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29th Annual AMS Survey 1985
Second Report

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Second Report

A first report of the 1985 Survey appeared in the November 1985 *Notices*, pages 758–787. It included a report of the survey of faculty salaries, tenure, and women, a first report of the survey of new 1984–1985 doctorates, and a list of the names and thesis titles of the 1984–1985 doctorates included in the Survey. This second report includes an update of the fall 1985 employment status of new doctorates, an analysis of faculty mobility, and a report on fall 1985 enrollments and class sizes.

The 29th Annual AMS Survey was made under the direction of the Society's Committee on Employment and Educational Policy (CEEP), whose members in 1985 were Lida K. Barrett, Stefan A. Burr, Philip C. Curtis, Jr., Lisl Novak Gaal, Gerald J. Janusz, and Donald C. Rung (chairman). A Data Subcommittee of CEEP, consisting of Lida K. Barrett, Edward A. Connors, Lincoln K. Durst, Arthur P. Mattuck, James W. Maxwell (ex officio), Donald E. McClure, and Donald C. Rung (chairman), designed the questionnaires with which the data were collected. The committee is grateful to members of the AMS staff, especially Marcia C. 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, Nonacademic Employment and Enrollments, Fall 1985

by *Edward A. Connors*

We report on employment patterns, enrollments, and departmental size in the mathematical sciences beginning with an update of the fall 1985 employment status of new 1984–1985 doctorates (Table 1). We continue with an analysis of trends in the academic job market in the mathematical sciences derived from the 1985 AMS Annual Survey of Faculty Mobility and we provide estimates for the total enrollments and numbers of junior-senior majors and graduate students in the mathematical sciences extrapolated from the 1985 AMS Annual Survey of Enrollments and Departmental Size. Our estimation technique is described below. We note that this survey asked for data on enrollments and departmental size for fall 1984 and fall 1985, so we have data from consecutive years from the same sample.

Estimates based on AMS Survey data suggest that since fall 1984, 685 full-time positions in U.S. colleges and universities (excluding Group V departments) were filled by nondoctorates, and for 359 of these positions, the department would have preferred someone with a doctorate. Of these 359 positions, 327 were in Groups M and B departments. (See the box for descriptions of the groups.) The estimated total increase for this year in the size of the full-time faculty (469) is not as large as the comparable estimate last year (682). The doctorate faculty for Groups I, II and III increased by 95 (compared to 134 last year), but the tenured doctorate faculty increased by 218 (compared to 54 last year). See Table 2A for the estimated sizes of the full-time faculty in Groups I, II, and III. The size of the nondoctorate faculty in Groups I, II, III, IV, M, and B is estimated to

Groups I and II include the leading departments of mathematics in the U.S. according to the 1982 assessment of Research-Doctorate Programs conducted by the Conference Board of Associated Research Councils in which departments were rated according to the quality of their graduate faculty.¹

Group I is composed of 39 departments with scores in the 3.0–5.0 range.

Group II is composed of 43 departments with scores in the 2.0–2.9 range.

Group III contains the remaining U.S. departments reporting a doctoral program.

Group IV contains U.S. departments (or programs) of statistics, biostatistics and biometrics reporting a doctoral program.

Group V contains U.S. departments (or programs) in applied mathematics/applied science, operations research and management science which report a doctoral program.

Group VI contains doctorate-granting departments (or programs) in the mathematical sciences in Canadian universities.

Group M contains U.S. departments granting a master's degree as the highest graduate degree.

Group B contains U.S. departments granting a baccalaureate degree only.

Response rates varied from one group to another, with the largest response rate from Groups I, II, and III. Of an estimated total in 1983 of 18,527 full-time U.S. mathematical sciences faculty members, 9,425 are members of departments which responded to the survey.

¹These findings were published in *An Assessment of Research-Doctorate Programs in the United States: Mathematical and Physical Sciences*, edited by Lyle V. Jones, Gardner Lindzey and Porter E. Coggeshall, National Academy Press, Washington, D.C., 1982. The information on mathematics, statistics and computer science was presented in digest form in the April 1983 issue of the *Notices*, pages 257–267, and an analysis of the above classifications was given in the June 1983 *Notices*, pages 392–393.

be 4,515 compared to 4,674 last year. The net decrease of 159 reverses the trend of the last five years.

Useable Responses

	I	II	III	IV	V	VI	M	B
Enrollments and								
Departmental Size	30	34	44	39	7	12	127	345
Faculty Mobility	23	28	36	38	7	12	121	318

**New Doctorates
Fall and Spring Counts**

	1982-1983	1983-1984	1984-1985
Fall	792	789	769
Spring	840	827	807

For the first time these surveys show a decrease of 1% in total enrollments, thus fulfilling the prediction offered by Don Rung in his article last year (see Table 5). It is interesting to note that the raw data reported by Groups I, II and III combined show an increase of 4% in enrollments in courses below calculus (excluding statistics and computer science) and a decrease of 4.5% in enrollments in first-year calculus. The number of junior-senior majors in Groups I, II and III combined shows a small increase of 1% from fall 1984, while Groups M and B combined report a 3% decrease. However, the raw data

for the individual groups shows an increase of 4% for Groups I, an increase of 2% for Group II, a decrease of 5% for Group III, an increase of 5% for Group IV, an increase of 2% for Group B, and a decrease of 6% for Group M. Graduate enrollments increased across the board with a relatively large increase in first year students (10% in Groups I, II and III combined and 17% in Group IV).

Enrollments in computer science courses offered by the surveyed departments continued to decline. Some of this decline is due to these courses now being offered by new and separate departments of computer science which we do not survey. However, the major part of the decline is doubtlessly due to a decline in interest in careers as computer scientists and analysts.

Part-time members of the faculty continue their significant role in undergraduate instruction in departments in Groups M and B. Here we have an estimated 5,570 part-time faculty members compared to 13,502 full-time faculty members. In contrast, we estimate that Groups I, II, and III combined utilize 959 part-time faculty members compared to 5,845 full-time faculty members. Last year's estimates were 904 and 5,497, respectively. In a subsequent survey we hope to obtain the number of full-time nontenure-track faculty members (permanent visitors).

Table 1: 1984-1985 Employment Status of New Doctorates in the Mathematical Sciences

Type of Employer	PURE MATHEMATICS						Statistics	Computer Science	Operations Research	Applied Mathematics	Mathematics Education	Other	Total
	Algebra and Number Theory	Analysis and Functional Analysis	Geometry and Topology	Logic	Probability								
Group I	23	17	20	4	3				8		8	83	
Group II	4	8	8	1	3	3			8		2	37	
Group III	10	10	8	1	6	5		1	14	1	3	59	
Group IV					3	14					2	19	
Group V					1	2		1	4			8	
Masters	11	18	4	2	3	19		1	6	1	3	68	
Bachelors	17	10	5	7	1	12	1	3	6	4	4	70	
Two-year College		2	2		1						1	6	
Other Academic Departments	5	1	4	1		23	3	13	8		3	61	
Research Institutes	2	3	1	2	2	5		2	5		2	24	
Government		3	1			4			5		1	14	
Business and Industry	4	6	4	5	6	31	6	12	15		19	108	
Canada, Academic	3	5			3	8			2		1	22	
Canada, Nonacademic	1	1			1	4					1	8	
Foreign, Academic	6	9	10	4	2	29	3	3	20	1	9	96	
Foreign, Nonacademic	5	8			2	25		5	9		7	61	
Not seeking employ.	1				1							2	
Not yet employed			1			1	2		1		1	6	
Unknown	2	4	2		1	4			4			17	
Total	94	105	70	27	39	189	15	41	115	7	67	769	

Table 2A: Faculty Flow 1984-1985 To 1985-1986

Full-Time Doctorate-Holding Faculty in 155 Doctorate-Granting Mathematics Departments in the U.S.
(Groups I, II, III)

From	Sources of New Faculty		To	Faculty Leaving	
	Nontenured	Tenured		Nontenured	Tenured
Graduate school	133	0	Doctorate-granting departments	112	27
Another college or university position	161	44	Other college or university position	48	9
Nonacademic employment	7	0	Nonacademic employment	16	12
Outside U.S.	30	11	Deaths and retirements	2	55
Other sources	<u>11</u>	<u>7</u>	Position outside U.S.	9	12
			Seeking employment	2	0
			Other	<u>12</u>	<u>19</u>
Total	342	62	Total	201	134
Received doctorate and not moving	(23)				
Received tenure and not moving		(97)	Received tenure and not moving		(97)

Estimated size of full-time faculty, Fall 1985 Groups I-III

Doctorate, Nontenured	1255	(-123 from Fall 1984)
Doctorate, Tenured	4204	(+218 from Fall 1984)
Nondoctorate faculty	386	(- 7 from Fall 1984)
Total full-time faculty	5845	(+ 88 from Fall 1984)

Table 2B: Faculty Flow 1984-1985 To 1985-1986

Full-Time Doctorate-Holding Faculty in Group IV

From	Sources of New Faculty		To	Faculty Leaving	
	Nontenured	Tenured		Nontenured	Tenured
Graduate school	31		Doctorate-granting departments	4	3
Another college or university position	13	4	Other college or university position	3	4
Nonacademic employment	1		Nonacademic employment	9	3
Outside U.S.	1	1	Deaths and retirements		9
Other sources	<u>4</u>	<u>1</u>	Position outside U.S.	1	
			Seeking employment		
			Other	<u>—</u>	<u>1</u>
Total	50	6	Total	17	20
Received doctorate and not moving	(5)				
Received tenure and not moving		(21)			

Estimated size of full-time faculty, Fall 1985 Group IV

Doctorate, Nontenured	247
Doctorate, Tenured	513
Nondoctorate faculty	21
Total full-time faculty	781

in Table 2A. However, useable responses to the Enrollments and Departmental Size Survey report 4,098 full-time faculty members for departments in Groups I, II, and III; hence, an index of 5,757/4,098, or 1.40, is used to extrapolate data on the enrollments.

Continuing the policy enunciated in the first report of the 1983 Survey, the survey no longer contains data from departments of computer science. The limited response from these departments made reliable estimates difficult. For the second year, returns from Group V departments were too small to be included. This survey, then, is an analysis of what might be called the traditional mathematics and statistics community. Because the response rate in the remaining groups continues at a high level, this year's survey gives a fairly accurate picture of faculty mobility, enrollments etc. within this community. It should be noted that while departments of computer science are not included in the survey, many departments of mathematics in Groups M and B teach computer science.

Faculty Mobility

This part of the Annual AMS Survey is concerned with the number of faculty members newly hired from various sources, as well as with the number of those individuals leaving faculty positions and information on their subsequent employment status. The Survey also monitors trends in the percentage of faculty members with tenure and the percentage of faculty members with doctoral degrees. The number of departments in each of Groups I, II, III, IV, M and B responding to the 1985 Survey of Faculty Mobility is somewhat smaller than last year. The responding departments represent nearly half (46%) of all mathematical sciences faculty members. About 56% of the faculty members in doctorate-granting mathematics departments (Groups I-III) are included among responding departments.

Tables 2A, 2B, and 2C show estimated faculty flow between 1984-1985 and 1985-1986 for U.S. departments. A composite number for all U.S. departments, excluding Group V, may be obtained by adding corresponding rows. The left side of each table shows the estimated numbers of new full-time faculty members hired from the sources indicated between fall 1984 and fall 1985. The right side of each table shows the fall 1985 employment status of those full-time faculty members (as of fall 1984) who had permanently left their departments by fall 1985.

Combining Tables 2A, 2B, and 2C, we have an estimated increase of 628 in the size of the doctorate-holding faculty and a decrease of 159 in the nondoctorate faculty, for an overall increase of 469 as compared to last year's increase of 681.

The pattern of faculty mobility obtained by comparing the two sides of a composite of Tables 2 continues past trends. Many full-time

nondractorate faculty members are being hired for jobs intended for doctorates (359 of 685). Most of the new nondoctorate faculty members (88%) were hired by Group M and B departments.

Attrition due to deaths and retirement is about 1.4% of the total, a slight increase over last year's 1.2%, but still in the vicinity of 1%. The number of faculty obtaining tenure was 414, down from last year's total of 453 but about equal to the previous year's total.

Nonacademic Employment of Doctorates in the Mathematical Sciences

Table 3 is a summary of AMS Survey data on the employment of new doctorates during the last six years 1979-1980 to 1984-1985.

Table 3: New Mathematical Sciences Doctorates Taking Nonacademic Positions in U.S.

	1979	1980	1981	1982	1983	1984
	<u>-80</u>	<u>-81</u>	<u>-82</u>	<u>-83</u>	<u>-84</u>	<u>-85</u>
In government	37	28	22	24	23	14
In business/ industry	<u>165</u>	<u>169</u>	<u>141</u>	<u>105</u>	<u>110</u>	<u>108</u>
Total	202	197	163	129	133	122
Total new doctorates employed in U.S.	691	732	659	583	597	557
% in govt./ bus./ind.	29%	27%	25%	22%	22%	22%

Table 3 shows a levelling in the hiring of new doctorates by business and industry. Many of these jobs are in companies in high technology, computer-information processing, or communications areas. A significant number are with organizations which do consulting work in operations research, statistics or applied physics, or which provide computer software or data management services.

Table 4: Estimated Net Outflow of Doctorate-Holding Faculty Members to Nonacademic Employment

	1979	1980	1981	1982	1983	1984
	<u>-80</u>	<u>-81</u>	<u>-82</u>	<u>-83</u>	<u>-84</u>	<u>-85</u>
Net outflow	168	116	94	46	125	22

Table 4 shows the estimated annual net outflow of doctorate-holding faculty members to nonacademic positions since 1979. The number 22 is obtained by combining the results of the survey. Note the breakdown was a net outflow of 21 in Groups I, II, III combined, an outflow of 12 in Group IV, and a net inflow of 11 in Groups M and B. The data reflects a return to the decline in the loss of doctorate-holding mathematical sciences faculty members to nonacademic employment.

In summary, the 1985 AMS Survey showed an increase of 628 in the number of doctorate-holding faculty members in U.S. colleges and universities and a decrease of 159 in the nondoctorate faculty

members, for a net increase of 469. Most new doctorates took academic positions, but 22% of those employed in the U.S. took jobs in government, business or industry, and 20% of the new doctorates took foreign employment. There

are very few unemployed Ph.D.'s in mathematics at any level, and there is a shortage of new doctorate-holding faculty members in Groups M and B.

Table 5: Total Course Enrollments for Fall 1985 (in Thousands)

(Percent increase from fall 1984 in parentheses)*

Type of Course	Groups				
	I, II, III	IV	VI	M, B	
Below calculus	288 (4%)		10 (11%)	641 (-1%)	
First year calculus	207 (-4%)		25 (-1%)	258 (-3%)	
Statistics	25 (4%)	43 (2%)	12 (-3%)	114 (0%)	
Computer Science	18 (-19%)		3 (-7%)	196 (-6%)	
Other undergraduate mathematics courses	167 (-5%)		34 (-3%)	213 (0%)	
Graduate courses	25 (8%)	11 (3%)	1 (+2%)	21 (10%)	
All courses	730 (-1%)	54 (2%)	85 (-1%)	1443 (-2%)	

*This is obtained from the raw data as reported for the two years on this 29th Annual Survey. It is not based on last year's estimates.

Table 6: Majors and Graduate Students

(Percent increase over fall 1984 in parentheses)*

Fall 1985	I, II, III	IV	VI	M, B
Total junior-senior majors	18508 (1%)	717 (5%)	5008 (8%)	55851 (-3%)
Total first year graduate students	2618 (10%)	606 (17%)	196 (-3%)	1733 (6%)
Total graduate students	8191 (7%)	1782 (4%)	598 (5%)	3679 (5%)

*See footnote for Table 5.