Report of the Nineteenth Annual AMS Survey, 1975. Part Two
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1975 REPORT ON EMPLOYMENT DATA AND ACADEMIC MATHEMATICS

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The first part of this report concerns employment patterns for doctorate level mathematicians this fall. The second concerns student enrollments in mathematics and their relationship to employment of mathematicians. A report on graduate mathematics student phenomena is being prepared separately by Wendell H. Fleming. The data reported in the 1975 AMS survey have been obtained primarily on forms submitted by department chairmen. The current employment status of new Ph.D.'s also includes updated information supplied by some of the new Ph.D.'s themselves. The standard departmental AMS forms request some comparative data for two (or three) years. Thus the year by year changes are rather accurately recorded.

The employment pattern for doctorate level mathematicians in 1975 appears to have been quite similar to that of 1974. The AMS statistics assembled this summer indicate a slight worsening of employment opportunities both for new Ph.D.'s and for nonretained faculty members. However, anecdotal information from early this fall indicates that there was more last minute hiring than previously and, therefore, the overall picture may have been marginally better than a year ago. An apparent unexpectedly large increase in numbers of undergraduate students and, specifically under-

TABLE 1

1975–1976 EMPLOYMENT STATUS OF NEW DOCTORATES IN THE MATHEMATICAL SCIENCES

Type of Employer	PURE MATHEMATICS											Totals
	Algebra and Number Theory	Analysis and Functional Analysis	Geometry and Topology	Logic	Probability	Statistics	Computer Science	Operations Research	Applied Mathematics	Mathematics Education	Other	
University	33	45	39	9	13	36	31	5	21		22	254
College	38	46	29	11	9	18	27	4	11	10	10	213
Two-year colleges and high schools	6	3	5	1		3			2	5		25
Other academic departments and research institutes	4	3	2	2	1	18	14	9	12		2	67
Government	6	6	4	1		10	6	7	11		2	53
Business and industry	8	13	1	1	2	24	29	2	17		9	106
Canada	8	9	4	2	3	7	15	2	9		6	65
Foreign	23	29	11	6	5	24	18	6	8		6	136
Not seeking employment		1				2	2		1		1	7
Not yet employed	23	38	26	5	5	16	7	2	16		9	147
Unknown	10	7	4	2	5	5	6		2			41
Totals	159	200	125	40	43	163	155	37	110	15	67	1,114

*This article comprises the second report based on the Nineteenth Annual AMS Survey, 1975. It was prepared by the author on behalf of the AMS Committee on Employment and Educational Policy whose members are Michael Artin, Charles W. Curtis, Wendell H. Fleming (chairman), Calvin C. Moore, Martha K. Smith, and Daniel H. Wagner. The data in the report were compiled by the AMS staff under the direction of Lincoln K. Durst. Special acknowledgement is made of the contribution of Ernest Davis to this effort.

graduate students taking mathematics courses, created some additional demand for (temporary) faculty at the end of the summer.

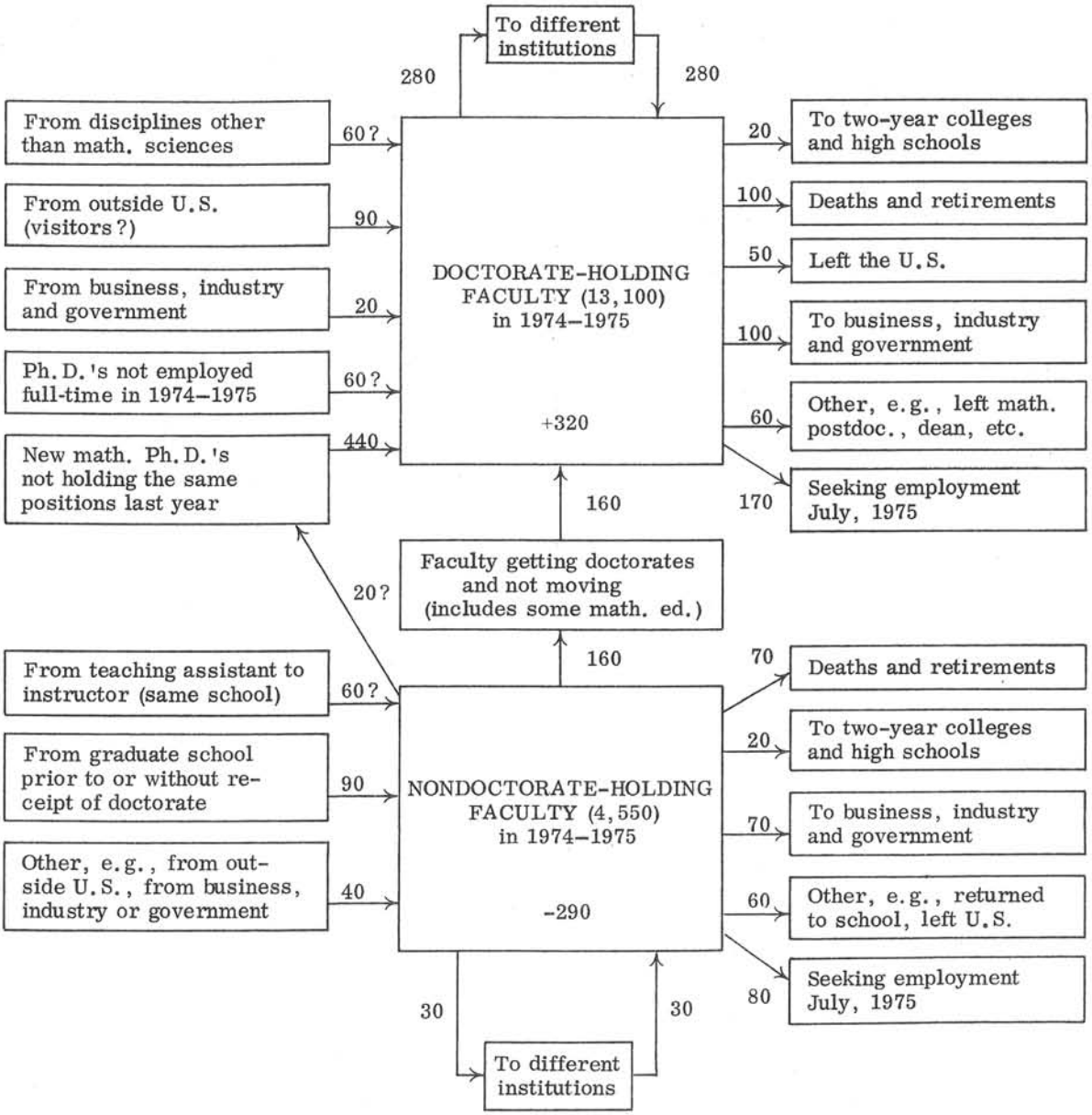
There are perhaps three major trends in the AMS data that should be noted.

(1) In new pure mathematics Ph.D. degrees, there has been a decided shift: about 39% of the total came from Group I departments in 1974 while about 48% came from Group I departments in 1975. (Departmental classification is described in the box at the top of page 359.)

(2) Including a few departments still to report, there were marginally more pure mathematics doctorates granted in fiscal 1975 than in fiscal 1974, reversing a downward trend observable since 1971. (See Table 2.) However, data on numbers of graduate students and attrition rates strongly suggest that there will be a further downward trend over the next several years.

(3) As discussed in more detail later in this report, there was an increase of about 4% overall in mathematics course enrollments in four-year colleges and universities from fall 1973 to fall 1974. Anecdotal data suggests a further, perhaps even larger, increase from 1974 to 1975. This increase in student enrollment in mathematics courses should produce pressure for a somewhat larger national mathematics faculty over the next couple of years. Therefore, it seems likely that employment prospects will be slightly better next fall than was the case this fall. However, since economic and fiscal funding factors also control job

FACULTY FLOW DIAGRAM 1974–1975 to 1975–1976
Full-Time Mathematics Faculty in Four-Year Colleges and Universities in the U.S.



Note: The total faculty listed for 1974–1975 has been adjusted upward by about 400 from estimates of a year ago because of more complete information. The distribution between doctorates and nondoctorates has correspondingly been adjusted.

In this article departments in mathematical sciences in U.S. universities and four-year colleges are classified as below. Groups I–V are departments with Ph.D. programs.

Group I: the top 27 ACE ranked mathematics departments
Group II: the other 38 ACE rated mathematics departments
Group III: 90 ACE unrated mathematics departments
Group IV: 64 statistics, biostatistics and biometry departments
Group V: 99 other mathematical science departments
Group M: 320 departments with masters' programs
Group B: 980 departments which offer at most bachelors' degrees

Note: 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.

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 of Education, Washington, D.C., 1969, 115 pp. The information on mathematics was reprinted by the Society and be found on pages 338–340 of the February 1971 issue of these *Notices*.

opportunities for faculty, there are enough uncertainties to make any short-term prediction highly problematical. There is no basis for longer term optimism that prospective higher percentages of student enrollments in the 1980s will offset the known substantial decline in numbers of those of college age in that period.

In Table 1, we give the matrix of new Ph.D.'s by mathematical areas together with the nature of their fall 1975 employment. The general pattern is quite similar to that of a year ago and, in fact, of several years ago. The figures given include all the new doctorates listed in the October 1975 *Notices*, pp. 309 ff., including Canadians. While the total number listed is slightly lower than that for 1974, it is known that some major departments had not reported in time for the October *Notices* and, thus, figures from such departments are not included. Projections to the total supply of new Ph.D.'s indicate little change in total numbers from 1974.

A comparison with last year's totals, as reported in the November 1974 *Notices*, shows an approximate 10% increase in statistics and computer science degrees, an increase from 111 to 147 in "not yet employed", but a drop from 90 to 41 in the "unknown" category, which may account for the larger "not yet employed" number.

The Faculty Flow Diagram on the previous page is quite similar to that of a year ago, but is based on somewhat more complete information. It shows a very slight gain (of 30) in total faculty—attributable to statistics and computer science increases. While the number still seeking employment is about the same as a year ago, it is believed that late hiring this year probably kept the number of the 1974–1975 faculty members who were actually professionally unemployed as of September less than the comparable figure of a year ago.

Tenure. The percentage of the total doctorate faculty with tenure increased by about 2% in Groups I–V, and by about 2.5% in Groups M and B. From AMS salary survey data, the percentage of all doctorates on the faculty with tenure is about 72% in departments in Groups I and II, and is about 70% in Groups III and M. It is about 58% in Group B. Of course, the percentage of all doctoral faculty of professorial rank having tenure is several percentage points higher in Groups I and II. The indicated percentage of doctoral faculty members who either have tenure or as individuals are expected to be retained indefinitely remains at the 80% or higher level.

As indicated earlier, the distribution of new pure mathematics doctoral degrees among Groups I, II, and III changed markedly this year as compared to last year. Based on all the doctorates reported by mid-August 1975, the net changes of all U.S. departments reporting both in 1974 and 1975 showed the following changes in pure and applied degrees.

TABLE 2

	Pure	Applied
Group I	+51	−4
Group II	−11	+20
Group III	−24	+13

Among all new pure mathematics Ph.D. degrees (about 600 in number), the percentage awarded by Group I departments rose from 38.7% in fiscal 1974 to 47.6% in fiscal 1975.

A study of the distribution of doctorates by sex, race, and citizenship among the various groups of departments showed that 16.7% of all Group III degrees were awarded to women, whereas only 8.3% of Group I degrees were awarded to women. While 22% of Group I, II, and III degrees were awarded to non-U.S. citizens, almost 32% of Group IV and V degrees were awarded to non-U.S. citizens. The composite pattern of sex, race, and citizenship data was reported in the October *Notices*, p. 308.

As would be expected, the percentages of those nonretained doctorate faculty who were still seeking employment generally went up as the research status level of the department they left went down. While only 11% of those leaving Group I departments were still seeking positions when the data were collected, the percentages of those from other groups were 26% for Group II, 31% for Group III, 45% for Group M, and 21% for Group B.

The data provided no evidence that nonretained faculty members with degrees for more than three years had significantly greater difficulty than those who earned their degrees more recently.

This year for the first time the AMS survey contained questions regarding "prospects of permanency" for newly hired doctorate faculty. The percentages of those new nontenured doctorate faculty who were hired from other academic employment with prospects of permanency identified as fair-to-better were 72% for those in Groups B and M, 70% for Group III, 61% for Group II, and

55% for Group I. For new Ph.D.'s, the percentage of those hired with fair-to-better prospects of permanency varied from 74% in Group B departments, to 17% in Group I departments.

This year, there were about 60 doctorates who left positions in departments in the mathematical sciences to take positions in four-year colleges and universities outside such departments. There appear to be expanding opportunities for mathematicians to find academic employment outside their traditional departments.

Almost 200 vacancies a year occur due to deaths and retirements and this number is expected to remain stable for several years and then increase quite slowly till the early 1990s. Therefore we might be tempted to think of a steady-state demand for only about 200 new faculty members per year. That is more or less valid in terms of those who will be retained indefinitely. But, in terms of temporary opportunities for new Ph.D.'s, the steady-state is probably closer to 400 per year, since our evidence indicates that there is a net flow of perhaps another 200 out of temporary departmental positions to scientific or mathematical jobs outside academia, to jobs within academia but outside the usual departments, to two-year colleges and miscellaneous other options.

A more detailed report by Professor Donald J. Albers of Menlo College on two-year college employment and educational phenomena is scheduled on the MAA program at the San Antonio meeting. His report is based in part on data collected by the AMS.

Course Enrollments, Faculty Size and Teaching Loads. For the past three years the AMS has been collecting data on enrollments in mathematics courses. The data collected in 1973 was used by John Jewett in his report in the November 1973 *Notices*. That data, together with that collected in 1974, provided a basis for some reports on teaching loads.

It should be noted that course enrollment data lags behind other AMS data by almost a year. The data analyzed here were collected in the summer of 1975; they record enrollments for fall 1974 with comparative figures for fall 1973. We concentrate on U.S. departments only, omitting Canadian departments. Reports were received from about 70% of the departments in Groups I–III, from about 40% of those in Groups IV and V, and from about 40% of Groups M and B. As cited in the introduction, there was an approximate 4% increase in mathematics course enrollments from fall 1973 to fall 1974. This followed a 2% increase from fall 1972 to fall 1973, and a 2% decrease from fall 1971 to fall 1972. While experiencing a total 4% increase in course enrollments over the past 3 years, we have experienced an almost stable total faculty. Thus, our student/faculty ratio has increased perceptibly but not alarmingly. Indeed, we should cheerfully welcome an increase brought about by more enrollments, since such an increase creates pressure for more academic job opportunities for mathematicians.

It should also be noted that from fall 1973 to fall 1974 the recorded increase in the number of sections taught in mathematics was only about 1%, and this was accompanied by an increase of about 2% in total teaching staff–the increase coming wholly in part-time faculty and teaching assistants. Thus, average teaching loads, as measured by sections per teacher, probably actually dropped very slightly from 1973 to 1974.

As shown by Table 3 below, the increases in enrollments from fall 1973 to fall 1974 were concentrated in pre-calculus courses, in first year calculus courses, and in enrollments in undergraduate computer science and statistics courses. There were generally small decreases in enrollments in the category of other undergraduate mathematics courses, and there were somewhat larger decreases in graduate course enrollments (except in statistics and computer science departments where there were sizable increases).

The apparent singularities in Table 3 seem individually explainable; for example, the big increase in Group II calculus course enrollments may well reflect new or expanded courses for business students. The small increases in computer science enrollments in Groups I and II may well reflect the existence of separate computer

TABLE 3

Fall 1973 to Fall 1974 Percentage Changes in Mathematics Course Enrollments by Groups and by Type or Level of Courses

Group and % of Departments Reporting	Courses Below Calculus	First Year Calculus	Undergraduate Statistics	Undergraduate Computer Science	Other Undergraduate Math. Courses	All Graduate Courses	All Courses
I (70%)	+0.9%	+ 4.8%	-0.8%	+ 1.1%	-2.2%	- 8.0%	+ 0.4%
II (71%)	+5.9%	+11.1%	+3.6%	+ 3.4%	-0.5%	- 5.3%	+ 5.6%
III (71%)	+5.4%	+ 6.1%	+9.1%	+21.2%	-2.8%	- 5.0%	+ 4.0%
IV (50%)	-	-	+8.5%	-	-	+11.3%	+11.5%*
V (31%)	-	-	-	+11.4%	-	+ 4.7%	+ 6.3%*
M (43%)	+3.0%	+ 4.9%	+0.6%	+15.7%	-5.3%	- 0.4%	+ 2.2%
B (37%)	+7.8%	+ 3.8%	+4.8%	+16.5%	+3.1%	-	+ 6.6%*

*Includes data from columns on left not individually tabulated because the numbers were too small for the percentages to be meaningful.

science departments in the institutions concerned.

The general consistency of the data lends credence to the data itself and to the effectiveness of the tabulation by the AMS staff.

In Table 4 we give projections to the 1974 total faculty size and total course enrollments for the various classes of departments. These projections give an indication of the relative sizes and roles of the various classes in U. S. academia. The projections are obtained from the reported totals by multiplying by the ratio of the total number of departments to the number reporting in the particular category.

For Groups I, II, and III combined, the number of full-time faculty members is 5,172 and the total enrollment is 557,618. For both Group M and Group B the corresponding numbers are comparable in size to these.

The totals listed are probably fairly accurate. The least certain figures are those in Groups V and B, where the return rates are smallest. In B, for example, there may be a tendency for the smallest departments, or for departments combined with other science departments, not to report to the AMS. Thus, the total faculty under B may be a few hundred too high. The numbers for Group V are also probably somewhat too large since a few of the departments are only partly in the mathematical sciences and nonreporting departments may be smaller or more specialized. Other data suggest that the total U.S. four-year college and university mathematics faculty is between 17,500 and 18,000. An independent count of all full-time faculty members in Groups I, II, and III as reported in the sixth edition of the MAA Guidebook (1975) shows a total count for 1974 in these departments differing by less than 100 from the figures above.

TABLE 4

Projections for Fall 1974 of Total Teaching Staff and Total Course Enrollments by Class of Departments

	Total U. S. Departments	TEACHING STAFF: Full-time	TEACHING STAFF: Part-time	TEACHING STAFF: Teaching Assistants	Total Course Enrollments
I	27	1,135	79	1,553	101,331
II	38	1,463	207	1,474	151,479
III	90	2,574	281	2,077	304,808
IV	64	686	196	735	57,476
V	99	1,374	351	1,533	94,915
M	320	5,354	954	1,444	552,870
B	980	5,396	1,322	71	471,493
	Total	17,982	3,390	8,887	1,734,372

TABLE 5

Percentage of Total Fall 1974 Course Enrollments in Various Types of Courses by Group of Department

Each Row Should Sum to 100%

	Courses Below Calculus	First Year Calculus	Undergraduate Statistics	Undergraduate Computer Science	Other Undergraduate Math. Courses	All Graduate Courses
I	22.5%	35.3%	1.6%	0.9%	31.7%	8.0%
II	45.5%	29.8%	2.0%	1.1%	17.1%	4.5%
III	42.0%	27.6%	4.3%	2.8%	20.0%	3.4%
IV	7.2%	-	62.1%	5.8%	-	23.7%
V	-	-	-	70.1%	5.7%	23.2%
M	49.1%	18.2%	6.2%	5.6%	17.4%	3.5%
B	44.3%	19.4%	8.7%	8.8%	17.4%	1.4%

In Table 5 we show the percentage of course enrollments by groups and various types of courses. The similarity of Groups II, III, M, and B, as contrasted to the dissimilarity between them and Group I is worthy of note. The very high (about 70%) enrollments in pre-calculus and calculus courses in Groups I, II, III, M, and B means that a large majority of mathematicians are employed to teach elementary mathematics. The relatively higher statistics and computer science enrollments in Groups III, M, and B are probably the result of two phenomena. One is the absence of separate departments in many of the institutions represented; the other is the fact that, although many departments of statistics and/or computer science are included in the M and B categories, those with doctoral programs are separately classified in Groups IV or V.

Teaching Loads. As commented earlier, the evidence appears conclusive that, nationally, teaching loads, as measured by sections per teacher, did not increase from fall 1973 to fall 1974. This evidence contradicts the impression expressed a year ago in surveying department chairmen that loads were expected to rise slightly from 1973 to 1974. This year, department

chairmen have again indicated that they expect a slight rise in teaching loads from fall 1974 to fall 1975. Out of 631 departments in all groups reporting on this question, 559 expected essentially no change, 13 expected a decrease and 59 expected an increase. Thus, a net of about 7% expected some increase. In any event, the pattern does not appear alarming. As noted earlier, it is increased course enrollments and/or teaching loads one year that provide pressure for increased faculty in subsequent years.

There are wide-spread informal reports of increased college and university enrollments for fall 1975 over fall 1974. Thus, it seems likely that there was a further increase in course enrollments in mathematics this fall, hopefully creating substantial pressure for additional faculty positions next year.