 in Groups I-III left for nonacademic positions, including only about 5 with tenure.

Frequency of Nontenured Faculty Members Leaving After Only One or Two Years (Groups I-III). Among nontenured doctorate-holding faculty members leaving Group I departments, about 10% were reported as leaving after only one year in the department, with an additional 45% leaving after two years. However, among those leaving Groups II and III departments about 30% left after only one year in the department, and an additional 30% left after only two years.

TABLE 5

Estimated Number of Full-Time 1977-1978 Faculty Members No Longer Employed

in U.S. Mathematical Sciences Departments

Fall 1978 Status

	Doctorate-Holding	Nondoctorate	Total	(Total Tenured)
Retired or died	90	90	180	(175)
Nonacademic employment	270	100	370	(65)
Two-year college/high school	5	25	30	(5)
Left U.S.	35	5	40	(15)
Graduate/professional school	15	50	65	(0)
Seeking employment	10	10	20	(0)
Other	25	20	45	(20)
	450	300	750	(280)

There were altogether about 70 nontenured doctorates leaving Group I departments, with about 190 leaving Groups II and III departments, between 1977-1978 and 1978-1979. Of these 260 individuals, about 185 moved to other colleges and universities. While some left before their appointments expired, the data indicate a high frequency of one-year and two-year nonrenewable positions. The Council of the AMS recently passed a resolution urging departments to avoid the systematic use of one-year nonrenewable appointments. See the April 1978 NOTICES, p. 201, and related comments, February 1978, p. 119.

Promotions to Tenure. From Faculty Mobility data it is estimated that about 450 doctorate-holding faculty members received tenure in their institutions between fall 1977 and fall 1978. These included about 130 in Groups I-III, 45 in Groups IV and V, and 275 in Groups M and B. About 280 of the 450 who were newly tenured can be regarded as replacements for tenured faculty members shown in Table 5 as no longer employed in a mathematical science department. The other 170 represent growth in the number of tenured positions. A similar number of 450 to 550 were estimated last year as having received tenure between fall 1976 and fall 1977.

A very rough estimate can be made of the proportion of Ph.D.'s receiving tenure who entered the pool of the nontenured doctorate faculty a few years earlier. This estimate involves individuals entering in various (undetermined) years, as well as extrapolations from Faculty Mobility data; hence, it cannot be very precise. In nearly the current form, Faculty Mobility data go back to fall 1973. The number of Ph.D.'s entering the pool of the doctorate faculty in fall 1973 was estimated by R. D. Anderson at somewhat over 800, including 700 new doctorates in the mathematical sciences and mathematics education plus over 100 from other sources (but excluding foreign visitors). See the November 1973 NOTICES, p. 351. For simplicity, assume that all were initially nontenured. If 1973 is taken as fairly typical of the years immediately preceding it, then it appears that somewhat over half of the Ph.D.'s entering during that period later received tenure.

Of more interest to currently nontenured faculty members and to graduate students are the prospects for tenure in the years ahead. New legislation on mandatory retirement has introduced uncertainties about the probable number of retirements during 1982-1987. (A recent AAUP report on this subject is summarized on p. 122.) The author believes that until after 1987 the annual number of replacements for tenured faculty members due to deaths and retirements will not much exceed the present level of around 200. If inflation becomes more serious in the U.S., the number could be significantly less. Fewer faculty members will risk early retirement; and those reaching age 65 after July 1, 1982 will have the option of postponing retirement to age 70, if physically able to do so.

The long-range demand for applied mathematicians, computer scientists, and statisticians in government and industry is expected to remain strong, although the nonacademic job market is subject to cyclic fluctuations of considerable magnitude. If academic salaries continue to decline, in terms of constant dollars, then tenured faculty members may leave for nonacademic positions at a somewhat greater rate than the 65 per year in Table 5. However, this trend (if it occurs) is likely to have least effect on the number of tenured openings in Groups I-III.

An estimate of about 300 permanent positions per year during the early-to-mid 1980s, to replace tenured faculty members leaving, has been made previously in this series of reports on employment. The evidence currently available suggests that this estimate is still reasonable. For Groups I-III departments only, the corresponding estimate is 75 to 100 replacements for tenured faculty members per year.

The number of Ph.D.'s entering the pool of the nontenured doctorate faculty has now declined to the 650-700 range, from over 800 in 1973. If the number of promotions to tenure per year in the period around 1985 should, in fact, turn out to average about 300 per year, then slightly fewer than half those Ph.D.'s entering the pool in 1978 would eventually get tenure. The number of tenured openings is also influenced by expansion or contraction. While enrollments in elementary mathematics increased again this year, college enrollments overall seem to have peaked. Mathematics enrollment declines must be expected during the 1980s, as the college age population declines steadily. There is little prospect of further expansion of mathematics departments during the 1980s. Indeed, cutbacks will be probable should "taxpayers' revolts" now underway in several states become widespread, resulting in severe limits on funds for publicly supported colleges and universities. It appears that tenure percentages are stabilizing in the 75% to 80% range. They are unlikely to go higher, unless cutbacks reduce the number of nontenured positions.

A bit more optimism seems in order regarding the long-term employment prospects for students just now at the point of entering graduate school. For those who get the Ph.D. around 1983 to 1985 and then seek academic positions, the first crucial stages will be in the mid-to-late 1980s, at the times of initial hiring and of first reappointment. The number of replacements for tenured and nontenured faculty members will probably then be below the level of 750 per year shown in Table 5. However, unless one takes an extremely pessimistic view, there should still be several hundred openings per year at the assistant professor level, counting positions in all types of departments (I, II, ..., B). The crucial tenure decision would normally come around 1990, for students entering graduate school in 1979 who get the Ph.D. and then take an academic job. Starting about then, the annual number of retirements will begin to increase substantially. There will be in any case a great need for new faces, as the many faculty members hired during the period of growth in the 1960s reach late middle age.

There has been for several years a steady decline in the number of new "pure mathematics" Ph. D. 's, with the current rate of decline about 8% per year. This decline is expected to continue, though probably at a slower rate. The number of graduate students in Groups I-III departments has also been steadily declining, currently at a rate of about 2% per year. There were about 450 new "pure mathematics" Ph. D. 's in 1977-1978, counting those shown in Table 1 and a few reported late. This number may well decline to a level somewhere around 300 by the mid-1980s. This trend should lead in the long run to less competition for tenured positions in mathematics departments emphasizing research in areas of mathematics not traditionally identified with some application. The number of such openings will depend on how well the case is made for support of basic mathematical research.

The proportion of mathematical sciences Ph. D. 's employed in business, industry, and government is increasing. Among recent Ph. D. 's employed in the U. S., nearly half hold non-academic jobs, counting both those taking such positions immediately after the Ph. D. and those moving later from academic to nonacademic employment. Relatively few mathematicians with nonacademic jobs are in laboratories emphasizing basic research. A much larger number are working as "practitioners" of applied mathematics, on problems of more immediate concern to their employers. A great deal of the recent growth in the applied mathematical sciences is in one way or another, related to the revolution in computer technology. The growth has occurred not only in computer science itself, but also in such areas as the coding and statistical analysis of large sets of data, modelling of complicated physical phenomena, and the study of large scale systems in engineering or management science. Present indications are that it is in such directions that growth in mathematics-related employment opportunities is to be expected during the years immediately ahead.

Trends in Course Enrollments and Staff Sizes. There have been substantial increases in mathematics course enrollments recently. Table 6 shows percentage increases in one year, fall 1977 to fall 1978, and also over the four-year period, fall 1974 to fall 1978.

TABLE 6

Percent Increase in Course Enrollments

Groups	1977 to 1978	1974 to 1978
I, II, III	3%	18%
IV	3%	24%
V	5%	36%
VI	5%	28%
M	6%	24%
B	5%	26%

Table 6 shows an average annual increase in course enrollments of about 4.5% over the past four years in Groups I, II, and III departments, with a larger average increase of over 6% per year in Groups M and B. In contrast, the average increase in the number of faculty members has been less than 1% per year in Groups I, II, and III departments since fall 1974; for Groups M and B, the average increase in the faculty has been about 2% per year since fall 1974, if part-time positions are converted into full-time equivalents in calculating this percentage. In Groups IV and V departments, the number has increased at about 3% per year over the same period, with less than 1% per year among the Canadian departments in Group VI. The total number of teaching assistants has not changed significantly since fall 1974, except for an increase of around 5% to 6% per year in Groups IV and V departments.

These data show a significant increase during the last four years in overall faculty load, measured in course enrollments per full-time faculty member. However, when measured in terms of the average number of sections taught per full-time equivalent faculty member, there have been only slight increases since fall 1974. The increases in loads have occurred mainly through increased average class sizes.

Table 7 shows percentage changes in course enrollments by type of course from fall 1977 to fall 1978 reported by Groups I, II, III, M, and B departments.

TABLE 7

Percent Change in Course Enrollments, by Type of Course

Fall 1977 to Fall 1978

Type of Course	Group				
	I	II	III	M	B
Below calculus	-1.2%	3.0%	1.9%	3.5%	1.8%
First-year calculus	8.5%	4.0%	2.5%	6.7%	4.8%
Statistics	*	*	0%	4.2%	5.3%
Computer science	*	*	16.0%	23.0%	19.0%
Other undergraduate courses	.8%	1.1%	7.2%	1.8%	3.9%
Graduate courses	1.3%	0%	1.5%	2.0%	*

*Enrollments in this type of course amount to less than 2% of total course enrollments for this group of departments.

Table 7 shows a significantly greater increase in calculus enrollments among all groups of departments than in courses below calculus. Overall, enrollment increases occurred in all types of courses, including graduate courses. In Groups I, II, and III departments about 30% of course enrollments are in first-year calculus, and over 40% of course enrollments are in courses below calculus. For Groups M and B departments, slightly under 20% of course enrollments are in first-year calculus, and about 50% of course enrollments are in courses below calculus.

In the 1978 Survey, departments were also asked to report numbers of their junior and senior majors. Small increases were reported by most groups of departments, with an overall increase of some 2% to 3%. However, the number of majors in Group V departments increased by about 25% in one year, with computer science accounting for a large part of the increase.

Two-year College Survey

by Wendell H. Fleming

The Annual American Mathematical Society Survey monitors trends in both two-year and four-year colleges regarding mathematics enrollments, the composition of mathematics faculties, faculty mobility, and faculty salaries. Summaries and analyses of Survey results are published each year in the February and October issues of the NOTICES of the American Mathematical Society. The present article is a report of results from the 1978 Survey of two-year colleges, and includes 3-year trends (1975-1978) observed from the last three Annual Surveys. The Survey data summarized below were provided by over 250 two-year college mathematics departments (or departments including mathematics faculty). The questionnaire was sent to 978 departments, including all those listed in the Mathematical Sciences Administrative Directory published by the American Mathematical Society each year. (The 1978 questionnaire was distributed in September and requested current data for the fall term.) The departments responding to the survey questionnaire were self-selected, and do not represent a scientifically chosen random sample. While the trends reported below are consistent from year to year, one should be cautious about extrapolating to all two-year colleges.

In the years before 1975 two-year college mathematics in the U.S. underwent remarkable growth. According to the 1975-1976 Conference Board of Mathematical Sciences Survey[1], mathematics enrollments grew by 50% from fall 1970 to fall 1975. During the same 5-year period the full-time mathematics faculty increased by 22% and the part-time mathematics faculty by 54%. Since 1975, however, AMS Survey data indicate only modest growth. Among departments responding to the AMS Survey, mathematics course enrollments increased at the rate of 3% per year during the 3-year period, fall 1975 to fall 1978. This is about the same rate of increase as for two-year college enrollments as a whole, during the same three years. The number of mathematics

faculty members increased only slightly, at roughly $1\frac{1}{2}\%$ per year between fall 1975 and fall 1978.

Course enrollments. Table 1 shows, in the center column, a percentage breakdown of fall 1978 mathematics enrollments by type of course. The right-hand column in Table 1 shows the percent change in enrollments for each type of course over the 3-year period, fall 1975 to fall 1978.

TABLE 1 — COURSE ENROLLMENTS

Type of course	Percent of fall 1978 enrollment	Percent change in enrollment, 1975-1978
Arithmetic	12%	+20%
Elementary and intermediate algebra	31%	+10%
Basic concepts for general math.*	7%	-10%
Math. for elementary teachers	2%	-18%
Precalculus	17%	+10%
Calculus	10%	+12%
Computing	2%	+65%
Elementary statistics	4%	+20%
Business, vocational or technical math.	11%	+2%
Other courses	4%	+4%

*Structure, logic, basic skills, operations.

Overall, two-year college mathematics course enrollments increased by about 9% (3% per year) between fall 1975 and fall 1978, among departments responding. Table 1 shows that the increase was uneven among different types of courses, with declines in courses in basic concepts and in mathematics for elementary teachers. Computing showed a dramatic 65% increase, though still contributing only 2% to the total. Enrollments in calculus courses for engineers

[1] A summary of 1975-1976 CBMS Survey for two-year colleges was given by D. J. Albers in the NOTICES, February 1977, pp. 106-109 and in the Two Year College Mathematics Journal, September 1977, pp. 236-238.

TABLE 2 — SIZE OF FACULTY

| | 1977–1978 | | | | 1978–1979 | | | |
| | FACULTY | | WOMEN | | FACULTY | | WOMEN | |
	Total	With Tenure	Total	With Tenure	Total	With Tenure	Total	With Tenure
Nondoctorate	1,260	867	303	156	1,278	861	325	160
Doctorate	197	109	31	18	198	112	32	18
Total	1,457	976	334	174	1,476	973	357	178

and for those in the physical sciences increased more rapidly than in calculus courses for those in the social and life sciences or business.

Two-year college mathematics faculty. Table 2 shows numbers of full-time mathematics faculty members by sex, tenure status (doctorate-holding vs. nondoctorate) in departments providing usable responses (255 of 978 departments).

About 66% of 1978-1979 faculty members included in Table 2 are tenured. About one-quarter of the departments reported that there is no formal tenure system in the institution.

The 1975-1976 CBMS Survey gave estimated numbers of 5,944 full-time and 3,411 part-time mathematics faculty members in U.S. two-year colleges, as of fall 1975. AMS Survey data show a slight increase in the number of full-time faculty members, from fall 1975 to fall 1978 (roughly $1\frac{1}{2}$% increase per year). During the same three-year period, the number of part-time faculty members reported decreased by about 4% (slightly over 1% decline per year).

About 75% of part-time mathematics faculty members in the reporting departments also hold another job full-time. This includes about 38% who are high school teachers, 12% with another full-time, two-year college position, and 25% employed by business, industry, or government.

As noted above, mathematics course enrollments increased at about 3% per year during 1975-1978. The number of sections of mathematics courses taught increased at about 2% per year from 1975 to 1978. Measured in terms of the ratio of either course enrollments per faculty member or sections per faculty member, there has been an overall increase in teaching load. About one-quarter of all sections of mathematics courses are taught by part-time faculty members.

Of the full-time mathematics faculty members for 1978, about 24% are women, according to Table 2. In fall 1975, about 20% of the full-time faculty members were women. Of the part-time mathematics faculty members reported for fall 1978, about 36% are women, compared to 27% reported for fall 1975.

About 13% of the two-year college mathematics faculty members reported for fall 1978 have doctoral degrees, compared to 11% reported for fall 1975 by the CBMS Survey. No increase in the size of the doctorate-holding faculty was reported for fall 1978, in contrast to previous years.

About 6% of current full-time two-year college mathematics faculty members were reported as newly hired for fall 1978. Only about one-sixth of those newly hired came directly from graduate schools. Nearly three-fourths of those newly hired came from teaching positions in four-year colleges, other two-year colleges, secondary schools, or part-time in the same department. (New faculty members were drawn about equally from each of these four sources.) Only about 7% of newly hired faculty members came from nonacademic positions, compared to 12% two years earlier. This probably reflects the unusually strong demand in industry during 1978 for computer scientists, statisticians, and applied mathematicians, and the more attractive salaries frequently offered by industry.

Among those full-time members of the faculty reported as leaving between fall 1977 and fall 1978, about 25% retired or died. Another 25% took nonacademic jobs, while another 40% moved to other full-time teaching positions. About 10% returned to graduate school or to part-time work.

Salary data. The Survey questionnaires asked for information on salaries including a minimum, median, and maximum salary figure both for staff members with doctorates and for those without doctorates. Annual salaries of full-time faculty members for the academic year of 9-10 months were sought. In Table 3 the data in the parentheses give the range of the middle fifty percent of salaries reported. The figures outside the parentheses represent the minimum and maximum salary listed by any reporting institution.

TABLE 3 — SALARIES (in hundreds of dollars)

| | 1977–1978 | | | 1978–1979 | | |
	Minimum	Median	Maximum	Minimum	Median	Maximum
Nondoctorate	70(118–161)	(137–186)	(150–211)300	73(122–169)	(144–192)	(160–228)310
Doctorate	112(140–195)	(150–204)	(156–220)320	106(155–204)	(160–217)	(163–223)320