

1998 Annual Survey of the Mathematical Sciences

(Second Report)

Report on the 1998 Survey of New Doctoral Recipients, Starting Salary Survey of New Doctoral Recipients, Faculty Characteristics, Enrollment Profile, Undergraduate Majors, and Graduate Student Profile

Paul W. Davis, James W. Maxwell, and Kinda M. Remick

This is the Second Report of the 1998 Survey, which includes analysis of data on departmental enrollments, majors, and faculty size, as well as an update of the First Report, which appeared in the *Notices of the AMS* in February 1999, pages 224-35. It included a report on the 1997-98 new doctoral recipients and salary data on faculty members in four-year colleges and universities.

The 1998 Annual Survey represents the forty-second in an annual series begun in 1957 by the Society. The 1998 Survey was under the direction of the Annual Survey Data Committee, whose members were Paul W. Davis (chair), Lorraine Denby, Malay Ghosh, Mary W. Gray, Alfred W. Hales, Don O. Loftsgaarden, James W. Maxwell (ex officio), Mary Beth Ruskai, Ann K. Stehney, and Ann E. Watkins. Comments or suggestions regarding the Annual Survey may be directed to the Committee.

Highlights

The final count of 1,231 new doctorates awarded July 1, 1997, through June 30, 1998, is a slight increase over the previous year's final count of 1,174, continuing last year's gradual increase. The number (and proportion) of 1997-98 doctoral recipients who were female rose slightly to 306 (24.8%) after last year's substantial jump to 298 (25.0%). However, this year's figure of 306 represents the largest number of female recipients ever reported.

The final fall 1998 unemployment rate was 4.9%, an increase from last year's 3.8% but still about half the devastating rates of much of the '90s. As last year, employment in business, industry, and government seemed to account for much of the improvement. These sectors employed 307 individuals (34.8%) of those who found employment in the U.S., comparable to last year's 286 individuals (35.5%).

Using data collected from 539 of the 1997-98 doctoral recipients employed in the U.S., 313 reported obtaining a permanent position and 226 a temporary position. Of the latter, 128 took the position because a suitable permanent one was not available; 129 classified their temporary position as postdoctoral.

Of those who were employed, about three-quarters agreed that their positions were related to their field, professionally challenging, and commensurate with their

education. About three-fifths agreed that their position was similar to what they expected at the beginning of their doctoral programs, but one-fifth disagreed, sometimes strongly, with that proposition.

The fall 1998 median starting salary for a 9-10-month appointment, teaching or teaching and research, was \$37,000, a very slight increase from the 1997 median of \$36,600, itself an increase of only \$600 from 1996.

Within mathematics departments, the total full-time doctoral faculty increased by only 0.5% over the year. The number of untenured tenure-track doctoral faculty increased by 1.7%, reversing a trend of steady decline. However, the number of non-tenure-track doctoral faculty continued to increase, this year by 6.1%

This year's 3.8% increase in the number of first-year graduate students enrolled in doctorate-granting mathematics departments continues last year's increase of 4.7%, the first since 1991. Although the total number of full-time female graduate students in these institutions increased by 3.1% (following last year's first-year increase of 8.1%), first-year female enrollments rose only 0.9%. Group Va departments reported substantial drops in almost all categories of graduate enrollment, but response rates were too small to permit reliable prediction for all such departments.

As has been the case for a number of years, much of the data in these reports is presented for departments divided into groups according to several characteristics, the principal one being the highest degree offered in the mathematical sciences. Doctorate-granting departments of mathematics are further subdivided according to their ranking of "scholarly quality of program faculty" as reported in the 1995 publication *Research-Doctorate Programs in the United States: Continuity and Change*.¹ These rankings update those reported in a previous study published in 1982.² Consequently, the departments that now comprise Groups I, II, and III differ significantly from those used in prior surveys. The reader should keep this in mind when attempting to make comparisons by group with previous Annual Survey reports.

The subdivision of the Group I institutions into Group I Public and Group I Private was new with the 1996 Annual Survey. With the increase in the number of Group I departments from 39 to 48, the AMS-IMS-MAA Data Committee judged that a further subdivision along the lines of public and private would provide more meaningful reporting of the data for these departments.

Brief descriptions of the groupings used for reporting purposes are as follows:

Group I is composed of 48 departments with scores in the 3.00-5.00 range.

Group I Public and **Group I Private** are Group I departments at public institutions and private institutions respectively.

Group II is composed of 56 departments with scores in the 2.00-2.99 range.

Group III contains the remaining U.S. departments reporting a doctoral program, including a number of departments not included in the 1995 ranking of program faculty.

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 Va is applied mathematics/applied science; **Group Vb** is operations research and management science.

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.

Listings of the departments which comprise Groups I through V are available through the AMS's Web site at www.ams.org/membership/survey.html.

¹*Research-Doctorate Programs in the United States: Continuity and Change*, edited by Marvin L. Goldberger, Brendan A. Maher, and Pamela Ebert Flattau, National Academy Press, Washington, DC, 1995.

²These 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, DC, 1982. The information on mathematics, statistics, and computer science was presented in digest form in the April 1983 issue of the *Notices*, pages 257-67, and an analysis of the classifications was given in the June 1983 *Notices*, pages 392-3.

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Introduction

The AMS-IMS-MAA Annual Survey collects information each year about departments, faculties, and students in the mathematical sciences at four-year colleges and universities in the United States. This article reports results from three parts of the 1998 AMS-IMS-MAA Annual Survey. First, we update information about new doctoral recipients reported earlier in the February 1999 issue of the *Notices of the American Mathematical Society* (see pages 224-35). Second, we present the starting salaries of the new doctoral recipients who responded to a follow-up survey. Third, we present results about the characteristics of faculties and of instructional programs at the undergraduate and graduate levels.

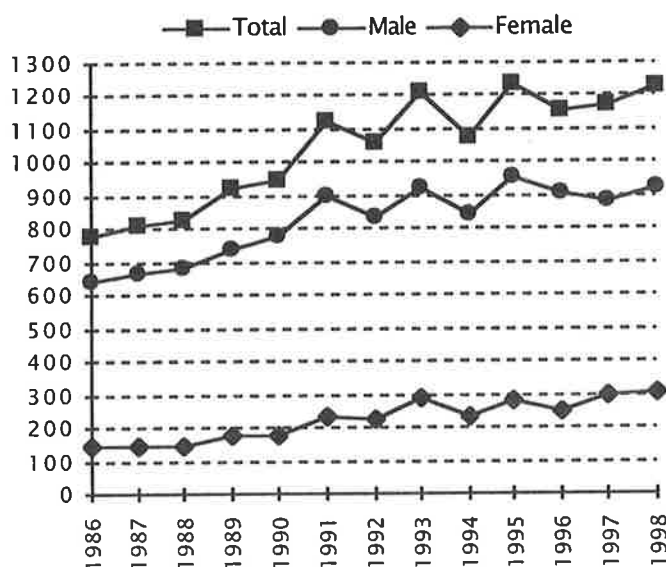
In the interest of continuity in analysis and presentation and to make year-to-year comparisons possible, we report the same kinds of information that were included in last year's Second Report. Details are presented concerning employment patterns for new doctoral recipients, department faculty characteristics, and distribution of enrollments in different types of departments. As explained in the 1997 First Report section "Revised Procedure for Survey of Employment Status" (*Notices of the AMS*, January 1998, page 33), individual recipients of new doctorates formerly reported their employment status for the upcoming fall during the summer following the academic year in which the degree was awarded. For this year's survey, all doctoral recipients were sent in October the revised and expanded questionnaire Employment Experiences of New Doctoral Recipients. They were asked to report their employment status as of the week of October 12, 1998, and to report additional details on their employment experiences as of that week. In spite of this change in procedure, comparisons with prior years of the key employment indicators remain valid. In addition, use of the survey form and procedures allows the employment experiences of the 1997-98 doctoral recipients in the mathematical sciences to be compared with those of doctoral recipients in a number of other academic disciplines. An initial report on this comparative data is available through *Science* magazine's Next Wave Web site at www.nextwave.org/.

For the Departmental Profile Survey, we follow the procedure started in the 1991 Second Report of reporting projections of survey responses to the entire population of mathematical sciences departments. The projections of survey responses to the entire population are done within strata defined by the survey groups. For example, on the part concerned with faculty, there were 21 usable responses from the twenty-five departments in Group I Public (see Table 3A). The twenty-one responding departments reported 30 full-time faculty to have retired or died, and this tally was multiplied by 25/21 to obtain the projected value of 36 for the group as a whole.

We caution the reader that survey responses and the proportional projections are potentially biased due to (i) selection bias of the responding departments and (ii) inhomogeneity of departments within the survey groups. The responses and projections for total faculty size are slightly affected by this bias. Nonetheless, the problems of a possible selection bias are mitigated by the generally high re-

Table 1A: U.S. New Doctoral Recipients, Fall and Final Counts, 1991-1998

Year	Fall	Final
1992-1993	1202	1214
1993-1994	1059	1076
1994-1995	1226	1237
1995-1996	1153	1154
1996-1997	1158	1174
1997-1998	1216	1231

Table 1B: Trend Chart of Final Count of New Doctoral Recipients, 1986-1998

sponse rates to the Annual Survey. In groups with lower response rates (e.g., Groups M and B) there is greater risk of biased projections.

Update on the 1998 Survey of New Doctoral Recipients

Information about recipients of doctoral degrees awarded between July 1, 1997, and June 30, 1998, was collected from doctorate-granting departments in late spring 1998 and from a follow-up census of individual degree recipients beginning in October. The "1998 AMS-IMS-MAA Annual Survey First Report" (*Notices of the AMS*, February 1999, pages 224-35) presents the survey results obtained about new doctoral recipients from the departments. Here we update the earlier figures on the basis of the follow-up census.

The names of the 1997-98 doctoral recipients and their thesis titles were published in "Doctoral Degrees Conferred" (*Notices of the AMS*, February 1999, pages 246-65). A supplement to this list appears after this report.

The final count of new doctoral recipients (Table 1A) shows a total of 1,231 doctorates in mathematical sciences awarded by U.S. institutions. This number represents an increase of 4.9% from the 1,174 doctorates awarded during 1996-97. Table 1B shows the overall and

by-gender trends in the final counts of new doctoral recipients from 1985-86 through 1997-98.

Citizenship status is known for all of the 1,231 new doctoral recipients. The final count of new doctoral recipients who are U.S. citizens is 592. The percentage of 1997-98 new doctoral recipients who are U.S. citizens is 48.1%, up from the reported 44.5% of the past year and up slightly from the previous high of 47.9% of 1994-95. The final count of new doctoral recipients who are non-U.S. citizens decreased slightly from 652 to 639 and was well below the record high of 679 reported in the final count five years ago. Pages 228-30 of the First Report present further information related to the citizenship of the 1997-98 new doctoral recipients.

Of the 592 U.S.-citizen new doctoral recipients, 164 are women and 428 are men. The 164 women new doctoral recipients comprise 27.7% of the U.S. citizen total for 1997-98, a slight increase over last year's count of 150 (28.7%). The number of U.S. citizen men, 428, increased by 15.1% from 1996-97.

Tables 2A and 2B display updates of employment data for the fall count of 1997-98 doctoral recipients, partitioned by field of thesis research and by the survey group of their degree department. At the time of the Second Report, the fall 1998 employment status of 1,078 of the 1,216 doctoral recipients was known. Of the 1,078, 49.4% assumed academic employment in the U.S. Another 11.0% took academic employment in other countries. Both of these percentages are equivalent to percentages reported last year but are down sharply from their levels of the early 1990s.

Employment of 1997-98 doctoral recipients by U.S. Ph.D.-granting institutions increased by 7.8% from the corresponding figure for 1996-97. Employment of the 1997-98 doctoral recipients by research institutes, government, and business and industry increased by 7.6% (including a slight increase of 3.6% in employment by business and industry).

Among those 1997-98 doctoral recipients taking employment in the U.S., 35.3% took nonacademic employment (government or business and industry). Although this percentage was almost identical to the 1996-97 doctoral recipients, overall there has been a steady growth throughout the 1990s of employment of mathematical scientists in nonacademic positions in the U.S. The corresponding figure for 1990-91 was 21.0%. The fraction of the 1997-98 doctoral recipients taking nonacademic employment varied significantly by field of thesis. Of those whose field of thesis was either algebra/number theory, real or complex analysis, or geometry/topology, 17.4% took nonacademic employment. For probability or statistics the analogous figure is 48.5%; and for applied math, discrete math/combinatorics/logic/computer science, numerical analysis/approximations, or linear/nonlinear optimization the analogous figure is 43.1%.

Group I departments continued to award the most doctorates. Of the 1,216 doctoral degrees awarded in the mathematical sciences between July 1, 1997, and June 30, 1998, 39.5% (480) were awarded by the Group I departments, while 21.7% (264) by Group II, and 10.6% (129) by Group III.

Table 2A: Fall 1998 Employment Status of 1997-98 U.S. Doctoral Recipients in the Mathematical Sciences, Updated April 1999

TYPE OF EMPLOYER	FIELD OF THESIS											TOTAL		
	Algebra Number Theory	Real or Complex Analysis	Geometry/Topology	Discr. Math./Combin./Logic/Comp. Sci.	Probability/Statistics	Applied Math.	Numerical Analysis Approximations	Functional Analysis	Linear Nonlinear Optim./Control	Differential Integral and Difference Equations	Harmonic Analysis and Topological Groups		Other/Unknown	
Group I (Public)	22	1	15	5	5	3	1	3		7	3	1	66	
Group I (Private)	13	1	7	2	2	5	4			7	1		42	
Group II	14	2	9	1	7	2	3	5	1	6	2	1	53	
Group III	3	2	6	3	3	2	4	2			1	1	27	
Group IV		2	1		32			1					36	
Group V			1	1	2	4	2						10	
Master's	12	6	6	8	18	4	7	4	1	5	2	2	75	
Bachelor's	28	10	24	15	9	7	9	6		13	4	4	129	
Two-Year College	1	1	3		1	2			1				9	
Other Academic Dept.	6	1	5	7	29	16	10	1	3	3	2	2	85	
Research Inst./Nonprofit	4	1	2	1	10	5	1		1	3	2	1	31	
Government	6	2	1	3	13	6	9	2	4	3	1		50	
Business/Industry	18	9	8	19	98	35	20	4	11	23	8	4	257	
Foreign, Academic	26	3	23	6	16	10	6	8	1	12	5	3	119	
Foreign, Nonacademic	1	1	1	2	6	4	3		1	1	4		24	
Not seeking employment	2	1	2		3	2				2			12	
Still seeking employment	9	1	6	8	8	3	6	2	2	4	4		53	
Unknown (U.S.)	7	2	6	9	21	7	4		3	6	3	3	71	
Unknown (non-U.S.)*	10	5	12	3	14	4	1	1	3	6	2	6	67	
Column Total	182	51	138	93	297	121	90	39	32	101	44	28	1216	
Column	Male	143	40	114	72	201	94	75	33	24	73	32	17	918
Subtotals	Female	39	11	24	21	96	27	15	6	8	28	12	11	298

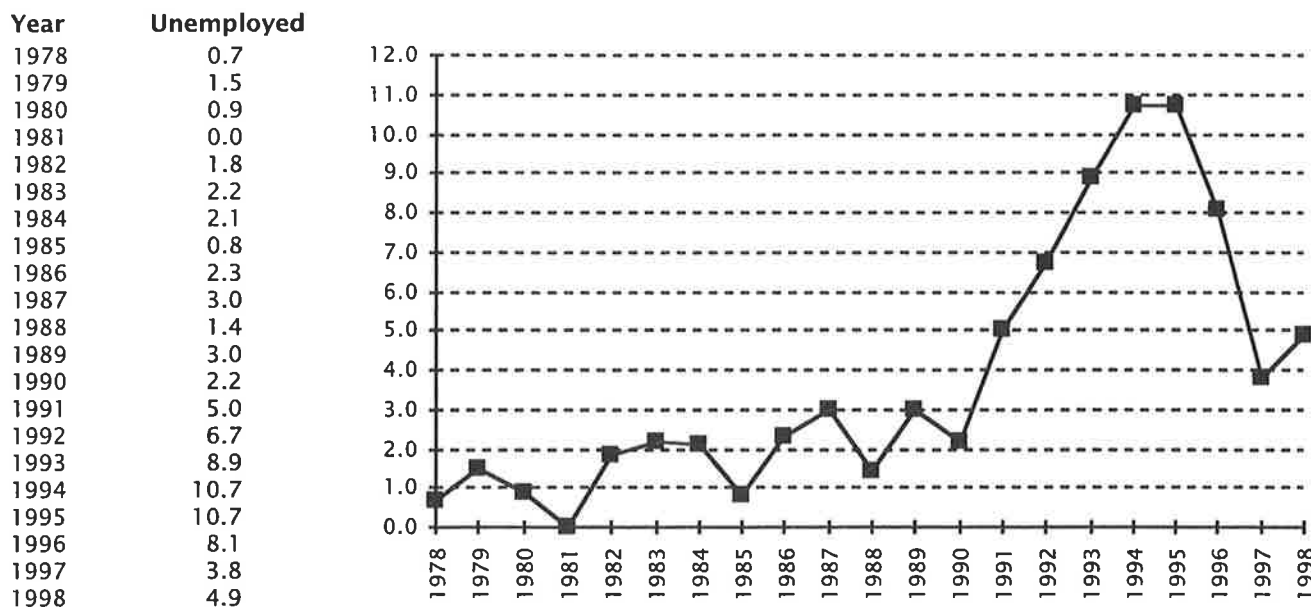
*Non-U.S. citizens who return to their country of citizenship and whose status is reported as "unknown" or "still seeking employment".

Table 2B: Fall 1998 Employment Status of 1997-98 U.S. Doctoral Recipients by Type of Granting Department, Updated April 1999

TYPE OF EMPLOYER	TYPE OF DOCTORAL DEGREE-GRANTING DEPARTMENT						ROW TOTAL	ROW SUBTOTAL	
	Group I (Public) Math	Group I (Private) Math	Group II Math	Group III Math	Group IV Statistics	Group V Applied Math/OR		Male	Female
Group I (Public)	30	24	9	1		2	66	51	15
Group I (Private)	10	24	5	1		2	42	39	3
Group II	19	10	18	2	2	2	53	42	11
Group III	7	4	6	6	3	1	27	21	6
Group IV	1		3	2	29	1	36	25	11
Group V	1	1		2	2	4	10	7	3
Master's	13	8	24	15	13	2	75	54	21
Bachelor's	34	12	53	23	6	1	129	88	41
Two-Year College	1		6	2			9	5	4
Other Academic Dept.	10	9	13	5	24	24	85	55	30
Research Inst./Nonprofit	7	8	1	2	6	7	31	23	8
Government	14	2	11	5	11	7	50	38	12
Business/Industry	37	27	44	25	75	49	257	195	62
Foreign, Academic	49	19	19	7	14	11	119	99	20
Foreign, Nonacademic	8	5		3	2	6	24	20	4
Not seeking employment	4	3	1	1	1	2	12	6	6
Still seeking employment	14	6	16	10	6	1	53	41	12
Unknown (U.S.)	24	4	19	8	10	6	71	56	15
Unknown (non-U.S.)*	23	8	16	9	9	2	67	53	14
Column Total	306	174	264	129	213	130	1216	918	298
Column	Male	239	139	210	90	139	918		
Subtotals	Female	67	35	54	39	74	298		

*Non-U.S. citizens who return to their country of citizenship and whose status is reported as "unknown" or "still seeking employment".

Table 2C: Percentage of New Doctoral Recipients Unemployed, As Reported in the Respective Annual Survey Second Reports, 1978–1998



The fall 1998 unemployment rate for new doctoral recipients, based on information gathered by the time of the Second Report, increased significantly from 6.7% for fall 1992 to 8.9% for fall 1993 to 10.7% for fall 1994 and fall 1995. Following the last two years' decline to 8.1% in fall 1996 and 3.8% in fall 1997, the fall 1998 unemployment rate made an increase to 4.9%. The counts on which these rates are determined do not include those new doctoral recipients whose fall employment status was unknown at the time of the Second Report.

Table 2C presents the fall 1978 through fall 1998 trend in the final fall unemployment rate of new doctoral recipients.

Out of the 1,216 doctoral recipients reported in the First Report, 1,095 were sent the Employment Experiences of New Doctoral Recipients (EENDR) survey, and 625 (57.1%) individuals responded. The response rates varied considerably among the various subgroups of new doctorates defined by their employment status as reported by departments. Among those reported by the departments as employed in the U.S., the response rate was 58.6%. The response rate was 63.9% for those employed in academia in the U.S., but for those employed in business and industry in the U.S. the response rate dropped to 50.0%. The response rate was 37.5% for the 112 individuals in the U.S. whose employment status was unknown to the department. Females were slightly more likely to respond than males: 54.9% for females versus 50.3% for males. The response rates for U.S. citizens, permanent residents, and temporary residents were 58.5%, 47.9%, and 44.0% respectively.

The EENDR gathered details on employment experiences not available through departments and not gathered in previous Annual Surveys. The rest of this section pre-

sents the additional information available on this subset of the 1997–98 doctoral recipients.

Of the 625 total respondents to the EENDR, 539 were employed in the U.S., 68 were employed outside the U.S., and 18 were unemployed in the U.S. as of the week of October 12, 1998. Among those employed in the U.S., 518 were employed full-time and 21 were employed part-time. Of the 21 reporting part-time employment, 10 reported that they were working part-time because a suitable full-time job was not available. Four also reported they were working part-time while they pursued additional education.

Among the 539 employed in the U.S., 313 reported obtaining a permanent position and 226 a temporary position. Of the 226 in temporary positions, 128 (56.6%) reported taking temporary employment because a suitable permanent position was not available and 129 (56.8%) classified their position as postdoctoral. Furthermore, among those in postdoctoral positions, 43.4% responded that they took the position because a suitable permanent position was not available.

Among the 313 who reported obtaining a permanent position in the U.S., 52.3% were employed in academia, 41.2% in business or industry, 4.2% in government, and the remaining 2.2% in other nonprofits or self-employed. Women held 29.7% of the permanent positions.

Among the 226 individuals with temporary employment in the U.S., 83.6% were employed in academia, 3.5% in business or industry, 5.8% in government, and the remaining 6.6% in other nonprofits, typically a research institute. One individual did not respond with a sector.

Among the 68 individuals employed outside the U.S., 72.1% were employed in academia, 17.6% in business or industry, 1.5% in government, and 8.8% in other nonprofits.

Thirteen of those employed outside the U.S. were U.S. citizens, and two were U.S. permanent residents.

The most frequently used job search resources were electronic at 56.6%, publications at 46.8%, faculty advisor at 43.9%, and informal channels (networking with colleagues or friends) at 42.0%. The remaining types of resources are used much less often, each below 23.0%. When asked to indicate the single most effective job search resource, 36.1% chose electronic resources. The next highest was informal channels at 16.7%, followed by publications at 11.7%. Not surprisingly, 76.0% reported using two or more of these methods. The AMS's Web site, e-MATH, was the most frequently mentioned electronic resource. The *Notices of the AMS* was the most frequently mentioned publication, followed by the *Chronicle of Higher Education*, *Amstat News*, and then the publications of other mathematical societies.

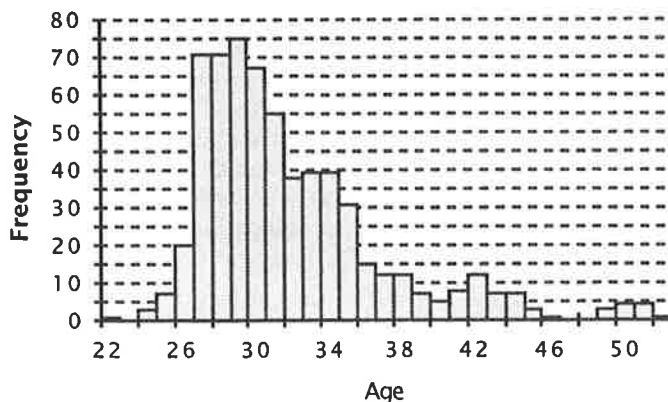
Doctoral recipients who found employment were asked to indicate their agreement or disagreement with the following four statements.

1. The position is related to my field.
2. The position is commensurate with my education and training.
3. The position is similar to what I expected to be doing when I began my doctoral program.
4. The position is professionally challenging.

Response options ranged from 5 for "strongly agree" down to 1 for "strongly disagree". The distribution of responses was very similar for statements (1), (2), and (4), and each distribution indicates strong agreement with these three statements. Between 74.0% and 81.0% responded to each with either a 4 or a 5. For statement (3), the response indicated less overall agreement, with 61.0% responding 4 or 5 and 22.6% responding 1 or 2. In summary, the positions obtained were appropriate for the type of education but were not always what was expected at the outset of the doctoral program. This distribution is very similar to last year's.

Table 2D shows the age distribution of new doctoral recipients. The median age was 30, while the mean age was 31.8. The first and third quartiles were 28 and 34 respectively.

Table 2D: Age Distribution of New Doctoral Recipients



Starting Salary Survey of New Doctoral Recipients

The salary figures for 1998 were compiled from information gathered on the EENDR questionnaires sent to individuals who received doctoral degrees in the mathematical sciences during the 1997-98 academic year from universities in the United States (see previous section for more details).

The questionnaires were distributed to 1,095 recipients of degrees using addresses provided by the departments granting the degrees; 625 individuals responded between late October and mid-April. Responses with insufficient data or from individuals who indicated they had part-time employment were considered unusable. Numbers of usable responses for each salary category are reported in the following tables.

Readers should be warned that the data in this report are obtained from a self-selected sample, and inferences from them may not be representative of the population.

Key to Tables. *Salaries* are listed in hundreds of dollars. Nine-month salaries are based on 9-10 months' teaching and/or research, not adding extra stipends for summer grants or summer teaching or the equivalent. *Years* listed refer to the academic year in which the doctorate was received. *M* and *F* are male and female respectively. Some persons receiving a doctoral degree had been employed in their present position for several years. Quartile figures are given only in cases where the number of responses is large enough to make them meaningful. All categories of "Teaching or Teaching and Research" and "Research" contain only those recipients employed at academic institutions. In addition, the "Research, 9-10 Month Salaries" table was dropped as of last year because so few recipients responded in this category that the data is not considered meaningful. Starting salaries for those reporting a postdoctoral position are available for a second year on page 902. These salaries are also included within the academic tables and box plots on the following pages 900 and 901.

Note that salaries for teaching or teaching and research have yet to return to their high point of 1970, although considerable progress has been made since 1980.

Graphs. The graphs show variants of standard box plots summarizing salary distribution information for the years 1994 through 1998. All values plotted for 1994 through 1997 are converted to 1998 dollars using the implicit price deflator prepared annually by the Bureau of Economic Analysis, U.S. Department of Commerce.

For a given year, the box shows the first and third quartiles and the median salary. The "whiskers" give additional information about the spread of the data, extending to points that are 1.5 interquartile distances from the median. Minimum and maximum salaries are depicted by asterisks or dots outside the whiskers; dots are used to distinguish extreme outliers, i.e., values that are more than 3 interquartile distances from the median.

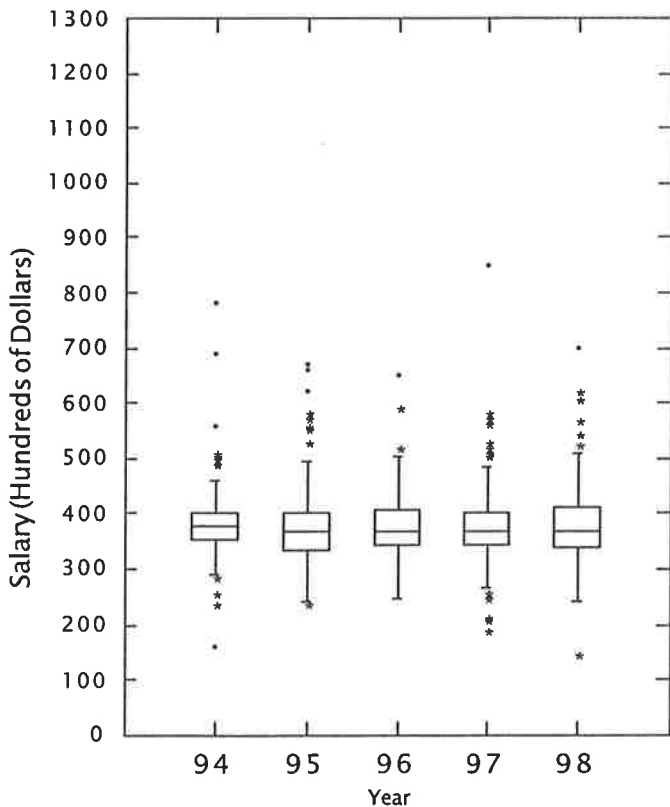
**Teaching or Teaching and Research
9-10 Month Salaries
(189 men/59 women)**

Ph.D. Year	Min	Q ₁	Median	Q ₃	Max	Reported Median in 1998 \$
1965	70		80		105	361
1970	85		110		195	407
1975	90	120	128	135	173	343
1980	105	155	171	185	250	320
1985	170	230	250	270	380	359
1990	230	305	320	350	710	385
1994	150	330	350	375	730	375
1995	220	320	350	382	640	367
1996	240	333	360	400	636	369
1997	180	340	366	400	840	370
1998	140	340	370	410	700	370
1994M	150	329	350	378	730	
1994F	270	330	348	370	520	
1995M	220	320	350	388	640	
1995F	240	323	350	380	525	
1996M	240	330	360	400	636	
1996F	270	345	365	399	500	
1997M	180	340	367	400	571	
1997F	180	340	366	396	840	
1998M	140	340	370	411	700	
1998F	250	350	377	409	600	
One year or less experience (156 men/52 women)						
1998M	140	340	370	404	560	
1998F	280	350	374	408	600	

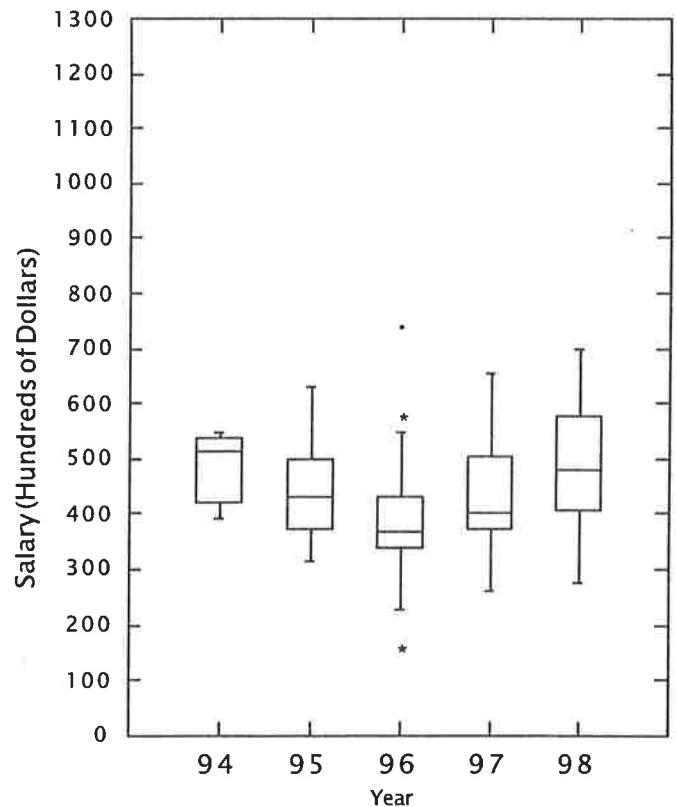
**Teaching or Teaching and Research
11-12 Month Salaries
(27 men/12 women)**

Ph.D. Year	Min	Q ₁	Median	Q ₃	Max	Reported Median in 1998 \$
1965	78		104		121	469
1970	95		128		200	473
1975	87		145		204	388
1980	143		195		350	365
1985	220	230	273	300	470	392
1990	225	318	365	404	670	440
1994	365	391	480	503	510	515
1995	300	354	410	478	600	430
1996	150	302	340	390	720	348
1997	260	370	400	497	650	404
1998	275	403	480	578	700	480
1994M	365	401	455	510	510	
1994F	370	380	480	500	505	
1995M	300	380	420	490	600	
1995F	-----	-----	-----	-----	-----	
1996M	150	280	330	460	720	
1996F	330	340	358	368	400	
1997M	260	360	400	420	635	
1997F	260	393	447	505	650	
1998M	275	410	495	573	700	
1998F	300	395	464	575	630	
One year or less experience (19 men/11 women)						
1998M	275	406	440	573	700	
1998F	300	393	442	570	630	

**Teaching or Teaching and Research
9-10 Month Salaries**



**Teaching or Teaching and Research
11-12 Month Salaries**



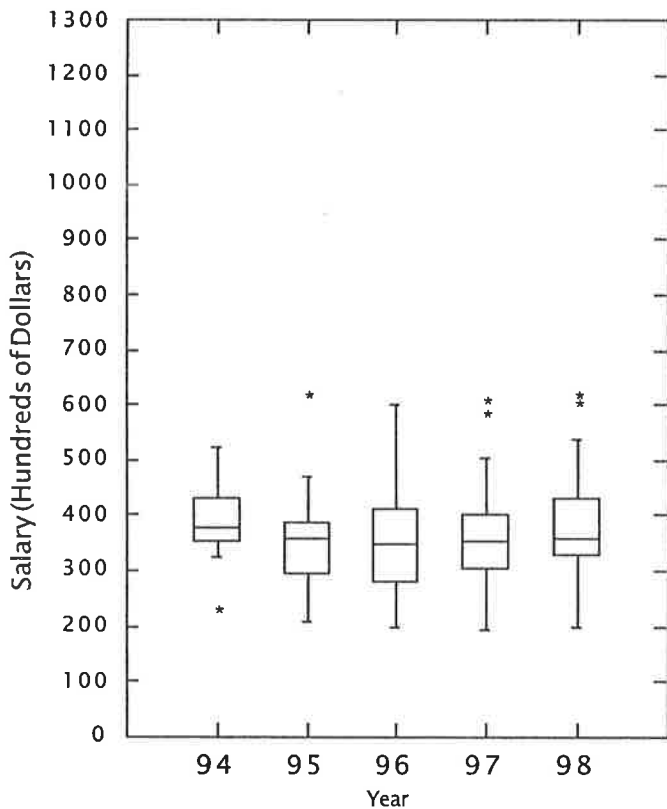
**Research
11-12 Month Salaries
(17 men/9 women)**

Ph.D. Year	Min	Q ₁	Median	Q ₃	Max	Reported Median in 1998 \$
1965	81		93		107	419
1970	90		120		205	443
1975	90		119		180	319
1980	120		180		321	336
1985	190	295	342	400	520	491
1990	180	280	300	365	546	361
1994	210	330	350	400	490	375
1995	196	280	340	370	587	356
1996	192	270	330	400	585	338
1997	190	300	350	400	600	353
1998	200	333	360	428	617	360
1994M	210	300	340	433	490	
1994F	330	340	365	400	400	
1995M	196	280	350	370	587	
1995F	200	-----	287	-----	400	
1996M	210	273	330	360	585	
1996F	192	265	390	455	500	
1997M	210	300	350	406	500	
1997F	190	313	350	386	600	
1998M	200	340	360	400	600	
1998F	285	330	360	540	617	
One year or less experience (15 men/8 women)						
1998M	200	332	370	410	600	
1998F	285	323	355	458	600	

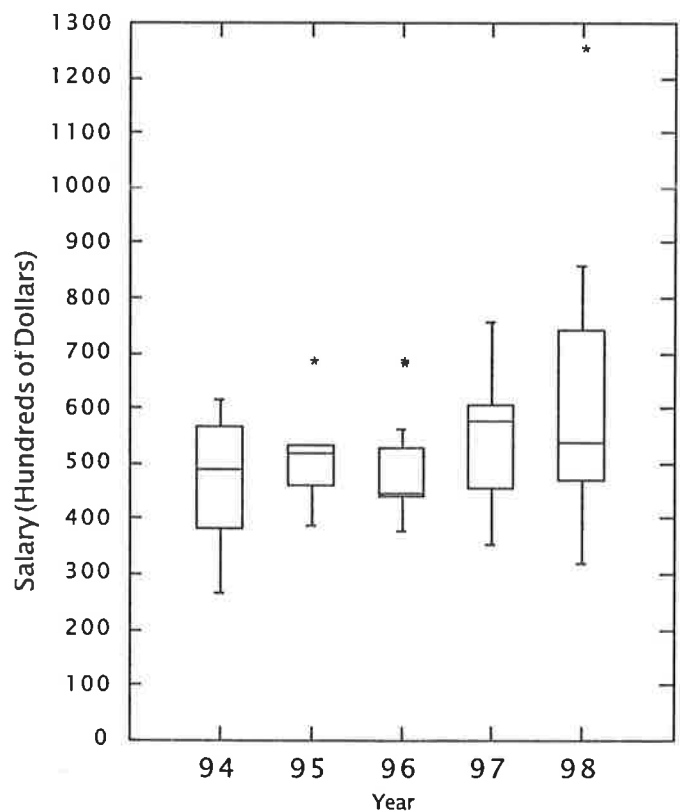
**Government
11-12 Month Salaries
(20 men/4 women)**

Ph.D. Year	Min	Q ₁	Median	Q ₃	Max	Reported Median in 1998 \$
1965	70		126		160	568
1970	100		150		223	554
1975	78		182		247	487
1980	156		244		501	456
1985	263	294	325	381	440	467
1990	320	345	378	430	587	455
1994	250	355	455	530	576	488
1995	370	440	494	507	650	518
1996	360	420	427	504	650	438
1997	350	454	573	600	750	579
1998	320	475	540	736	1250	540
1994M	250	350	423	550	576	
1994F	-----	-----	-----	-----	-----	
1995M	440	-----	499	-----	650	
1995F	-----	-----	-----	-----	-----	
1996M	360	405	427	500	650	
1996F	-----	-----	-----	-----	-----	
1997M	370	476	573	608	750	
1997F	350	465	560	586	680	
1998M	320	500	568	756	1250	
1998F	-----	-----	-----	-----	-----	
One year or less experience (16 men/4 women)						
1998M	320	480	530	650	860	
1998F	-----	-----	-----	-----	-----	

**Research
11-12 Month Salaries**



**Government
11-12 Month Salaries**



**Business and Industry
11-12 Month Salaries
(99 men/32 women)**

Ph.D. Year	Min	Q ₁	Median	Q ₃	Max	Reported Median in 1998 \$
1965	100		136		180	613
1970	96		170		235	628
1975	114		187		240	501
1980	190		284		400	531
1985	260	360	400	420	493	574
1990	320	438	495	533	700	596
1994	200	418	525	600	750	563
1995	288	480	568	690	1250	596
1996	250	510	580	610	1000	594
1997	300	483	600	658	1000	606
1998	240	550	650	750	2250	650
1994M	200	405	490	600	750	
1994F	-----	-----	-----	-----	-----	
1995M	288	480	550	690	1250	
1995F	397	550	630	680	1000	
1996M	250	480	580	610	1000	
1996F	520	-----	590	-----	650	
1997M	300	490	600	670	1000	
1997F	400	460	540	620	900	
1998M	240	550	650	750	1250	
1998F	305	565	662	765	2250	
One year or less experience (79 men/25 women)						
1998M	240	535	650	737	1250	
1998F	305	576	650	760	2250	

**Academic Postdoctorates
9-10 Month Salaries
(48 men/10 women)**

Ph.D. Year	Min	Q ₁	Median	Q ₃	Max	Reported Median in 1998 \$
1997	180	350	385	410	450	389
1998	290	350	390	420	500	390
1997M	250	350	380	405	446	
1997F	180	350	385	408	450	
1998M	290	340	390	430	500	
1998F	310	361	375	390	436	

Faculty Characteristics

The Departmental Profile Survey, sent in fall 1998 to mathematical sciences departments at four-year colleges and universities as part of the Annual Survey, provided information about faculty and instructional programs. In order that more reliable year-to-year comparisons could be made, data for fall 1997 and fall 1998 were gathered, except for data on retirement, deaths, and faculty recruitment. The annual percent change figures reported in Tables 3F, 3G, 4A, 4D, 5A, 5C, and 5D are based on these two years of data. The First Report presented information collected earlier about faculty salaries (pages 232-5 of the February 1998 issue of the *Notices of the AMS*).

Table 3A displays losses of full-time mathematical sciences faculty due to retirements or deaths. The fall 1998 mathematical sciences faculty attrition rate for mathematics departments (Groups I, II, III, M & B combined) was 3.1%, compared with fall 1997, 1996, and 1995 figures of 2.4%, 2.3%, and 2.2% respectively. Table 3B depicts the trend in the faculty attrition rates for mathematics departments during the years 1986-98.

Table 3C displays Departmental Profile Survey information on the number of full-time faculty positions under recruitment in mathematical sciences departments in 1997-98. The number of positions under recruitment in mathematics departments increased 23.7% from 1996-97. Table 3D presents the positions under recruitment in mathematics departments for the years 1989-90 through 1997-98, while Table 3E presents the percentage of these positions reported as unfilled. Although there was a steady decrease from 1990 to 1994 and recruitment appeared to have leveled off in the past few years, this year showed the first substantial increase since 1990.

Table 3C indicates that 89.5% of the positions under recruitment by mathematics departments in 1997-98 were available to new doctoral recipients and of these 65.1% were tenured/tenure-track. The number of tenured/tenure-track positions under recruitment by mathematics departments increased by 23.1% from last year's count.

Tables 3F and 3G describe the makeup of faculties by sex, tenure status, and doctoral/nondoctoral degree in the different groups. Table 3E indicates that the total number

**Business and Industry
11-12 Month Salaries**

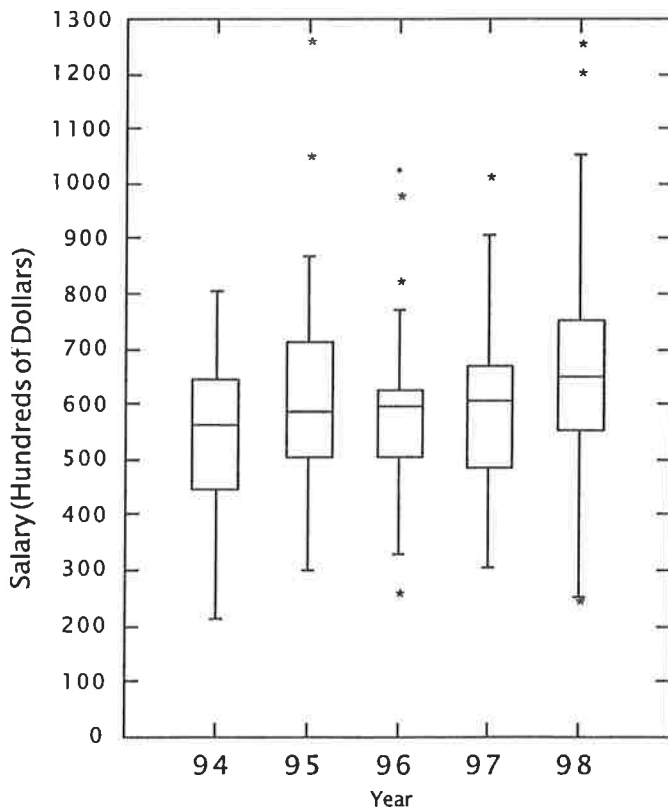


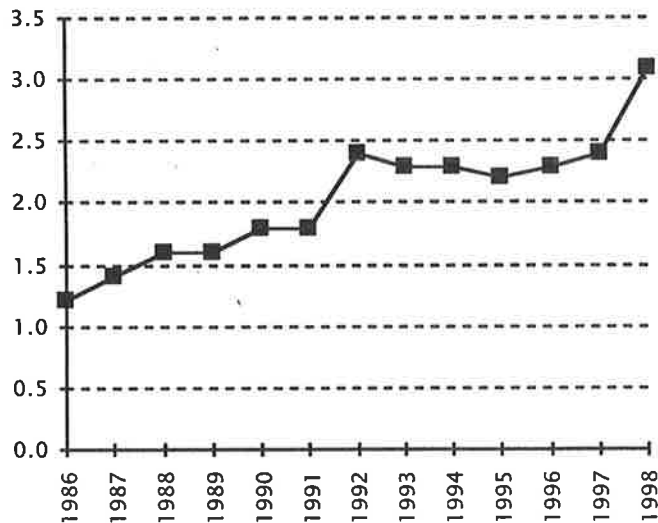
Table 3A: Faculty Attrition*

	GROUP									
	I Public	I Private	II	III	I, II, & III	IV	Va	M	B	I, II, III, M & B
Full-time faculty who retired or died										
Total number	36	14	64	58	171	32	5	175	257	604
Percentage (%)	2.2	1.7	2.9	2.9	2.6	2.4	1.8	3.5	3.2	3.1
Usable responses**										
Total number	21	18	42	57	138	52	6	104	381	623
Percentage (%)	84	78	75	78	78	63	40	45	38	44

* Number and percentage of full-time faculty who were in the department in fall 1997 but were reported to have retired or died by fall 1998.

** All counts are projected from the survey response to the respective group as a whole. The number of usable responses varies for different sections of the Departmental Profile Survey. The response rates reported here apply to faculty size and recruitment data only.

Table 3B: Percent of Full-Time Doctoral Faculty Who Retired or Died in Groups I, II, III, M & B Combined



of full-time faculty in mathematics departments increased slightly from fall 1997 to fall 1998. After the 1995 reported decrease of 6.5%, the number of non-tenure-track, doctoral full-time faculty in mathematics departments increased by 5.7% in 1996, 12.8% in 1997, and 6.1% in 1998. This increase in non-tenure-track full-time positions continues a disturbing trend reported in "Changes in Mathematics Faculty Composition, Fall 1990 to Fall 1996" (*Notices of the AMS*, November 1997, pages 1321-3). There was a small overall increase in the untenured tenure-track doctoral faculty in mathematics departments. (Note that Group B accounts for 48.8% of the total of these positions within mathematics departments.) There was an overall increase of 8.1% in part-time faculty in mathematics departments. This increase was due primarily to a 6.5% increase in Group B, which accounts for 55.7% of all the reported part-time faculty in mathematics departments. The number of female non-tenure-track, doctoral full-time faculty increased by only 0.5% in mathematics departments, following the fall 1996 increase of 15.1% and the fall 1997 increase of 11.4%.

Table 3C: Recruitment of Doctoral Faculty

	GROUP									
	I Public	I Private	II	III	I, II, & III	IV	Va	M	B	I, II, III, M & B
Open doctoral positions										
Total number*	140	107	141	118	507	126	33	291	730	1528
Tenured/tenure-track	67	40	72	85	263	98	13	247	496	1006
Open to new doctoral recipients	111	83	111	101	406	110	20	278	685	1368
Tenured/tenure-track	40	17	64	69	190	87	3	233	467	890
Male doctoral hires	92	88	101	69	350	55	25	131	364	845
Female doctoral hires	24	9	15	17	64	24	3	64	146	274
Male nondoctoral hires	0	3	0	6	9	0	0	9	50	68
Female nondoctoral hires	0	0	0	4	4	5	0	4	42	51
Unfilled positions	25	8	25	22	80	43	5	82	127	289

*Number of full-time doctoral positions under recruitment in 1997-98 to be filled for 1998-99. Subtotals of rounded table values may exhibit rounding errors.

Table 3D: Number of Full-Time Doctoral Positions under Recruitment in Groups I, II, III, M & B Combined

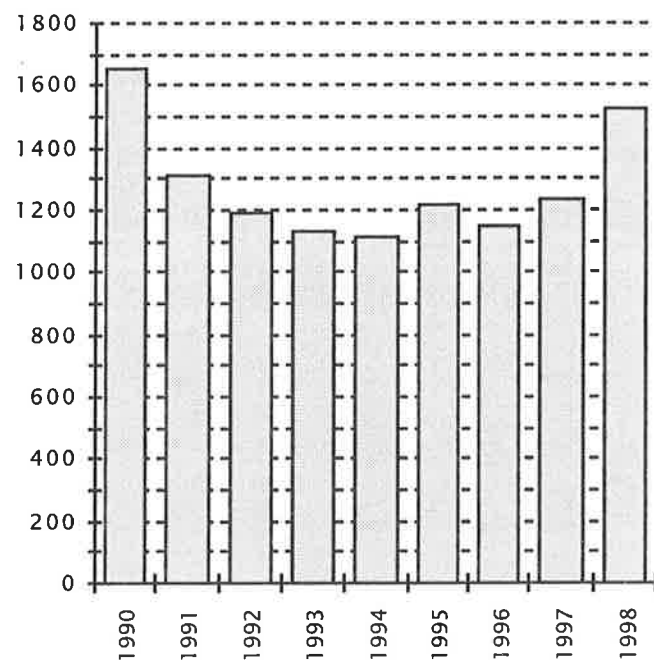


Table 3E: Percentage of Full-Time Doctoral Positions under Recruitment in Groups I, II, III, M & B Combined Reported as Unfilled

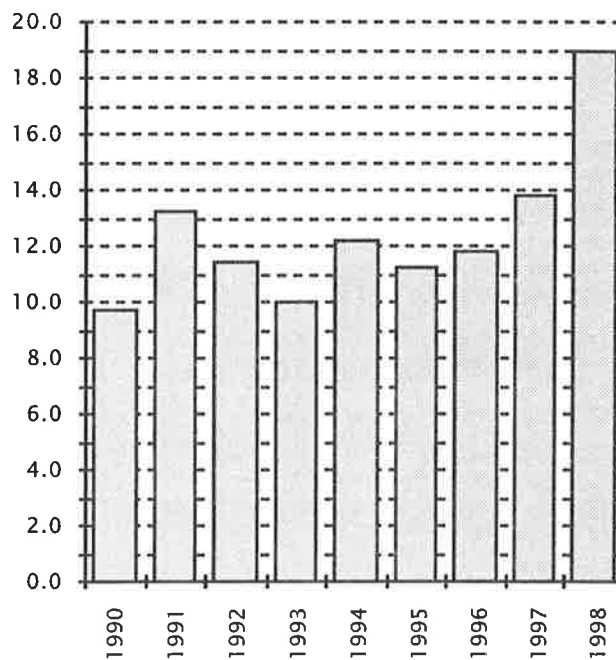


Table 3F: Faculty Size, Fall 1998, and Percentage Change in Size, Fall 1997 to Fall 1998

	GROUP									
	I Public	I Private	II	III	I, II, & III	IV	Va	M	B	I, II, III, M & B
Full-time faculty										
Total number	1661	840	2272	1979	6751	1299	285	5015	7926	19692
Percentage change (%)	0.6	3.1	-1.5	1.4	1.4	3.3	0.0	-1.7	1.2	0.5
Doctoral full-time faculty										
Total number	1612	834	2072	1762	6281	1263	285	4131	6154	16565
Percentage change (%)	0.4	3.5	0.8	0.7	1.0	3.2	0.0	-1.6	1.0	0.4
Tenured doctoral full-time faculty										
Total number	1254	515	1647	1346	4761	806	183	3225	4354	12341
Percentage change (%)	-0.9	0.0	-1.5	-1.0	-1.1	1.8	0.0	-0.5	0.0	-0.6
Untenured tenure-track doctoral full-time faculty										
Total number	129	83	197	266	675	241	43	766	1372	2814
Percentage change (%)	0.0	10.2	5.7	4.5	4.6	5.5	13.3	-2.8	3.0	1.7
Non-tenure-track doctoral full-time faculty										
Total number	230	236	228	150	844	216	60	140	427	1411
Percentage change (%)	8.4	9.5	16.3	11.4	11.3	6.2	-7.7	-17.1	5.9	6.1
Part-time faculty										
Total number	200	17	304	567	1088	125	53	1768	3585	6441
Percentage change (%)	-14.7	0.0	9.6	16.9	7.3	9.7	5.0	11.8	6.5	8.1

Table 3G: Female Faculty Size, Fall 1998, and Percentage Change in Size, Fall 1997 to Fall 1998

	GROUP									
	I Public	I Private	II	III	I, II, & III	IV	Va	M	B	I, II, III, M & B
Full-time female faculty										
Total number	174	79	319	342	914	262	28	1266	2216	4395
Percentage change (%)	3.5	8.8	1.7	1.5	2.6	7.1	0.0	0.0	2.3	1.7
Doctoral full-time female faculty										
Total number	142	78	201	223	644	238	28	806	1436	2886
Percentage change (%)	4.4	10.9	0.7	0.6	2.6	7.1	0.0	2.0	1.7	2.0
Tenured doctoral full-time female faculty										
Total number	76	19	99	110	304	77	13	522	815	1641
Percentage change (%)	3.2	0.0	1.4	2.4	2.1	2.1	0.0	6.8	4.8	4.9
Untenured tenure-track doctoral full-time female faculty										
Total number	21	17	49	73	160	87	8	247	488	895
Percentage change (%)	28.6	30.0	0.0	3.6	7.5	19.6	0.0	-5.9	-3.7	-2.5
Non-tenure-track doctoral full-time female faculty										
Total number	44	42	53	40	179	74	8	38	133	350
Percentage change (%)	-2.6	10.0	0.0	-8.8	-0.7	0.0	0.0	-5.6	4.2	0.5
Part-time female faculty										
Total number	71	4	112	222	409	43	25	757	1518	2684
Percentage change (%)	-4.8	0.0	1.2	6.8	3.0	17.4	0.0	5.6	6.9	5.9

Enrollment Profile and Undergraduate Majors

The Departmental Profile Survey obtains information about enrollments and distribution of instructional effort in mathematical sciences departments.

Table 4A indicates that undergraduate mathematical sciences course enrollments increased by 3.5% from fall 1997 to fall 1998. In addition, graduate course enrollments increased by 1.0% over the same period. A comparison of this year's Table 4B with Table 4B from last year's Second Report (page 1168 of the October 1998 *Notices of the AMS*)

shows a similar pattern of enrollment distributions for mathematics departments.

Table 4D reports that the total number of junior/senior majors in mathematics departments (Groups I, II, III, M & B combined) increased by 1.0% from fall 1997 to fall 1998. The number of female junior/senior majors increased slightly by 0.3% during the same period. Although many groups actually showed declines in female majors, Groups I Public, III, and IV showed sizable increases.

Table 4A: Undergraduate and Graduate Enrollments (thousands), Fall 1998, and Percentage Change in Enrollments, Fall 1997 to Fall 1998

	GROUP									
	I Public	I Private	II	III	I, II, & III	IV	Va	M	B	Total
Undergraduate course enrollments										
Total number (thousands)	182	43	258	214	697	78	23	585	741	2124
Percentage change (%)	0.5	3.8	4.0	3.9	3.0	7.0	5.8	3.6	3.5	3.5
Graduate course enrollments										
Total number (thousands)	7	4	8	8	26	18	2	11		57
Percentage change (%)	5.9	4.7	-3.6	6.9	2.9	0.1	0.8	-1.9		1.0
Usable responses*										
Total number	20	17	41	56	134	51	5	103	365	658
Percentage (%)	80	74	73	78	76	62	39	45	36	44

* The number of usable responses varies for different sections of the Departmental Profile Survey. The response rates reported here apply to Tables 4A through 4C on enrollments only. All counts are projected from the survey response to the respective group as a whole.

Table 4B: Distribution of Undergraduate Enrollments (thousands), Fall 1998

	GROUP									
	I		II	III	I, II, & III	IV	Va	M	B	
	Public	Private								
Remedial Mathematics*										
Total number (thousands), %**	19 10	0 1	22 8	32 15	72 10	0 0	4 16	120 21	125 17	
Precalculus										
Total number (thousands), %	30 17	2 4	59 23	48 23	139 20	1 2	1 3	98 17	108 15	
1st-year Calculus (mainstream)										
Total number (thousands), %	52 28	18 40	51 20	35 17	156 22	0 0	3 12	68 12	98 13	
1st-year Calculus (nonmainstream)										
Total number (thousands), %	20 11	5 11	32 12	20 9	77 11	1 2	0 1	34 6	36 5	
Statistics										
Total number (thousands), %	3 2	1 3	9 3	17 8	30 4	73 95	3 14	48 8	79 11	
Computer Science										
Total number (thousands), %	2 1	1 1	2 1	6 3	10 1	1 1	0 1	26 5	78 11	
Other courses for majors										
Total number (thousands), %	33 18	7 17	31 12	23 11	94 13	0 0	3 14	51 9	70 9	
Other undergraduate courses										
Total number (thousands), %	23 13	10 23	54 21	33 15	120 17	0 0	9 39	138 24	145 20	

*Arithmetic, high school algebra, geometry.

**Percents are "column percents" describing relative enrollments within the respective survey groups of the different types of undergraduate courses.

Table 4C: Undergraduate and Graduate Enrollments per Full-Time Faculty Member, Fall 1998

	GROUP							
	I	I	II	III	IV	Va	M	B
	Public	Private						
Undergraduate course enrollments per full-time faculty member	109	52	114	108	60	82	117	94
Graduate course enrollments per full-time faculty member	4	4	3	4	14	7	2	
Total course enrollments per full-time faculty member	113	56	117	112	74	88	119	94

Table 4D: Undergraduate Junior/Senior Majors and Undergraduate Female Junior/Senior Majors (hundreds), Fall 1998, and Percentage Change in Majors, Fall 1997 to Fall 1998

	GROUP								
	I	I	II	III	IV	Va	M	B	I, II, III, M & B
	Public	Private							
Junior/senior majors									
Total number (hundreds)	47	15	48	50	7	10	159	261	580
Percentage change (%)	8.2	-1.2	-11.1	10.0	7.9	6.1	-3.2	-3.6	1.0
Female junior/senior majors									
Total number (hundreds)	18	5	20	22	3	4	75	111	251
Percentage change (%)	8.0	-0.5	-6.5	7.5	8.1	-7.4	-1.3	0.3	0.3
Usable responses*									
Total number	18	17	37	54	33	5	92	325	543
Percentage (%)	75	74	67	75	57	42	40	35	41

* The number of usable responses varies for different sections of the Departmental Profile Survey. The response rates reported here apply to undergraduate majors data only. All counts are projected from the survey response to the respective group as a whole.

Graduate Student Profile

Tables 5A, 5C, and 5D summarize population statistics for graduate students gathered by the 1998 Departmental Profile Survey. Table 5A indicates that the total number of full-time graduate students in mathematics departments (Groups I, II, III & M combined) declined by 4.5% from fall 1997 to fall 1998 and declined in every group except Group I Private and IV. Following a five-year decline, the Ph.D.-granting mathematics departments (Groups I, II & III combined) reported an increase for the second year—4.7% in 1997 and 3.8% in 1998—in the number of full-time first-year graduate students. In addition, the number of full-time

first-year female graduate students in Ph.D.-granting mathematics departments increased only slightly, by 0.9%. Table 5D also indicates a slight increase of 0.6% in the total number of U.S. citizen full-time first-year mathematics graduate students from fall 1997 to fall 1998 for these same departments. Table 5B presents the trend in annual percentage change of first-year graduate students in Ph.D.-granting mathematics departments during the years 1986 to 1998. For the second year since 1991, the number of first-year graduate students increased.

Table 5A: Full-Time Graduate Students, Fall 1998, and Percentage Change in Graduate Students, Fall 1997 to Fall 1998

	GROUP								
	I Public	I Private	II	III	I, II, & III	IV	Va	M	I, II, III, & M
Full-time graduate students									
Total number	2462	1035	2575	2114	8186	2895	605	1929	10115
Percentage change (%)	-6.6	1.6	-0.8	-0.6	-2.2	0.7	-4.5	-12.8	-4.5
First-year graduate students									
Total number	542	293	770	743	2348	817	162	793	3141
Percentage change (%)	-7.5	22.5	-2.4	14.9	3.8	11.2	-19.6	-10.7	-0.3
Usable responses*									
Total number	21	18	41	56	136	52	5	97	233
Percentage (%)	84	78	73	77	77	63	28	42	57

* The number of usable responses varies for different sections of the Departmental Profile Survey. The response rates reported here apply to Tables 5A through 5C on graduate student enrollments only. All counts are projected from the survey response to the respective group as a whole.

Table 5B: Annual Percentage Change in Full-Time First-Year Graduate Students in Groups I, II & III Combined, 1986 to 1998

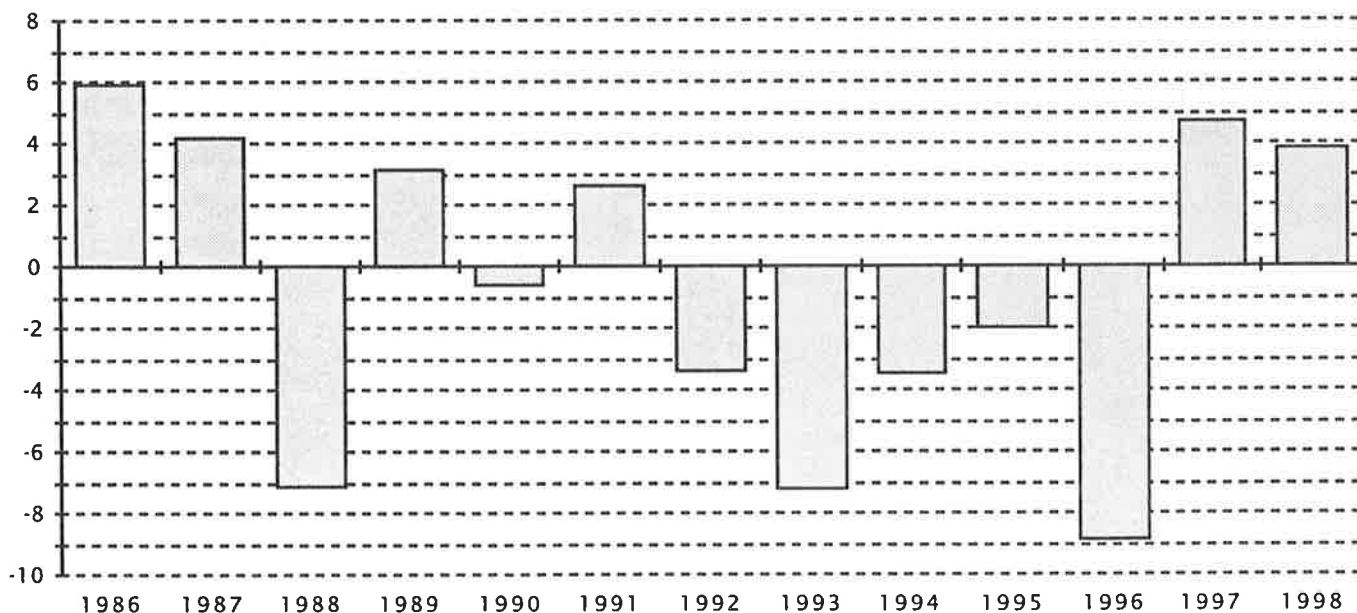


Table 5C: Full-Time Female Graduate Students, Fall 1998, and Percentage Change in Female Graduate Students, Fall 1997 to Fall 1998

	GROUP								
	I Public	I Private	II	III	I, II, & III	IV	Va	M	I, II, III, & M
Full-time female graduate students									
Total number	649	222	901	795	2568	1306	202	898	3466
Percentage change (%)	-5.2	5.5	8.0	4.6	3.1	6.4	-3.4	-1.8	1.8
First-year female graduate students									
Total number	137	61	311	288	798	412	61	376	1174
Percentage change (%)	-19.0	0.0	-0.4	16.3	0.9	16.5	-5.6	-12.7	-3.9

Table 5D: Full-Time U.S. Citizen Graduate Students, Fall 1998, and Percentage Change in U.S. Citizen Graduate Students, Fall 1997 to Fall 1998

	GROUP								
	I Public	I Private	II	III	I, II, & III	IV	Va	M	I, II, III, & M
Full-time U.S. citizen grad. students									
Total number	1306	478	1528	1163	4475	1467	356	1243	5718
Percentage change (%)	-6.1	-0.8	-5.3	-0.8	-3.9	-3.6	-5.7	-19.2	-7.7
First-year U.S. citizen grad. students									
Total number	310	130	438	415	1293	435	94	526	1819
Percentage change (%)	-4.8	15.9	-15.3	25.7	0.6	6.2	-23.5	-13.3	-3.9

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- _____, *Selected Data on Graduate Students and Postdoctorates in Science and Engineering, Fall 1991* (NSF 92-335); Selected Pamphlet No. 11: *Institutional Listings* (NSF 90-324-11); Selected Pamphlet No. 12: *Postdoctorates and Other Nonfaculty Research Staff* (NSF 90-324-12); Washington, DC, 1990.
- _____, *Survey of Mathematics and Statistics Departments at Higher Education Institutions*, Higher Education Surveys Report, Survey Number 5, Washington, DC, December 1990.
- _____, *Foreign Participation in U.S. Academic Science and Engineering: 1991* (NSF 93-302), Washington, DC, 1993.

Acknowledgments

The Annual Survey of the Mathematical Sciences attempts to provide an accurate appraisal and analysis of various aspects of the academic mathematical sciences scene for the use and benefit of the community and for filling the information needs of the professional organizations. Every year, college and university departments in the United States are invited to respond. The Annual Survey relies heavily on the conscientious efforts of the dedicated staff members of these departments for the quality of its information. On behalf of the Annual Survey Data Committee and the Annual Survey staff, I thank the many secretarial and administrative staff members in the mathematical sciences departments for their cooperation and assistance in responding to the survey questionnaires.

—Paul W. Davis

Supplemental Listing of Doctoral Degrees Conferred, 1997-1998

DISTRICT OF COLUMBIA

American University (9)

MATHEMATICS AND STATISTICS

Fofack, Hippolyte, Distribution of parallel market premium under stable alternative modeling.

Foret, Katia, Teaching induction: Historical perspective and current views.

Hackett, Linda, The effects of writing in an applied calculus course: An analysis of performance and error.

Jones, Kenneth, The effects of the base of graphing calculation on learning-disabled students' achievement and attitudes in a university finite mathematics course.

Kpamegan, Eloi, Optimal designs for binary random variables in a bivariate treatment space.

Merriweather, Michelle, A study of high school mathematics teachers on their attitude towards and use of calculators.

Montiquila, Jill, A new approach to variance estimation in the presence of imputed data.

Randou, Elena, Theory and application of empirical distribution functions in the inter-satellite calibration problem.

Tawfig, Abu-Diab, The impact of writing assignments in mathematics classes on the language minority students' performance.

NEW YORK

Columbia University (4)

BIOSTATISTICS

Hu, Xiao-Ping, Survival analysis for competing risks model.

Panageas, Katherine, Statistics in periodontal research: Interval estimation of the common odds ratio under cluster sampling.

Shi, Qiuhu, Simultaneous confidence bounds for hazard data.

Zhang, Haiying, Nonparametric method for longitudinal studies with dropout.

New York University, Courant Institute (1)

MATHEMATICAL SCIENCES

Jorge, Helena, Geometry and combinatorics of polytopes with a finite group of symmetries.

VIRGINIA

University of Virginia (2)

APPLIED MATHEMATICS

Ong, John, Global existence, uniqueness and stability of a quasilinear hyperbolic equation with boundary dissipation.

Shuster, David, A composite grid streamline diffusion method for hyperbolic problems.