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27th Annual AMS Survey   1983
Second Report

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A first report of the 1983 Survey appeared in the November 1983 *Notices*, pages 720–747. It included a report of the survey of faculty salaries, a first report of the survey of new 1982-1983 doctorates, and a list of the names and thesis titles of the 1982-1983 doctorates included in the Survey. This second report includes an update of the fall 1983 employment status of new doctorates, an analysis of faculty mobility, and a report on fall 1983 enrollments and class sizes.

The 27th Annual AMS Survey was made under the direction of the Society's Committee on Employment and Educational Policy (CEEP), whose members in 1983 were Lida K. Barrett, Irwin Kra, Robert W. McKelvey, Donald C. Rung (chairman), Lisl Novak Gaal, and Barnet M. Weinstock. A Data Subcommittee of CEEP, consisting of Lida K. Barrett, Susan J. Devlin, Lincoln K. Durst, Wendell H. Fleming, Arthur P. Mattuck 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 1983

by Donald C. Rung

This report is one in a series of annual reports on employment patterns, enrollment and class size in the mathematical sciences. It begins with an update of the fall 1983 employment status of new 1982-1983 doctorates, followed by an analysis of trends in the academic job market based upon the 1983 AMS Survey of Faculty Mobility. It also contains for the first time estimates on the total enrollment in courses for fall 1982 and fall 1983 as well as class size for fall 1983. Also for the first time are estimates for the number of majors at the junior and senior level and graduate student enrollment.

Estimates based on AMS Survey data suggest that 724 full-time positions in U.S. colleges and universities were filled by nondoctorates last fall and for 401 of these positions, the department would have preferred someone with a doctorate. Of these positions, 381 were in Groups M and B departments. (See the box for descriptions of the groups.) While the estimated total increase for this year in the size of the full-time faculty (672) is one of the largest in recent years, the increase for Groups I, II and III is only 33 (Table 3). Further the net increase in the nondoctorate faculty (174) is positive for the fourth consecutive year, after nine consecutive years of decline.

Enrollments in all courses totalled 2,450,000 with 62% of this number in Groups M and B (Table 6). Average class size is only slightly higher than last year (Table 7). Part-time members of the faculty continue to play a significant role in undergraduate instruction in departments in Groups M and B where there are an estimated 5,570 part-time faculty members as compared with 12,100 full-time faculty members. In contrast there are 775 part-time faculty members in Groups I, II, III where there are 5,600 full-time faculty members.

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 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 1982 of 17,850 full-time U.S. mathematical sciences faculty members, 9,282 are members of departments which responded to the survey.

[1] These findings were published in *An Assessment of Research-Doctorate Programs: Mathematical and Physical Sciences*. The information on mathematics, statistics and computer science was presented in digest form in the April 1983 issue of the *Notices*, pp. 257–267, and an analysis of the above classifications was given in the June 1983 *Notices*, pp. 392–393.

The number of graduate students increased by 8% in Groups I, II and III (Table 8). The percentage of new doctorates taking nonacademic employment dropped to 23% from the 1982 figure

of 25%, the lowest figure since 1975 (Table 4); there was a corresponding decline in the net outflow of doctorate-holding faculty members (42) to nonacademic employment (Table 5).

Fall 1983 Employment Status of 1982-1983 New Doctorates

Table 1 contains the fall 1983 employment status by type of employer and field of degree for 792 new mathematical sciences doctorates who receive the degree between July 1, 1982, and June 30, 1983. The names of these 792 people and the titles of their doctoral theses were published in the November 1983 *Notices*, pages 734-747. Table 1 updates the corresponding table on page 727 of the November 1983 *Notices*, using more recent information provided by departments and the recipients of the degrees. The total does not include a few more recipients of doctorates who were reported too late to gather employment information for these reports. (A supplementary list of recipients will appear in the April 1984 *Notices*.)

The first five rows in Table 1 refer to those 1982-1983 new doctorates employed by doctorate-granting departments in the U.S. The next two rows refer to those employed by U.S.

mathematical sciences departments which grant masters and bachelors degrees only. There seem to be good job prospects for new doctorates in departments in Groups M and B. It should be noted that the survey of enrollments shows that in Groups M and B computer science and statistics enrollments far exceed first year calculus enrollments! Mathematicians prepared to teach these courses will find no lack of opportunity to do so at those schools.

The numbers in Tables 2, 3, 5, 6 and 8 were obtained by extrapolation from the AMS Survey and are not actual counts. The various totals from each Group were multiplied by the ratio of the size of the faculty in various groups (obtained by adjusting the figures in the 1980 CBMS report or using actual counts in Group VI) to the number of faculty members represented in the responding departments.

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 this survey, returns from Group V departments were too small to be included. This survey, then, is an analysis of what might be called the traditional

TABLE 1: 1983-1984 Employment Status of New Doctorates in the Mathematical Sciences

Type of Employer	PURE MATHEMATICS											
	Algebra and Number Theory	Analysis and Functional Analysis	Geometry and Topology	Logic	Probability	Statistics	Computer Science	Operations Research	Applied Mathematics	Mathematics Education	Other	Total
Group I	11	23	23	4	4	2	0	0	6	0	3	76
Group II	10	14	4	2	0	4	0	1	7	0	2	44
Group III	4	14	5	1	2	11	1	1	9	0	2	50
Group IV	0	0	0	0	0	30	0	0	1	0	0	31
Group V	0	4	0	0	0	4	3	5	1	0	2	19
Masters	13	16	15	1	5	13	1	3	12	0	10	89
Bachelors	17	12	12	3	1	9	1	3	4	0	8	70
Two-year College or High School	1	0	2	0	0	0	0	0	0	0	2	5
Other Academic Departments	3	4	0	0	0	25	1	12	5	0	5	55
Research Institutes	4	4	2	0	0	1	0	0	3	0	1	15
Government	0	1	0	0	0	11	1	2	7	0	2	24
Business and Industry	3	8	5	0	3	33	7	19	17	0	10	105
Canada, Academic	2	6	3	0	1	6	0	1	2	0	2	23
Canada, Nonacademic	1	0	0	0	0	2	0	0	4	0	0	7
Foreign, Academic	13	20	14	1	4	21	1	5	10	0	8	97
Foreign, Nonacademic	6	2	3	0	0	14	1	9	7	0	2	44
Not seeking employ.	2	2	1	0	1	1	0	0	3	0	0	10
Not yet employed	0	6	2	1	0	1	0	2	2	0	2	16
Unknown	2	1	1	3	1	0	1	0	3	0	0	12
Total	92	137	92	16	22	188	18	63	103	0	61	792

mathematics and statistics community. Because the response rate in the remaining groups is at the highest level in recent years 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 most departments of mathematics in Groups M and B teach the computer science courses whose enrollment (300,000) is probably 70% of all computer science enrollments in the U.S.

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 with 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 1983 Survey of Faculty Mobility is similar to that of previous years. The responding departments represent about half (52%) of all mathematical sciences faculty members. About 70% of the faculty members in doctorate-granting mathematics departments (Groups I-III) are included among responding departments.

Table 2 shows estimated faculty flow between 1982-1983 and 1983-1984 for U.S. departments. Further analyses for Groups I-III are given in Table 3. The left side of Table 2 shows the estimated numbers of new full-time faculty members hired from various sources between fall 1982 and fall 1983. The right side of Table 2 shows the fall 1983 employment status of those full-time faculty members (as of fall 1982) who permanently left their departments by fall 1983. The row "graduate school" on the left side includes new faculty members coming from departments outside the mathematical sciences, or from mathematics education. Similarly, the second row in Table 2 includes some moving to or from departments in other fields or other positions in academia (e.g., in a university computer or statistical laboratory). The number (+49) in parentheses represents a change from nondoctorate to doctorate status of individuals who remained as full-time faculty members in the same department.

Table 2 shows an estimated increase, between fall 1982 and fall 1983, of 498 in the size of the doctorate-holding faculty and an increase of 174 in the nondoctorate faculty, for an overall increase of 672, the second largest in a decade.

The pattern of faculty mobility obtained by comparing the two sides of Table 2 continues somewhat the trend of last year. Many full-time nondoctorate faculty members are being hired. The figure of 724 shown in Table 2 corresponds to the estimate of 435 six years ago (February 1978 *Notices*, page 101). Most (93%) of the new nondoctorate faculty members were hired by departments in Groups M and B.

Attrition due to deaths and retirements is about (0.8%) of the total faculty. The number of faculty

TABLE 2: Faculty Flow 1982-1983 To 1983-1984

Full-Time Mathematical Sciences Faculty in Four-Year Colleges and Universities in the U.S.

FROM	Sources of New Faculty		TO	Fall 1983 Employment Status, Faculty Leaving	
	Doctorate-Holding	Nondoctorate		Doctorate-Holding	Nondoctorate
Graduate School	426	304	Two-year college or high school	8	60
Another college or university position	602	90	Another college or university position	459	106
Nonacademic employment	82	96	Nonacademic employment	128	92
Outside U.S.	85	14	Deaths and retirements	98	65
			Position outside U.S.	41	2
			Graduate or professional school	12	64
			Seeking employment	20	21
Other sources[1]	81	220	Other[3]	61	91
Total	1276	724	Total	827	501
Received doctorate and not moving[2]	(+49)		Received doctorate and not moving		(+49)
	1325				550

Estimated size of full-time U.S. mathematical sciences faculty, Fall 1983

Doctorate-holding 14,112 (+498 from Fall 1982)
Nondoctorate   4,415 (+174 from Fall 1982)
18,527 (+672 from Fall 1982)

[1] Part-time to full-time in same department, from postdoctoral or two-year college position, etc.
[2] Mostly in Group M and B departments.
[3] No longer full-time in department, unknown employment status, etc.

members who received tenure in their institutions is 418, up from last year's total of 403.

Doctorate-granting Departments of Mathematics (Groups I, II, III). Table 3 gives a somewhat different perspective of faculty mobility in and out of the 155 U.S. departments with doctoral programs. In Table 3 the sources of new tenured and nontenured doctorate-holding faculty members are shown, as well as the employment status of those leaving between academic years 1982-1983 and 1983-1984.

Group VI. The number of faculty in Canadian doctorate-granting universities (Group VI) increased from 880 in fall 1982 to 896 in fall 1983; with eight receiving tenure.

Groups M and B. The number of nondoctorate faculty members hired by Groups M and B departments had been steadily increasing, from about 350 newly hired for fall 1977 to 734 for fall 1982; there was a slight decrease to 674 for fall 1983.

The M and B departments are very diverse, ranging from medium-to-large departments in public institutions to quite small departments in private colleges of varying degrees of selectivity. Besides mathematics instruction, mathematics departments in Groups M and B often have responsibilities in applied areas which in larger universities are taken by separate departments of statistics, operations research or computer science. As mentioned earlier, there are opportunities for young mathematicians with a strong commitment to teaching who fit the needs of Groups M or B departments.

Nonacademic Employment of Doctorates in the Mathematical Sciences

Table 4 is a summary of AMS Survey data on the employment of new doctorates during the last six years 1977-1978 to 1982-1983.

TABLE 4: New Mathematical Sciences Doctorates Taking Nonacademic Positions in U.S.

	1977 -78	1978 -79	1979 -80	1980 -81	1981 -82	1982 -83
In government	44	34	37	28	22	24
In business/industry	166	168	165	169	141	105
Total	210	202	202	197	163	129
Total new doctorates employed in U.S.	734	690	691	732	659	583
% in govt./bus./ind.	29%	29%	29%	27%	25%	22%

Table 4 shows a sharp decline in hiring of new doctorates by business and industry. It will be interesting to see if the economic recovery will reverse this decline. 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. The November 1980 issue of *Employment Information in the Mathematical Sciences* contains lists of the names and addresses of nonacademic employers of the individuals included in Table 1 on page 608 of the November 1980 *Notices*, with an indication of the thesis field of the employee. Also see a related

TABLE 3: Faculty Flow 1982-1983 To 1983-1984

Full-Time Doctorate-Holding Faculty in 155 Doctorate-Granting Mathematics Departments in the U.S.

(Groups I, II, III)

Sources of New Faculty			Fall 1983 Employment Status, Faculty Leaving		
FROM	Nontenured	Tenured	TO	Nontenured	Tenured
Graduate School	150		Doctorate-granting departments	115	16
			Other college or university position	45	4
Another college or university position	131	20	Nonacademic employment	32	10
Nonacademic employment	14	1 }	Deaths and retirements	0	45
Outside U.S.	36	4 }	Position outside U.S.	14	
Other sources	16	—	Seeking employment	3	10 }
			Other	13	
Total	347	25	Total	222	85
Received doctorate and not moving	(+13)				
Received tenure and not moving		(+107)	Received tenure and and not moving	(+107)	—
	360	132		329	85

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Estimated size of full-time faculty, Fall 1983 Groups I—III
    Doctorate, Nontenured    1,298 (+31 from Fall 1982)
    Doctorate, Tenured       3,932 (+47 from Fall 1982)
    Nondoctorate faculty       390 (-46 from Fall 1982)

    Total full-time faculty  5,620 (+32 from Fall 1982)
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TABLE 6: Total Course Enrollments (in Thousands)

(Percent increase from fall 1982 in parentheses)

By Type of Course, Fall 1983

Type of Course	Groups				All Groups
	I, II, III	IV	VI	M, B	
Below calculus	270 (1%)	3.4 (6%)	*	626 (0%)	
First year calculus	224 (−1%)	*	32.2 (11%)	268 (3%)	
Statistics	*	42.9 (2%)	17.8 (11%)	110 (5%)	
Computer Science	*	*	*	299 (21%)	
Other undergraduate mathematics courses	167 (5%)	*	43.7 (1%)	204 (9%)	
Graduate courses	21.4 (16%)	14.1 (−3%)	1.03 (16%)	25.2 (16%)	
All courses	738 (3%)	62.6 (1%)	103 (5%)	1531 (6%)	2450 Total

*Enrollments in this type of course amount to less than 5% of total undergraduate enrollments for this group of departments.

article by David H. Bailey in the November 1983 *Notices*, pages 756–758. (*Errata*—In the Bailey article, there are two errors. An employer's name is misspelled. The last entry under Massachusetts should be: Verbex (5) 2 Oak Park, Bedford, MA 01730. Also, there is an incorrect address. The second entry under Virginia should be: Center for Naval Analyses (35) 2000 North Beauregard, Alexandria, VA 22311.)

TABLE 5: Estimated Net Outflow of Doctorate-Holding Faculty Members To Nonacademic Employment

	1978	1979	1980	1981	1982	1983
Net outflow	190	165	168	116	94	46

Table 5 shows the estimated annual net outflow of doctorate-holding faculty members to nonacademic positions since 1978. The number 46 for 1983 is the difference of 128 doctorates shown in Table 2 leaving academia and 82 hired in academia from nonacademic positions: the 1983 number is the lowest in at least eleven years, and is half of last year's total (94).

In summary, the 1983 AMS Survey showed an increase of 498 in the number of doctorate-holding faculty members in U.S. colleges and universities and a corresponding increase of 174 in nondoctorate faculty members. Most new doctorates (70%) found employment in academic positions, while 22% took positions in government or industry in the U.S. There are very few unemployed Ph.D.'s in mathematics at any level and there seems to be a shortage of new doctorate faculty members at schools in Groups M and B.

Changes in Enrollments and Class Size

For the first time total enrollments have been estimated. Table 6 gives these figures.

Table 7 gives class sizes for mathematical sciences departments for fall 1983.

Junior-Senior Major and Graduate Student Enrollments. Another new set of data is given in Table 8, where total enrollment of junior-senior majors and graduate students is presented. Doctorate-granting mathematics departments in

TABLE 7: Average Class Size in Fall 1983

Type of Course	Groups						
	I	II	III	IV	VI	M	B
Below calculus	38	46	48	—	—	40	32
First year calculus	35	43	43	—	96	36	29
Statistics	—	—	—	44	54	35	30
Computer Science	—	—	—	—	—	33	29
Other undergraduate mathematics courses	33	35	34	—	52	26	18
Graduate courses	11	10	9	13	6	11	13
All courses	34	39	39	32	57	33	28

A dash indicates that these courses represent less than 5% of total undergraduate enrollment for departments in this category.

TABLE 8: Junior-Senior Majors and Graduate Enrollment
(Percent increase over fall 1982 enrollment in parentheses)

Fall 1983

Groups

	I, II, III	IV	VI	M, B
Total junior-senior majors in department (including joint majors)	17,800 (20%)	1250 (13%)	3384 (17%)	64,900 (21%)
Total full-time graduate students (including teaching assistants)	7040 (8%)	1900 (2%)	881 (9%)	4980 (22%)
Total full-time first year graduate students (including teaching assistants)	2,300 (9%)	580 (2%)	296 (18%)	3218 (9%)

the U.S. (Groups I, II, III) reported an 8% increase in the number of full-time graduate students from fall 1982 to fall 1983. Further, the number of entering full-time first-year graduate students in Groups I, II, III increased by 9%.

This was the third year of such increases. Junior-senior majors also showed a hefty increase.

By way of a postscript the author welcomes any comments or suggestions on the format, data presented, etc. of these annual reports, as well as the various ad hoc reports of CEEP. Please send your remarks to Donald Rung, Department of Mathematics, 425 McAllister Building, Pennsylvania State University, University Park, Pennsylvania 16802.