

# Notices

of the  
American Mathematical Society



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# Calendar of AMS Meetings

**THIS CALENDAR** lists all meetings which have been approved by the Council prior to the date this issue of the **Notices** was sent to press. The summer and annual meetings are joint meetings of the Mathematical Association of America and the American Mathematical Society. The meeting dates which fall rather far in the future are subject to change; this is particularly true of meetings to which no numbers have yet been assigned. *Programs* of the meetings will appear in the issues indicated below. *First* and *second* announcements of the meetings will have appeared in earlier issues.

**ABSTRACTS OF PAPERS** presented at a meeting of the Society are published in the journal *Abstracts of papers presented to the American Mathematical Society* in the issue corresponding to that of the **Notices** which contains the program of the meeting. Abstracts should be submitted on special forms which are available in many departments of mathematics and from the office of the Society in Providence. Abstracts of papers to be presented at the meeting must be received at the headquarters of the Society in Providence, Rhode Island, on or before the deadline given below for the meeting. Note that the deadline for abstracts submitted for consideration for presentation at special sessions is usually three weeks earlier than that specified below. For additional information consult the meeting announcement and the list of organizers of special sessions.

MEETING NUMBER	DATE	PLACE	ABSTRACT DEADLINE	ISSUE
809	January 25–28, 1984 (90th Annual Meeting)	Louisville, Kentucky	NOVEMBER 2, 1983	January 1984
810	April 6–7, 1984	Notre Dame, Indiana	FEBRUARY 1, 1984	February
811	April 13–14, 1984	Richmond, Virginia	FEBRUARY 6, 1984	February
812	June 29–July 1, 1984	Plymouth, New Hampshire	APRIL 23	June
813	August 16–19, 1984	Eugene, Oregon		
	November 2–3, 1984	Minneapolis, Minnesota		
	November 9–10, 1984	San Diego, California		
	January 9–13, 1985 (91st Annual Meeting)	Anaheim, California		
	March 22–23, 1985	Chicago, Illinois		
	January 7–11, 1986 (92nd Annual Meeting)	New Orleans, Louisiana		
	January 21–25, 1987 (93rd Annual Meeting)	San Antonio, Texas		

<b>DEADLINES:</b> Advertising	(January 1984 Issue) December 1, 1983	(February 1984 Issue) February 16, 1984
News/Special Meetings:	(January 1984 Issue) November 9, 1983	(February 1984 Issue) January 30, 1984

## Other Events Sponsored by the Society

January 23–24, 1984, AMS Short Course: Mathematics of Information Processing, Louisville, Kentucky. This issue, page 773.

April 2–5, 1984, Symposium on Pseudodifferential Operators and Fourier Integral Operators with Applications to Partial Differential Equations, University of Notre Dame, Notre Dame, Indiana. This issue, page 791.

May 1984, Symposium on Some Mathematical Questions in Biology, DNA Sequence Analysis, New York, New York.

June 10–August 18, 1984, Joint Summer Research Conferences in the Mathematical Sciences, Bowdoin College, Brunswick, Maine. This issue, page 795.

July 8–21, 1984, AMS-SIAM Summer Seminar on Nonlinear Systems of PDE in Applied Mathematics, College of Santa Fe, Santa Fe, New Mexico. This issue, page 794.

July 16–August 3, 1984, AMS Summer Research Institute on Geometric Measure Theory and the Calculus of Variations.

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# Notices

## of the American Mathematical Society

Volume 30, Number 7, November 1983

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**INFORMATION ABOUT ADVERTISING** in the *Notices* may be obtained from Wahlene Siconio at 401-272-9500.

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# Mathematicians Invited to Address the Warsaw Congress

The list of speakers at the International Congress of Mathematicians, August 1983, in Warsaw, Poland, printed below updates the list which appeared on page 572 of the October 1983 issue of the *Notices*. Names marked with a small disk (•) are those of invited speakers who were not present in Warsaw to present their talks. Some of them reported in advance that they would not attend, and others gave such notice at the last minute. At least one person (Professor Lusztig of MIT), listed in the previous issue as not present, did indeed speak. The present list is based on information provided by the Congress organizers and other persons who attended. The EDITORS would appreciate notice of any further corrections that may be required.

## One-hour Plenary Addresses:

V. I. Arnold  
C. Hooley  
V. P. Maslov  
A. Pelczyński  
M. Sato  
• R. Thom  
P. Erdős  
Wu-Chung Hsiang  
B. Mazur  
• M. Rabin  
• S. Shelah  
W. H. Fleming  
P. D. Lax  
R. D. MacPherson  
D. Ruelle  
Yum-Tong Siu

## 45-minute Addresses in Sections:

### 1. Mathematical logic and foundations of mathematics

G. L. Cherlin  
R. A. Shore  
J.-Y. Girard  
A. O. Slisenko  
P. A. Loeb  
B. I. Zil'ber

### 2. Algebra

R. L. Griess, Jr.  
• A. Joseph  
C. Soule  
• M. Gromov  
A. Yu. Ol'sanskii  
R. P. Stanley  
J. C. Jantzen  
C. M. Ringel  
E. I. Zel'manov

### 3. Number Theory

A. N. Andrianov  
D. W. Masser  
J.-L. Waldspurger  
J.-M. Fontaine  
K. A. Ribet  
D. R. Heath-Brown  
• W. M. Schmidt

### 4. Geometry

S. Y. Cheng  
W. Müller  
• E. B. Vinberg  
N. J. Hitchin  
L. Simon  
• O. Ja. Viro  
A. G. Hovansky  
• R. M. Schoen  
• K. K. Uhlenbeck

### 5. Topology

F. R. Cohen  
• M. H. Freedman  
• J. I. Shaneson  
• R. L. Cohen  
• S. P. Kerckhoff  
H. Toruńczyk  
S. K. Donaldson  
Wen-Hsiung Lin

### 6. Algebraic geometry

A. Beilinson  
S. Itaka  
A. Ogus  
• W. Fulton  
V. A. Iskovskih  
B. Teissier  
• J. Harris  
S. Mori

### 7. Complex analysis

W. Barth  
G. M. Henkin  
• J. E. Fornæss  
P. W. Jones  
• R. Harvey  
S. I. Pinčuk

### 8. Lie groups and representations

• J. Arthur  
P. van Moerbeke  
A. B. Venkov  
R. S. Ismagilov  
T. Oshima  
M. Vergne  
G. Lusztig  
R. Parthasarathy

### 9. Real and functional analysis

R. Askey  
T. Figiel  
Y. Meyer  
D. Voiculescu  
J. Bourgain  
B. S. Kašin  
B. S. Pavlov  
• B. E. J. Dahlberg  
G. Kasparov  
G. Pisier

### 10. Probability and mathematical statistics

• D. R. Brillinger  
P. Malliavin  
S. Watanabe  
D. M. Chibisov  
P. Mandl

• H. Kesten  
• D. W. Stroock

### 11. Partial differential equations

A. Ambrosetti  
• L. A. Caffarelli  
T. Iwaniec  
V. Zaharov  
J.-M. Bony  
G. Eskin  
S. Klainerman  
V. S. Buslaev  
E. De Giorgi  
• A. Majda

### 12. Ordinary differential equations and dynamical systems

• A. Katok  
M. Misiurewicz  
A. Lasota  
G. R. Sell  
R. Mané

### 13. Mathematical physics and mechanics

M. Aizenman  
• T. Nishida  
S. Woronowicz  
J. M. Ball

• K. Osterwalder  
O. Ladyženskaja  
L. A. Takhtajan

### 14. Control theory and optimization

R. W. Brockett  
P.-L. Lions  
H. W. Knobloch  
• R. T. Rockafellar  
A. B. Kuržanskiĭ  
J. Zabczyk

### 15. Numerical methods

B. Engquist  
• G. H. Golub  
• M. J. D. Powell  
• Feng Kang  
Ju. A. Kuznetsov  
R. Glowinski  
C. A. Micchelli

### 16. Combinatorics and mathematical programming

D. Foata  
J. H. van Lint  
R. L. Graham  
L. Lovász  
• L. G. Khachiyan

### 17. Computer and information sciences

R. Karp  
R. E. Tarjan  
A. A. Letichevsky  
• L. G. Valiant  
• G. Plotkin

### 18. New applications of mathematics

N. Kopell  
B. B. Mandelbrot  
Ju. M. Svirezhev

### 19. History and education

H. Freudenthal  
A. V. Pogorelov  
J. B. Serrin

# Survey of American Mathematical Research Journals

At their November 1982 meeting, the Board of Trustees of the AMS voted to charge the Committee to Monitor Problems in Communication with the task of collecting and disseminating comparative information about the price of mathematical research journals published in the United States. It was the consensus of the Board that this information would be valuable to the mathematical community in general, and to department chairmen and librarians in particular. The information collected and reported here is similar in nature to that reported in previous studies by I. M. James of the Mathematical Institute, University of Oxford, on behalf of the European Mathematical Council.

The list of journals surveyed contains those published in the United States and reviewed in their entirety by *Mathematical Reviews*, with the exception of some of the translation journals, which may have been reviewed only in part or in the original. Data concerning the number of characters on a page and subscription price were collected by observation from published 1982 issues; these were forwarded to the publishers for verification, along with a questionnaire requesting additional information. A list of the data included in the survey and the reasons they were deemed of interest follow.

**Identification of Journal and Publisher.** Journals are listed in three classes: primary typeset journals, primary journals printed from typewriter copy, and translation journals. Production costs vary considerably for these three classes of journals; subscription prices generally reflect this fact. Other classes could also be formed; for example, many universities subsidize the journals they publish, an advantage not necessarily enjoyed by other scholarly and commercial publishers.

**Amount Published.** The number of pages published in the 1982 subscription, exclusive of front- and end-matter, is given, together with an approximation of the maximum number of characters on a page. Although this measure is inexact, it provides an estimate of the amount of material subscribers receive.

When making detailed comparisons based on the material included in this report, readers are encouraged to examine actual copies of the journal and to consider the factors which affect the amount of material that actually appears on each page. Variations in the amount of displayed material; additional space included around displays, sections and enunciations; and whether or not the subject matter typically requires relatively more or less mathematical notation all have an effect. The typesetting

specifications themselves, the size and style of type used as well as the size of the type page, are also important. Because of the difficulty of taking all such factors into account, the procedure described below was used; it should also be used by readers interested in comparing journals not included in our study to those listed here.

The first step was simply to count the number of characters in several full lines of text with no mathematics and find the average of the results. Next the number of possible lines of text on a page with no displays or extra spacing was determined. The two resulting numbers were multiplied and then rounded to the nearest 10 characters, giving an estimate of the maximum number of characters that can appear on a full page of type.

For journals printed from typewriter copy provided by authors, articles vary considerably in the amount of type on a page, so five articles from the subscription year were chosen when making our calculations. Readers are cautioned that, because of the nature of these journals, observed results for any given issue may vary from those reported here.

**Subscription Price and Circulation.** The annual U.S. subscription price for 1982 is listed as printed in published journal issues. The cost per 1000 characters was derived by combining the reported price with our estimate of the amount of material published. Readers are encouraged to consider also the effect of the size of a journal's circulation on the subscription price and the cost per 1000 characters.

**Back Volumes.** Publishers were asked whether back volumes are available, and if so, in what form. Responses are listed in the tables.

**Page Charges.** Publishers were asked whether page charges are requested, the amount, and whether or not they are mandatory. All positive responses stated that page charges are not mandatory. Some journals provide free offprints to authors who pay page charges, but we did not specifically ask for that information on our publisher questionnaire.

**Discounts and Offprints.** Information on the availability of discounts to institutions was requested. The American Mathematical Society offers discounts to its institutional members on single subscriptions; three publishers offer discounts for multiple subscriptions, the Association for Computing Machinery, Scripta Publishing Company, and the University of Central Florida jointly with the Calcutta Mathematical Society.

Responses concerning the availability of offprints indicated that practices vary too widely to be summarized adequately within our format.

# JOURNAL SURVEY

## Primary Typeset Journals

Journal	Publisher	1982 list subscription price, \$US	pages in 1982	char/ page	cents/ 1000 char	Circulation NA = not applicable NG = not given C = confidential	Requested page charges	Back volumes P = paper M = microform
Advances in Math	Academic Press	280.00	1284	3230	6.8	NG	NONE	P,*
Amer. J. Math	Johns Hopkins U. Press	60.00	1337	2810	1.6	1700	NONE	P
Ann. of Math, Ser. 2	Princeton Univ. Press	100.00	1328	3040	2.5	2000	NONE	P,M
Ann. of Probability	Inst. of Math. Stat.	48.00	1092	4830	.9	3377	33.00	P,M
Ann. of Statistics	Inst. of Math. Stat.	55.00	1311	4830	.9	4660	33.00	P,M
Appl. Math & Computation	Elsevier North-Holland	175.00	624	3120	9.0	NG	NONE	P,M
Appl. Math & Optimization, An Internat. J.	Springer-Verlag	188.00	764	3790	6.5	1000	NONE	P,M
Applicable Analysis, An Internat. J.**	Gordon & Breach	360.90	324	3180	35.0	C	NONE	P***,M
AMS Bulletin, New Series	Amer. Math. Soc.	36.00	1135	3530	.9	19,785	50.00	P,M
Comm. on Pure and Appl. Math	Wiley & Sons	115.00	867	3700	3.6	1412	NONE	P,M
Complex Variables. Theory & Appl., An Internat. J.#	Gordon & Breach	167.00	596	2740	10.2	C	NONE	P***,M
Computers & Math w/ Appl., An Internat. J.	Pergamon Press	190.00	469	5140	7.9	NG	50.00	P,M
Duke Math J.	Duke Univ. Press	88.00	1133	3510	2.2	1306	NONE	P,M
Ergodic Theory & Dynamical Systems	Cambridge Univ. Press	135.00	502	3560	7.6	NG	NONE	P
Houston J. of Math.	Univ. of Houston	50.00	600	2680	3.1	300	20.00	P
Illinois J. Math	Univ. Illinois Press	50.00	697	3420	2.1	1125	40.00	P,M
Indiana Univ. Math J.	Indiana Univ.	60.00	925	3480	1.9	1032	40.00	P
Information & Control	Academic Press	254.00	1440	3230	5.5	NG	NONE	P,*
Information Sciences, An Internat. J.	Elsevier North-Holland	185.00	780	3320	7.1	NG	NONE	P,M
J. of Algebra	Academic Press	438.00	3340	3290	4.0	NG	NONE	P,*
J. of Algorithms	Academic Press	58.50	394	3240	4.6	NG	NONE	P,*
J. of Amer. Stat. Assoc.##	Amer. Stat. Assoc.	50.00	964	6500	.8	18,500	40.00	P
J. of Approx. Theory	Academic Press	211.50	1177	2980	6.0	NG	NONE	P,*
J. of Assoc. for Computing Machinery	Assoc. for Computing Machinery	40.00	1000	4110	1.0	20,000	60.00	P,M
J. of Comb. Theory. A.	Academic Press	140.00	756	3180	5.8	NG	NONE	P,*
J. of Comb. Theory. B.	Academic Press	140.00	663	3180	6.6	NG	NONE	P,*
J. of Computer & System Sciences	Academic Press	171.00	814	3600	5.8	NG	NONE	P,*
J. of Diff. Equations	Academic Press	300.00	1859	3300	4.9	NG	NONE	P,*
J. of Diff. Geometry	Lehigh University	52.00	692	2980	2.5	800	20.00	P
J. of Functional Analysis	Academic Press	335.00	2092	3100	5.2	NG	NONE	P,*
J. of Graph Theory	Wiley & Sons	60.00	491	3360	3.6	723	NONE	P,M



J. of Integral Equations	Elsevier North-Holland	88.00	364	3180	7.6	NG	NONE	P,M
J. of Math Analysis & Appl.	Academic Press	552.00	3884	3280	4.3	NG	NONE	P,*
J. of Multivariate Analysis	Academic Press	98.00	612	3290	4.9	NG	NONE	P,*
J. of Number Theory	Academic Press	148.00	847	3010	5.8	NG	NONE	P,*
J. of Symbolic Logic#	Assoc. for Symbolic Logic	48.00	952	3730	1.4	2708	30.00	P
Libertas Mathematica	Amer. Romanian Acad. of Arts & Sci. Publ.	35.00	206	2710	6.3	200	NONE	P
Linear Alg. & its Appl.	Elsevier North-Holland	363.00	1882	3180	6.1	NG	NONE	P,M
Linear and Multilinear Algebra**	Gordon & Breach	388.42	601	3190	20.3	C	NONE	P***,M
Math of Comp.	Amer. Math. Soc.	80.00	1436	3870	1.4	2363	50.00	P,M
Math of Operations Research	Inst. of Management Sciences	36.00	634	4540	1.3	3824	NONE	P
Math Systems Theory	Springer-Verlag	87.00	375	3910	5.9	1200	NONE	P,M
Michigan Math. J.	Univ. of Michigan	30.00	379	3710	2.1	900	25.00	P
Notre Dame J. of Formal Logic	Univ. of Notre Dame	35.00	472	3620	2.0	775	NONE	P
Proc. Amer. Math Soc.	Amer. Math. Soc.	190.00	2000	3740	2.5	1793	50.00	P,M
Rocky Mt. J. Math	Rocky Mt. Math Consortium	85.00	865	3090	3.2	665	35.00	P
SIAM J. on Algebraic & Discrete Methods	Soc. for Indust. & Appl. Math	36.00	605	4170	1.4	774	64.00	P,M
SIAM J. on Appl. Math	Soc. for Indust. & Appl. Math	82.00	1368	4170	1.4	2862	64.00	P,M
SIAM J. on Control & Optimization	Soc. for Indust. & Appl. Math	82.00	893	4170	2.2	1949	64.00	P,M
SIAM J. on Math Anal.	Soc. for Indust. & Appl. Math	84.00	1026	4170	2.0	1407	64.00	P,M
SIAM J. on Numerical Anal.	Soc. for Indust. & Appl. Math	82.00	1304	4170	1.5	2781	64.00	P,M
SIAM J. on Scientific & Stat. Computing	Soc. for Indust. & Appl. Math	36.00	513	4170	1.7	1325	64.00	P,M
Studies in Appl. Math	Elsevier North-Holland	88.00	532	3760	4.4	NG	NONE	P,M
Technometrics, a J. on Stat. for the Phys., Chem., and Engin. Sciences##	Amer. Soc. for Qual. Control & Amer. Stat. Assoc.	23.00	328	6220	1.1	6500	NONE	P
Topology Proceedings	Auburn Univ.	35.00	400	1530	5.7	300	NONE	P
Trans. Amer. Math Soc.	Amer. Math. Soc.	330.00	4583	3740	1.9	1566	50.00	P,M

\* For information on microfilm, please contact the publisher.

\*\* These journals are not priced by the calendar year, but only by the volume. Often more than one volume appears in a calendar year. The price which appears here was determined by prorating volume prices over those issue numbers which were dated 1982.

\*\*\* As long as supplies last.

# Complex Variables is a new journal. Only one issue of Volume 1 has a 1982 publication date.

## These costs were calculated as if the entire issue were typeset to the specifications of the Research section. The Book Reviews sections, in all cases not more than 15% of the total pages, were actually typeset in a smaller size.

# Primary Typewriter Copy Journals

Journal	Publisher	1982 list subscription price, \$US	pages in 1982	char/ page	cents/ 1000 char	Circulation NA = not applicable NG = not given C = confidential	Requested page charges	Back volumes P = paper M = microform
Comm. in Algebra	Marcel Dekker	271.50	2269	2100	5.7	NG	NONE	P
Comm. in Partial Diff. Eq.	Marcel Dekker	156.50	1487	1920	5.5	NG	NONE	P
Comm. in Stat. A. Theory and Methods	Marcel Dekker	375.50	3744	2360	4.2	NG	NONE	P
Comm. in Stat. B. Simulation & Computation	Marcel Dekker							
Internat. J. of Math and Math Sciences	Univ. of Central Florida and Calcutta Math. Soc.	35.00	832	2350	1.8	300	20.00	P
Memoirs AMS	Amer. Math. Soc.	80.00	1892	2500	1.7	811	NONE	P
Numerical Functional Anal. & Optimization	Marcel Dekker	88.00	447	2230	8.8	NG	NONE	P
Semigroup Forum	Springer-Verlag	136.00	782	2430	7.2	700	NONE	P,M

# Translations Journals

Journal	Publisher	1982 list subscription price, \$US	pages in 1982	char/ page	cents/ 1000 char	Circulation NA = not applicable NG = not given C = confidential	Requested page charges	Back volumes P = paper M = microform
Algebra & Logic*	Plenum Publishing	270.00	452	3750	15.9	C	NA	P,M
Differential Equations*	Plenum Publishing	395.00	1532	6800	3.8	C	NA	P,M
Fluid Dynamics*	Plenum Publishing	380.00	978	5310	7.3	C	NA	P,M
Fluid Mech. - Soviet Res.	Scripta Publ. Co.	299.00	871	3350	10.2	NG	NONE	P
Functional Anal. Appl.*	Plenum Publishing	320.00	312	6420	16.0	C	NA	P,M
J. Soviet Math.	Plenum Publishing	680.00	2718	4670	5.4	C	NA	P,M
Lithuanian Math. J.*	Plenum Publishing	205.00	416	7120	6.9	C	NA	P,M
Magnetohydrodynamics*	Plenum Publishing	325.00	416	7540	10.4	C	NA	P,M
Math. Notes of the Acad. of Sci. of the USSR*	Plenum Publishing	400.00	944	5720	7.4	C	NA	P,M
Math. USSR - Izv.	Amer. Math. Soc.	290.00	1253	4080	5.7	547	NONE	P,M
Math. USSR - Sb.	Amer. Math. Soc.	400.00	1680	4130	5.8	541	NONE	P,M
Moscow Univ. Math. Bull.	Allerton Press	190.00	443	3020	14.2	NA	NONE	P
Proc. Steklov Inst. Math.	Amer. Math. Soc.	210.00	778	3800	7.1	378	NONE	P
Selecta Mathematica Sovietica	Birkhauser Boston	98.00	476	3180	6.5	200	NONE	P
Siberian Math. J.*	Plenum Publishing	495.00	929	6370	8.4	C	NA	P,M
Soviet Automat. Control	Scripta Publ. Co.	159.00	548	6240	4.6	NG	NONE	P
Soviet J. of Contemp. Math Anal.	Allerton Press	195.00	434	3180	14.1	NA	NONE	P



Soviet Math. Dokl.	Amer. Math. Soc.	250.00	2357	4140	2.6	902	NONE	P,M
Soviet Math. (Iz. VUZ)	Allerton Press	260.00	1269	3150	6.5	NA	NONE	P
Theoret. & Math. Phys.*	Plenum Publishing	380.00	1134	6310	5.3	C	NA	P,M
Theory Probab. Appl.**	Soc. for Indust. & Appl. Math	148.00	880	3650	4.6	1125	64.00	P,M
Theory Prob. & Math. Stat.	Amer. Math. Soc.	180.00	337	3620	14.8	246	NONE	P
Trans. Moscow Math. Soc.	Amer. Math. Soc.	120.00	566	3650	5.8	449	NONE	P
Ukrainian Math. J.*	Plenum Publishing	380.00	641	6020	9.8	C	NA	P,M
Vestnik Leningrad Univ. Math.	Amer. Math. Soc.	150.00	786	3310	5.8	161	NONE	P

\* 1982 issues appear in two different published volumes. At the request of the publisher, the higher price of the two volumes was used for the yearly subscription rate and to determine the price per character.

\*\* These costs were calculated as if the entire issue were typeset to the specifications of the Research section. The Book Reviews sections, in all cases not more than 15% of the total pages, were actually typeset in a smaller size.

*First Report*

The following pages contain a first report on the 1983 AMS Survey. Included in this report are salary and other data on faculty members in four-year colleges and universities, a report on the 1983 survey of new doctorates, a report on salaries of new doctorates, and a list of names and thesis titles for members of the 1982-1983 Ph.D. class.

The Annual AMS Survey is conducted in two parts. Questionnaires were distributed in May to all departments in the mathematical sciences in colleges and universities in the United States and Canada, and later to the recipients of doctoral degrees granted by these departments between July 1982 and June 1983, inclusive. This report is based on the information collected from these questionnaires. A second round of questionnaires was distributed in September; these are concerned with data on fall enrollments, class size, teaching loads and faculty mobility. These data will be reported in the February or April 1984 issue of the *Notices*.

This Survey is the twenty-seventh in an annual series begun in 1957 by the Society's Committee on the Economic Status of Teachers. The present Survey is under the direction of the Committee on Employment and Educational Policy (CEEP), whose members are Lida K. Barrett, Lisl Novak Gaal, Irwin Kra, Robert W. McKelvey, Donald C. Rung (chairman), and Barnet M. Weinstock. The questionnaires were devised by CEEP's Data Subcommittee consisting of Lida K. Barrett, Susan J. Devlin, Lincoln K. Durst, Wendell H. Fleming, Arthur P. Mattuck, and Donald C. Rung (chairman).

## Faculty Salaries, Tenure, Women

The questionnaires sent to departments in the mathematical sciences asked for information on salaries and tenure. Departments submitted a minimum, median, and maximum salary figure for each of four academic ranks, for staff members both with and without doctorates. Annual salaries of full-time faculty members for the academic year of 9 or 10 months were sought. The 1983 questionnaire requested information for both the years 1982-1983 and 1983-1984. The sample in this survey is thus the same for both years and is different from the sample used in the Twenty-Sixth AMS Survey in 1982. In the salary tables on the following pages the numbers in parentheses give the range of the middle fifty percent of salaries reported. The figures outside the parentheses represent the minimum and maximum salary listed by any reporting institution. In some categories relatively few departments reported and, because significant figures were not available, salaries are not listed.

The information reported this year on the number of faculty members is based on returns from 626 departments in the mathematical sciences, 124 of which did not contain usable salary information.

For these reports, the departments are divided into groups according to the highest degree offered in the mathematical sciences. The doctorate-granting departments are in six groups as described in the box.

**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.<sup>1</sup>

**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.

<sup>1</sup>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. It should be noted that the University of Maryland has separate programs in mathematics and applied mathematics within a single department, not separate departments as reported in the above cited articles in the *Notices*.

**TABLE 1: Total Faculty Reported for Four-Year Colleges and Universities**

	1982-1983				1983-1984			
	FACULTY		WOMEN		FACULTY		WOMEN	
	Total	With Tenure	Total	With Tenure	Total	With Tenure	Total	With Tenure
<u>WITHOUT DOCTORATE</u>								
Instructor/Lecturer	672	41	356	22	686	43	377	24
Assistant Professor	469	311	134	77	474	293	124	71
Associate Professor	330	314	52	52	319	299	57	54
Professor	109	107	10	10	109	106	9	9
	<u>1580</u>	<u>773</u>	<u>552</u>	<u>161</u>	<u>1588</u>	<u>741</u>	<u>567</u>	<u>158</u>
<u>WITH DOCTORATE</u>								
Instructor/Lecturer	205	7	33	1	206	8	34	2
Assistant Professor	1735	187	263	30	1823	177	276	31
Associate Professor	2234	1944	173	136	2220	1935	191	151
Professor	3296	3235	146	140	3438	3361	155	149
	<u>7470</u>	<u>5373</u>	<u>615</u>	<u>307</u>	<u>7687</u>	<u>5481</u>	<u>656</u>	<u>333</u>

**TABLE 2: Percent of  
Doctorate Faculty with Tenure**

	Fall 1982	Fall 1983
Groups I, II, III	73.8%	74.0%
Groups IV, V	64.7%	63.5%
Group VI	90.2%	90.1%
Masters and Bachelors	69.4%	68.0%

**Response Rates.** Response rates among the various classes of departments vary widely, thus making it difficult to draw firm conclusions about the sizes of the faculty groups studied. Because the questionnaires request data for two years in a row, however, it is possible to estimate

**TABLE 3: Response Rates**

U.S. Departments							
Group	I	II	III	IV	V	M	B
% Response	72	72	59	62	14	42	32
Canadian Departments							
Group	VI						
% Response	46						

relative changes from one year to the next with somewhat more confidence. This year's response rates are given in Table 3. As in past years, the greatest rates of response are in Groups I, II, and III, which have a combined response rate of 66%.

(in hundreds of dollars)

722

<u>WITH DOCTORATE</u>									
Instructor/Lecturer	19	0	1	0	23	0	4	0	156 (160-227)
Assistant Professor	259	23	28	2	263	22	29	3	152 (202-235)
Associate Professor	346	303	19	16	340	302	22	19	170 (235-282)
Professor	456	437	10	10	473	438	11	11	255 (288-339)
	1080	763	58	28	1099	782	66	33	

DOCTORATE GRANTING DEPARTMENTS, Group IV (40 of 65 reporting)

<u>WITHOUT DOCTORATE</u>									
Instructor/Lecturer	12	1	3	0	12	1	5	0	
Assistant Professor	3	2	1	0	3	2	1	0	
Associate Professor	0	0	0	0	1	1	0	0	
Professor	2	2	0	0	2	2	0	0	
	17	5	4	0	18	6	6	0	

<u>WITH DOCTORATE</u>									
Instructor/Lecturer	4	1	3	1	6	1	3	1	
Assistant Professor	151	5	23	1	157	4	20	1	183 (202-240)
Associate Professor	106	75	9	5	116	84	10	5	224 (263-315)
Professor	267	261	10	10	272	258	10	10	253 (302-380)
	528	342	45	17	551	347	43	17	

DOCTORATE GRANTING DEPARTMENTS, Group V (7 of 51 reporting)

<u>WITHOUT DOCTORATE</u>									
Professor	1	1	0	0	1	1	0	0	
	1	1	0	0	1	1	0	0	

<u>WITH DOCTORATE</u>									
Instructor/Lecturer	1	0	1	0	1	0	1	0	
Assistant Professor	26	0	3	0	28	0	4	0	215 (215-263)
Associate Professor	17	13	1	1	16	14	0	0	282 (282-312)
Professor	49	47	1	1	51	50	2	2	228 (350-405)
	93	60	6	2	96	64	7	2	

DOCTORATE GRANTING DEPARTMENTS, Group VI (13 of 28 reporting)  
(Canadian Departments)

<u>WITHOUT DOCTORATE</u>									
Instructor/Lecturer	4	1	1	1	3	1	1	1	
Assistant Professor	3	1	3	1	1	1	1	1	
Associate Professor	4	4	1	1	4	4	1	1	
Professor	3	3	0	0	3	3	0	0	
	14	9	5	3	11	9	3	3	

<u>WITH DOCTORATE</u>									
Instructor/Lecturer	4	0	2	0	2	0	0	0	
Assistant Professor	44	16	8	4	44	13	6	2	195 (236-264)
Associate Professor	138	137	5	5	134	133	7	7	273 (276-347)
Professor	150	150	1	1	164	164	1	1	313 (341-403)
	336	303	16	10	344	310	14	10	

## SALARIES

1982-1983

1983-1984

<u>FACULTY</u>	<u>With Tenure</u>
Total	67
Women	29

<u>FACULTY</u>	<u>With</u>	<u>Tenure</u>
<u>Total</u>		
<u>WOMEN</u>	<u>With</u>	<u>Tenure</u>
<u>Total</u>		

## MASTER DEGREE GRANTING DEPARTMENTS

(137 of 327 reporting)

WITHOUT DOCTORATE

**Instructor/Lecturer**  
**Assistant Professor**  
**Associate Professor**  
**Professor**

## WITH DOCTORATE

**Instructor/Lecturer**  
**Assistant Professor**  
**Associate Professor**  
**Professor**

**BACHELOR DEGREE GRANTING DEPARTMENTS**

(326 of 1019 reporting)

WITHOUT DOCTORATE

Instructor/Lecturer  
Assistant Professor  
Associate Professor  
Professor

**WITH DOCTORATE**

Instructor/Lecturer  
Assistant Professor  
Associate Professor  
Professor

(in hundreds of dollars)

(in hundreds of dollars)

Median

Median

80 (140-178)	(150-188)	(160-200)	304
151 (211-252)	(213-265)	(219-280)	330
178 (234-298)	(255-303)	(264-310)	370
213 (291-370)	(291-370)	(291-370)	530

(170-188-225)	(210-225)	(219-250) 282
(147-200-240)	(215-256)	(230-289) 355
(192-238-279)	(259-306)	(289-347) 461
(215-286-343)	(316-375)	(352-426) 582

1110 (155-185)	(163-188)	(165-195) 295
135 (181-230)	(185-240)	(186-250) 303
151 (210-277)	(211-278)	(221-280) 397
173 (238-343)	(238-343)	(238-345) 600

155(192-224)	(200-239)	(205-250)	358
155(221-273)	(230-285)	(234-300)	430
147(257-334)	(271-352)	(276-375)	546

# Singularities

**Peter Orlik, Editor**

This book presents the proceedings of the Summer Institute on Singularities held at Humboldt State University, Arcata, California on July 20–August 7, 1981, and was prepared with partial support from the National Science Foundation.

The Theory of Singularities is a relatively new area of research which has grown rapidly and developed into a major field of activity. It employs the tools of Algebraic Geometry, Algebraic Topology, Differential Geometry and Real and Complex Analysis. The basic aim of these volumes is to give an exposition of the area, describe recent progress and list open problems. Some of the major topics are resolution and deformation of singularities in the algebraic and analytic categories; smoothing theory and mixed Hodge structures; equisingularity, the study of polar varieties and Whitney stratifications; Milnor fibration, monodromy and intersection pairing; analytic results, including the Gauss-Manin connection and relations with differential systems; metric properties and curvature; connections with knot theory and link theory, equivariant results and automorphic forms; unfoldings, adjacency, classification of singularities and modality; stability of singularities; Newton diagrams; Morse theory and intersection homology; and applications to physics and other sciences.

The expository papers introduce the reader to the frontiers of broad areas of research activity in singularities. The research articles solve specific problems and pose related open questions. In addition, two articles are devoted entirely to open problems in the area. Background necessary for understanding the papers is two years of graduate-level mathematics with advanced courses in Algebraic Topology, Algebraic Geometry, and Analysis.

The book's most significant contribution is its breadth. It encompasses the entire spectrum of research in singularities at this time. The field is very active and this is the first attempt at such comprehensive coverage. Following is a list of contributors:

## PART 1

<i>Shreeram S. Abhyankar</i>	<i>Lawrence Brenton,</i>
<i>E. Akyildiz and</i>	<i>David Bindschadler,</i>
<i>J. B. Carrell</i>	<i>Daniel Drucker and</i>
<i>E. Akyildiz, J. B. Carrell,</i>	<i>Geert C. E. Prins</i>
<i>D. I. Lieberman and</i>	<i>E. Brieskorn</i>
<i>A. J. Sommese</i>	<i>S. A. Broughton</i>
<i>V. I. Arnold</i>	<i>J. W. Bruce, P. J. Giblin</i>
<i>Gottfried Barthel</i>	<i>and C. G. Gibson</i>
<i>(2 papers)</i>	<i>J. W. Bruce</i>
<i>Kurt Behnke</i>	<i>Ernesto Buzano and</i>
<i>Max Benson</i>	<i>Martin Golubitsky</i>
<i>M. S. Berger, P. T. Church</i>	<i>Antonio Campillo</i>
<i>and J. G. Timourian</i>	<i>Daniel S. Chess</i>
<i>Edward Bierstone and</i>	<i>P. T. Church</i>
<i>Pierre D. Milman</i>	<i>James Damon (3 papers)</i>
<i>Edward Bierstone and</i>	<i>A. Dimca and</i>
<i>Gerald W. Schwarz</i>	<i>C. G. Gibson</i>

<i>Igor V. Dolgachev</i>	<i>Martin Golubitsky and</i>
<i>Andrew Du Plessis</i>	<i>David Schaeffer</i>
<i>Alan H. Durfee (2 papers)</i>	<i>Mark Goresky and</i>
<i>Wolfgang Ebeling</i>	<i>Robert MacPherson</i>
<i>David Eisenbud</i>	<i>Gert-Martin Greuel</i>
<i>Fouad Elzein</i>	<i>and Joseph Steenbrink</i>
<i>Robert Ephraim</i>	<i>Helmut A. Hamm</i>
<i>István Fáry (2 papers)</i>	<i>Robert M. Hardt</i>
<i>Jonathan Fine</i>	<i>Herwig Hauser</i>
<i>Klaus Fischer</i>	<i>J. P. G. Henry and</i>
<i>Robert Friedman and</i>	<i>M. Merle</i>
<i>Roy Smith</i>	<i>Audun Holme</i>
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<i>Terence Gaffney and</i>	<i>Franz W. Kamber and</i>
<i>Leslie Wilson</i>	<i>Philippe Tondeur</i>
<i>A. Galligo</i>	<i>Ulrich Karras</i>
<i>Yih-Nan Gau and</i>	<i>H. King</i>
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<i>Marc Giusti</i>	<i>Klaus Lamotke</i>
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<i>Lê Dũng Tráng and</i>	<i>(2 papers)</i>
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<i>Lê Dũng Tráng and</i>	<i>John D. Randall</i>
<i>B. Teissier (2 papers)</i>	<i>Richard Randell</i>
<i>Harm van der Lek</i>	<i>Felice Ronga (2 papers)</i>
<i>Anatoly S. Libgober and</i>	<i>C. Sabbah</i>
<i>John W. Wood</i>	<i>Kyoji Saito</i>
<i>A. Libgober</i>	<i>Morihiko Saito</i>
<i>Ben Lichtin (2 papers)</i>	<i>John Scherk</i>
<i>Joseph Lipman</i>	<i>José A. Séade</i>
<i>Eduard Looijenga</i>	<i>Dirk Siersma</i>
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<i>Clint McCrory</i>	<i>David A. Stone</i>
<i>Isao Nakai</i>	<i>Tatsuo Suwa</i>
<i>Walter D. Neumann</i>	<i>Hiroaki Terao</i>
<i>(2 papers)</i>	<i>J. G. Timourian</i>
<i>Matsuo Oka</i>	<i>David Trotman</i>
<i>Peter Orlik and</i>	<i>Tohsuke Urabe</i>
<i>Louis Solomon</i>	<i>Philip Wagreich</i>
<i>Donal B. O'Shea</i>	<i>Jonathan M. Wahl</i>
<i>Jürgen Pesselhoy</i>	<i>C. T. C. Wall</i>
<i>and Oswald</i>	<i>Tamaki Yano</i>
<i>Riemenschneider</i>	<i>Stephen S.-T. Yau</i>
<i>Frédéric Pham</i>	<i>Yosef Yomdin (2 papers)</i>
<i>Ragni Piene</i>	<i>Steven Zucker</i>
<i>Henry C. Pinkham (2 papers)</i>	

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# Report on the 1983 Survey of New Doctorates

by Donald C. Rung

This report presents a statistical profile of new doctorates in mathematics and statistics from both United States and Canadian universities. It includes the employment status of recipients of 1982-1983 doctorates in mathematics and statistics, and an analysis of the data by the sex, racial/ethnic group, and citizenship of the new doctorates. In addition, trends in the number of doctoral degrees are reported for each group of departments as defined by the 1982 Conference Board of Associated Research Councils (described on the first page of this 1983 Survey).

Doctorates conferred by Computer Science Departments are *not* included in this report although they have been included in previous reports. The response rate from this group has been low. The number of doctorates in computer science reported in the 1982 survey was 105, while the actual number probably was more than twice this figure. By way of contrast, very few degrees in mathematics or statistics go unreported.

The number of new doctorates reported for 1982-1983 was 792. This is an increase over the comparable 1981-1982 figure of 755. The comparable figure for 1980-1981 was 812 and for 1979-1980 was 768. These figures are taken from the surveys reported each year in the November *Notices* with the computer science doctorates subtracted. A second updated report is planned for the February or April 1984 *Notices*.

It is interesting to analyze the 750 doctorates reported from U.S. universities (there were 42 doctorates from Canadian universities). The citizenship is known for 744 of these doctorates and 61%, or 455, of new doctorates are U.S. citizens. The percentage of doctorates who are U.S. citizens has declined dramatically over the last four years, from 73% in 1979-1980 to the present 61% figure. It is apparent that we are now producing annually less than 500 doctorates who are U.S. citizens. Of course, it is assumed that many of the non-U.S. citizens do stay in this country and eventually obtain permanent residency. Table 4 gives this analysis from 1972-1973 to 1982-1983.

For U.S. citizens, it is instructive to compare the ratio of men to women among the new doctorates. Because so many of the non-U.S. citizens are male, the overall percentage of doctorates who are women has been fairly steady. This year it is 16%, as compared to the 1981-1982 figure of 15% and the 1980-1981 figure of 16%. Yet when U.S. citizens are analyzed, the percentage of women has increased, doubling in 11 years from 10% in

1972-1973 to 20% in 1982-1983. Table 5 gives these figures.

There was an increase in those still seeking employment from 32 last year to 38 this year, with the percentage rising from 4% last year to 5% this year. If past experience holds, most will find employment later this year.

The number of those employed by government, business and industry, fell from 155 to 115 but some of this decline may have been caused by omitting the number of doctorates in computer science where opportunities for employment in this area are plentiful.

**Employment Status of New Doctorates, 1982-1983.** Table 1 shows the employment status, by type of employer and field of degree, of 792 recipients of doctoral degrees conferred by mathematical sciences departments in the U.S. and Canada between July 1, 1982 and June 30, 1983. These 792 individuals are listed, with their thesis titles, later in this report.

In rows 1 through 5, the numbers who accepted appointments in U.S. doctorate-granting mathematics and statistics departments (Groups I—V) are given. In the next two rows, the figures represent those accepting appointments in U.S. mathematical sciences departments granting masters and bachelors degrees only. The information was obtained both from the departments granting the degrees and from questionnaires subsequently completed by the recipients themselves.

Among those 1982-1983 new doctorates employed in the U.S., about 66% took positions in university or college mathematical sciences departments. About 21% took positions in government, business, and industry, while the remaining 13% are in two-year colleges, high schools, other academic departments, or research institutes. These figures reflect an increase in those taking academic positions, perhaps because of the omission of computer science doctorates.

Table 1 shows as "not yet employed" about 5% of the 1982-1983 new doctorates (this excludes those whose employment status is unknown, and those not seeking employment). The data in Table 1 were in many instances obtained early in the summer of 1983 and do not reflect subsequent hiring during the summer; an update of Table 1 is planned for the February or April 1984 *Notices*. A similar update last year revealed that nearly all new 1981-1982 doctorates not yet employed by early summer subsequently found positions by fall 1982. (See the *Notices*, November 1982, page 635 and February 1983, page 161.) Only thirteen

**TABLE 1: 1982-1983 Employment Status of New Doctorates in the Mathematical Sciences**

	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	10	23	22	4	4		2			5		3	73
Group II	9	14	4	1	0		4		1	7		2	42
Group III	3	12	4	1	2		11	1	1	9		2	46
Group IV							30			1			31
Group V		4					4	3	4	1		2	18
Masters	11	14	14	1	5		12	1	3	12		10	83
Bachelors	16	12	12	2	1		9	1	2	4		8	67
Two-year College or High School	1		2									2	5
Other Academic Departments	3	4					23	1	12	3		4	50
Research Institutes	4	4	2							3			13
Government		1					11	1	2	6		2	23
Business and Industry	3	7	2		3		30	6	18	16		7	92
Canada, Academic	2	4	3		1		5		1	2		2	20
Canada, Nonacademic							2			3			5
Foreign, Academic	10	19	14	1	4		20	1	5	9		7	90
Foreign, Nonacademic	6	2	3				13	1	8	7		2	42
Not seeking employ.	1	2	1		1		1			3			9
Not yet employed	7	9	4	1			5	1	4	3		4	38
Unknown	6	6	5	5	1		6	1	2	9		4	45
Total	92	137	92	16	22		188	18	63	103	0	61	792

**TABLE 2: Sex, Minority Group, and Citizenship of New Doctorates  
July 1, 1982-June 30, 1983**

U.S. DEGREES	MEN					WOMEN					TOTAL
RACIAL/ETHNIC GROUP	CITIZENSHIP				Total Men	CITIZENSHIP				Total Women	
	U.S.	Canada	Other	Not Known		U.S.	Canada	Other	Not Known		
Asian, Pacific Islander	14	1	104	3	122	4		13	1	18	140
Black	1		2		3	5				5	8
American Indian, Eskimo, Aleut						1				1	1
Mexican American, Chicano, Puerto Rican	2		4		6			1		1	7
None of those above	318	13	120	2	453	73	2	17		92	545
Unknown	31		11		42	6		1		7	49
Total Number	366	14	241	5	626	89	2	32	1	124	750
CANADIAN DEGREES	MEN					WOMEN					TOTAL
RACIAL/ETHNIC GROUP	CITIZENSHIP				Total Men	CITIZENSHIP				Total Women	
	U.S.	Canada	Other	Not Known		U.S.	Canada	Other	Not Known		
Asian, Pacific Islander			4		4						4
Black											
American Indian, Eskimo, Aleut											
Mexican American, Chicano, Puerto Rican											
None of those above		13	10		23				1	1	24
Unknown	1	7	5		13	1				1	14
Total Number	1	20	19		40	1			1	2	42

# Doctorates in Mathematics and Related Areas, NRC Reports: July 1967–June 1982

	1967- 1968	1968- 1969	1969- 1970	1970- 1971	1971- 1972	1972- 1973	1973- 1974	1974- 1975	1975- 1976	1976- 1977	1977- 1978	1978- 1979	1979- 1980	1980- 1981	1981- 1982
Mathematics	970	1,063	1,218	1,236	1,281	1,222	1,196	1,149	1,003	959	838	768	745	728	720
A. Algebra	145	181	190	200	167	141	124	126	115	88	87	87	78	54	60
B. Analysis	246	266	244	262	241	244	213	180	141	152	118	111	91	105	98
C. Geometry	31	25	39	35	35	32	38	26	23	26	22	25	35	29	32
D. Logic	30	28	37	31	39	33	21	38	34	17	24	21	24	18	17
E. Number Theory	20	24	27	33	36	31	23	27	26	32	18	17	28	24	28
F. Probability, Mathematical Statistics	132	49	83	91	151	156	150	174	165	159	168	165	152	163	165
G. Topology	105	108	143	120	130	111	112	94	72	70	56	60	57	55	45
H. Computing Theory and Practice	51	79	118	139	163	221	194	167	147	101	55	25	13	16	11
I. Operations Research	131	127	147	122	119	119	138	101	104	113	43	43	41	35	36
J. Applied Mathematics	51	86	94	108	112	90	111	115	97	89	92	81	102	118	107
K. Mathematics, General	28	90	96	95	88	41	48	46	43	70	47	22	41	31	36
L. Mathematics, Other															
Total Pure (A, B, C, D, E, G, K)	628	718	774	789	760	682	642	606	508	474	417	402	396	365	365
Total Other (F, H, I, J, L)	342	345	444	447	521	540	554	543	495	485	421	366	349	363	355
Computer Science											121	209	218	232	220
Engineering															
Computer Engineering								101	119	122	76	79	62	71	72
Electrical Engineering	602	688	706	748	690	673	601	536	512	461	410	451	405	411	469
Engineering Mechanics	227	238	235	215	209	176	161	162	113	102	95	85	91	78	103
Operations Research					62	104	125	90	82	76	84	66	63	80	58
Systems Design & Systems Science								79	68	71	62	75	62	68	49
Life Sciences															
Biometrics and Biostatistics	23	18	37	42	30	34	35	37	46	52	45	44	42	48	58
Social Sciences															
Econometrics	30	20	27	27	32	31	20	27	30	29	23	22	22	17	24
Statistics	19	96	121	133	85	62	36	43	35	36	46	23	33	39	43
Education															
Mathematics Education	95	111	128	131	152	134	110	108	96	98	57	85	74	62	50

individuals included in Table 1 were reported as having taken part-time employment.

**Sex, Minority Group, and Citizenship of New Doctorates, 1982-1983.** Table 2 represents a breakdown according to sex, racial/ethnic group, and citizenship of these 792 new doctorates. The information summarized in Table 2 was obtained from department heads and in some cases from recipients themselves.

Analysis of the 1982-1983 employment forms for the new U.S. doctorates indicates that 11% of those employed by Groups I, II, and III departments are women, the same figure as last year. Of the new doctorates employed by bachelors and masters degree-granting departments 21% are women, while of those employed by government, business, and industry, 23% are women.

**Trends in the Number of New Doctorates.** Table 3 gives the number of doctorates granted during 1980-1981, 1981-1982, and 1982-1983 by those departments in Groups I—VI, which reported in all three years (as of August 10, 1983). The number of such departments is indicated in parentheses. This table does not include computer science doctorates. The Groups are derived from the 1982 rating.

**TABLE 3: Number of New Mathematics and Statistics Doctorates Reported by Selected Departments**

	80-81	81-82	82-83
Group I (29 depts.)	262	283	278
Group II (37 depts.)	126	91	114
Group III (50 depts.)	<u>113</u>	<u>105</u>	<u>89</u>
Subtotal	501	479	481
Group IV (33 depts.)	161	168	154
Group V (17 depts.)	120	119	115
Group VI (16 depts.)	<u>51</u>	<u>43</u>	<u>42</u>
Subtotal	<u>332</u>	<u>330</u>	<u>311</u>
TOTAL	833	809	792

**Citizenship and Gender of U.S. Doctorates, 1972-1983.** In response to several inquiries, information is presented on the annual number of doctorates receiving their degrees from U.S. universities who are U.S. citizens (Table 4). This number is divided into male and female doctorates (Table 5). This is presented for the period 1972-1983 using the CEEP reports on new doctorates published annually in the October or November *Notices*.

In Table 4 the first column is the number of doctorates, *whose citizenship is known*, who received degrees between July 1 and June 30 of the indicated years. In Column 2, we give the number who were U.S. citizens and in Column 3 the percentage this represents. In Table 5 the number in Column 2 of Table 4 is further divided into men and women. Note that in both tables *all years but 1982-1983 contain computer science doctorates*.

**TABLE 4: U.S. Citizen Doctorates**

	Adjusted Total of Doctorates granted by U.S. universities	Total of Doctorates who are U.S. citizens	%
1972-1973	986	774	78%
1973-1974	938	677	72%
1974-1975	999	741	74%
1975-1976	965	722	75%
1976-1977	901	689	76%
1977-1978	868	634	73%
1978-1979	806	596	74%
1979-1980	791	578	73%
1980-1981	839	567	68%
1981-1982	798	519	65%
1982-1983	744	455	61%

**TABLE 5: U.S. Citizen Doctorates**

	Total	Male	Female	% Female
1972-1973	774	696	78	10%
1973-1974	677	618	59	9%
1974-1975	741	658	83	11%
1975-1976	722	636	86	12%
1976-1977	689	602	87	13%
1977-1978	634	545	89	14%
1978-1979	596	503	93	16%
1979-1980	578	491	87	15%
1980-1981	567	465	102	18%
1981-1982	519	431	88	17%
1982-1983	455	366	89	20%

It is apparent there has been a precipitous decline over the last four years in the number of new doctorates who are U.S. citizens. On the other hand, the percentage of women receiving doctorates who are U.S. citizens has increased, doubling over the eleven-year period.

The table entitled **Doctorates in Mathematics and Related Areas, NRC Reports: July 1967-June 1982**, extends the table published in 1982 to cover the years 1967-1968 through 1981-1982. It depicts the rise and fall in the number of doctoral degrees in "mathematics" awarded each year in this interval. The reports of corresponding numbers for statistics, computing and operations research are subject to variations in classification, as an examination of some of the lower lines in the printed table will reveal. The figures given are extracted from a series of NRC reports entitled *Doctorate Recipients from United States Universities*. (These reports are published annually and may be obtained from the Office of Scientific and Engineering Personnel, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.)

# Salary Survey for New Recipients of Doctorates

The figures for 1983 in this article were compiled from questionnaires sent to individuals who received a doctorate in the mathematical sciences during the 1982-1983 academic year from universities in the United States and Canada.

Questionnaires requesting information on salaries and professional experience were distributed to 619 recipients of degrees using addresses provided by the departments which granted the degrees. Of these, 9 were returned by the postal service as undeliverable and could not be forwarded. There were 355 individuals who returned forms between late June and early September. The tables below are based on the responses from 307 of these individuals (254 men and 53 women). Data from 48 responses were not used in the compilation of the tables below; forms with insufficient data, or from individuals who had indicated they had part-time employment, were not yet employed, or were not seeking employment were considered unusable.

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. More comprehensive information on the number, the sex—minority group status—citizenship, and the employment status of the recipients of new doctorates granted last year in the mathematical sciences in the U.S. and Canada may be found in the previous article of this report on the 1983 Survey.

**Key to Tables.** *Salaries* are listed in hundreds of dollars. *Years* listed refer to the academic year ending in the listed year. *M* and *F* are Male and Female respectively. *One year experience* means that the persons had experience limited to one year or less in the same position or a position similar to the one reported; some persons receiving a doctorate had been employed in their

present position for several years. ( $X + Y$ ) means there are  $X$  men and  $Y$  women in the 1983 sample. Quartile figures are given only in cases where the number of responses is large enough to make them meaningful.

**Graphs.** For each category and year, the median starting salary is denoted by a horizontal bar; a vertical bar extends to the extremes. When the quartiles have also been recorded, they are denoted by the range of the box around the median, thus for those cases, the middle 50% of starting salaries lie within the range of the box. The salary information in the graphs is in hundreds of dollars. This graphical technique is based on a proposal by McGill, Tukey and Larsen in *Variations of box plots*, *The American Statistician* (February 1978).

The connected line segments equate value of the dollar from one year to the next, using 1965 median starting salary as a benchmark and adjusting that to current dollars by the implicit price deflators prepared annually by the Bureau of Economic Analysis, U.S. Department of Commerce. If the rate of change in the actual starting salaries is less than the slope of the corresponding line segment, median starting salaries did not keep up with inflation.

Note that starting salaries for all categories fall behind the cost of living change in 1975 as compared to 1970. In most cases the *rate* of increase in median starting salary from 1975 to 1980 kept up with inflation, as the line connecting the medians is parallel with the line segment. Starting salaries in 1982 showed a greater increase over 1980 than one would anticipate merely by the change in the value of the dollar; however, the median starting salary has not yet made up for the loss in the early seventies. Generally, the range of salaries is increasing with time.

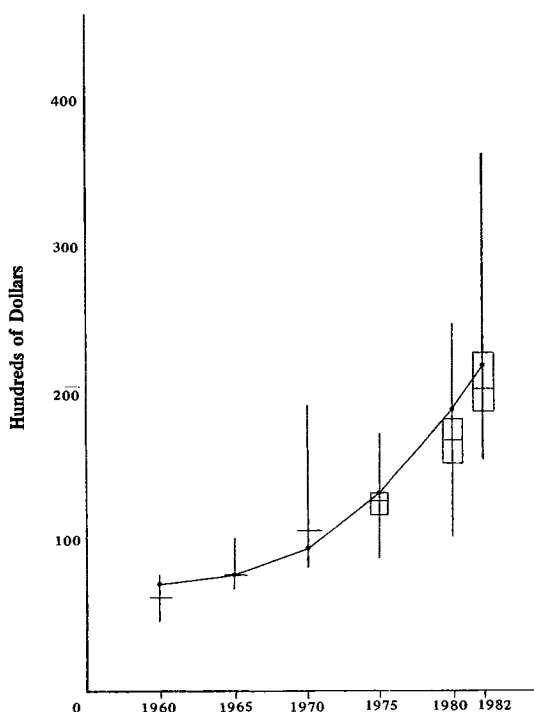
# Nine-Month Salaries

Year	Min	Q1	Median	Q3	Max	1965 Salary Median in Current \$
TEACHING OR TEACHING AND RESEARCH (168 + 35)						
1960	49		65		80	74
1965	70		80		105	80
1970	85		110		195	98
1975	90	120	128	135	173	135
1980	105	155	171	185	250	192
1981	130	175	190	210	320	210
1982	160	190	206	229	370	223
1983	80	200	217	240	350	-
1980M	120	155	171	185	250	
1980F	105	151	164	198	210	
1981M	130	175	190	210	320	
1981F	146	177	195	216	300	
1982M	160	192	210	229	370	
1982F	160	175	198	225	285	
1983M	95	204	220	240	350	
1983F	80	198	210	227	330	
One Year Experience (149 + 30)						
1983M	95	200	215	235	350	
1983F	80	200	213	240	330	

# Nine-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current \$
RESEARCH (5 + 1)				
1960	52	65	80	75
1965	71	81	90	81
1970	78	105	160	100
1975	100	-	110	137
1980	125	137	180	195
1981	143	-	145	213
1982	180	190	235	226
1983	100	200	230	-
1980M	125	137	180	
1980F	-	-	-	
1981M	143	-	145	
1981F	-	145	-	
1982M	180	190	190	
1982F	-	235	-	
1983M	100	200	230	
1983F	205	205	205	
One Year Experience (5 + 1)				
1983M	100	200	230	
1983F	205	205	205	

# Nine-month Teaching



Graph omitted because  
sample size too small

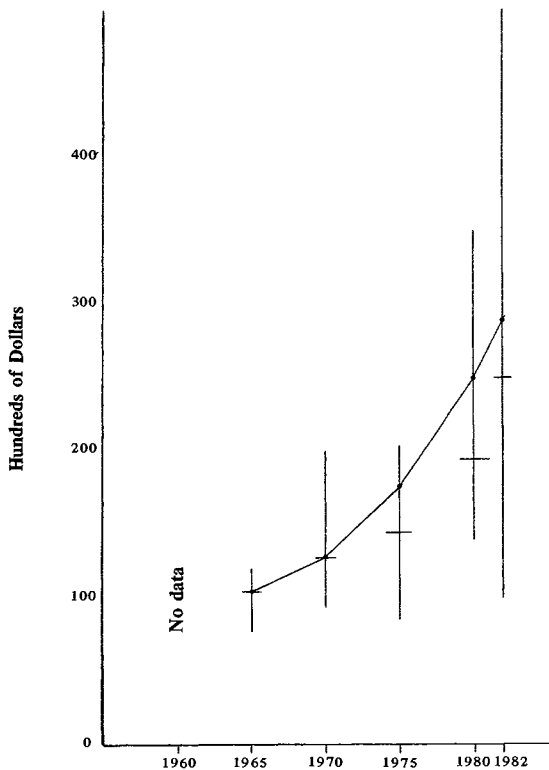
### Twelve-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current \$
TEACHING OR TEACHING AND RESEARCH (16 + 3)				
1960	.....NO DATA .....			
1965	78	104	121	104
1970	95	128	200	128
1975	87	145	204	176
1980	143	195	350	250
1981	156	203	400	274
1982	100	250	500	290
1983	160	260	320	-
1980M	143	190	350	
1980F	147	200	220	
1981M	156	200	400	
1981F	165	213	290	
1982M	180	250	500	
1982F	100	266	367	
1983M	160	255	320	
1983F	240	265	270	
One Year Experience (12 + 3)				
1983M	160	243	320	
1983F	240	265	270	

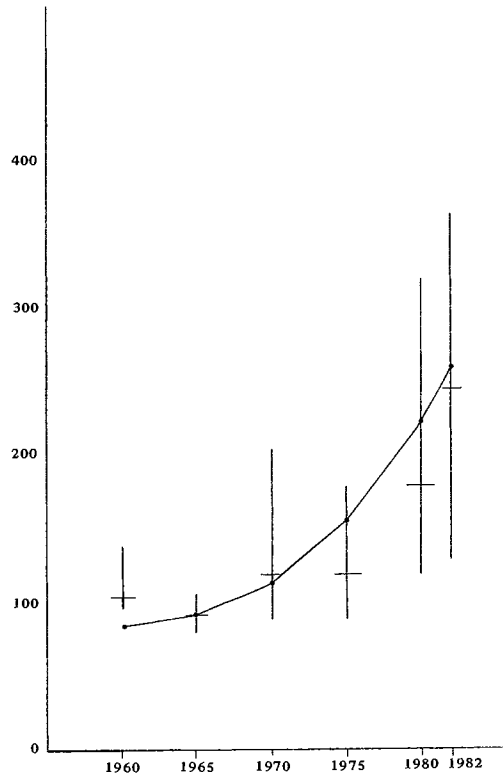
### Twelve-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current \$
RESEARCH (15 + 2)				
1960	97	105	140	86
1965	81	93	107	93
1970	90	120	205	114
1975	90	119	180	157
1980	120	180	321	224
1981	140	200	280	245
1982	130	245	364	259
1983	155	262	450	-
1980M	120	180	321	
1980F	178	200	264	
1981M	140	200	280	
1981F	150	168	200	
1982M	144	230	336	
1982F	130	265	364	
1983M	195	262	450	
1983F	155	260	364	
One Year Experience (13 + 1)				
1983M	195	250	450	
1983F	155	155	155	

### Twelve-Month Teaching



### Twelve-Month Research





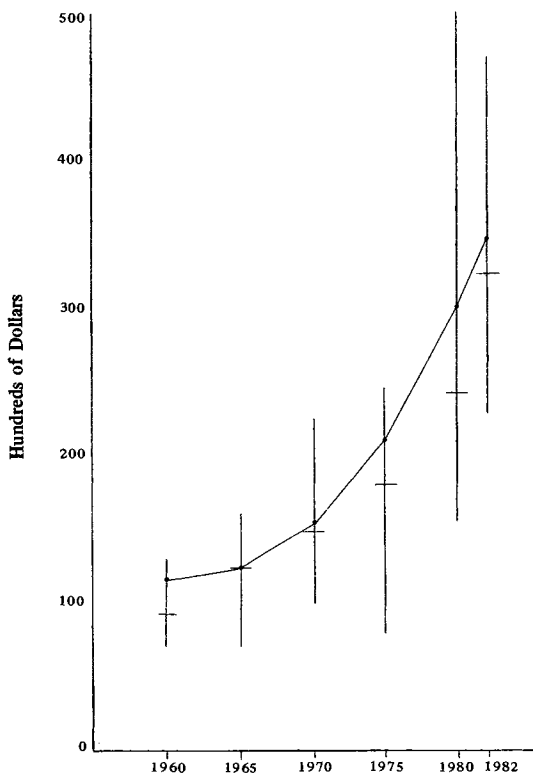
### Twelve-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current \$
<b>GOVERNMENT (11 + 3)</b>				
1960	72	93	130	117
1965	70	126	160	126
1970	100	150	223	155
1975	78	182	247	213
1980	156	244	501	303
1981	220	290	460	332
1982	228	325	470	351
1983	160	322	422	-
1980M	156	230	501	
1980F	205	247	280	
1981M	220	294	400	
1981F	252	269	460	
1982M	228	331	470	
1982F	282	326	369	
1983M	160	313	422	
1983F	293	320	350	
<b>One Year Experience (6 + 1)</b>				
1983M	160	245	330	
1983F	293	293	293	

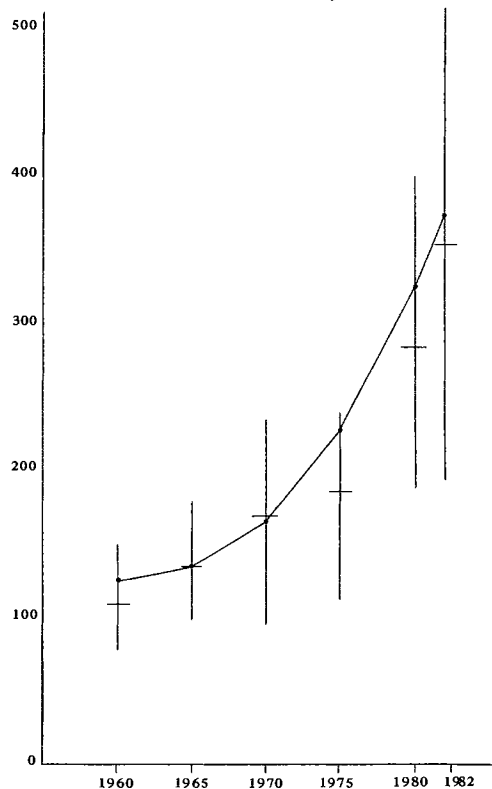
### Twelve-Month Salaries

Year	Min	Median	Max	1965 Salary Median in Current \$
<b>BUSINESS AND INDUSTRY (39 + 9)</b>				
1960	78	110	150	126
1965	100	136	180	136
1970	96	170	235	167
1975	114	187	240	230
1980	190	284	400	327
1981	195	308	500	358
1982	196	354	550	379
1983	276	375	580	-
1980M	190	284	400	
1980F	218	283	345	
1981M	195	319	500	
1981F	226	290	358	
1982M	196	366	550	
1982F	230	350	430	
1983M	300	370	580	
1983F	276	375	413	
<b>One Year Experience (25 + 6)</b>				
1983M	302	370	420	
1983F	276	375	413	

Twelve-Month  
Government



Twelve-Month  
Business and Industry



# Doctoral Degrees Conferred 1982–1983

THE ANNUAL AMS list of doctoral degrees in the mathematical sciences and related subjects reports 792 degrees conferred between July 1, 1982, and June 30, 1983 by 194 departments in 137 universities in the United States and Canada. Each entry contains the name of the recipient and the thesis title. The numbers in parentheses following the names of universities have the following meanings: the first number is the number of degrees listed for that university; the next seven numbers are the number of degrees in the categories of 1. Pure mathematics (i.e., algebra, number theory, analysis, functional analysis, geometry, topology, logic, or probability); 2. Statistics; 3. Computer science; 4. Operations research; 5. Applied mathematics; 6. Mathematics education; 7. Other.

## ALABAMA

**Auburn University**  
(3;3,0,0,0,0,0,0)

### MATHEMATICS

Daniels, Margaret Mary, *Pisley-Roy spaces and an application to normal, locally compact spaces.*

O'Farrell, John Michael, *Some methods of determining total paracompactness.*

Robinson, Cecil Eugene, Jr., *Green's relations for substochastic matrices and positive operators.*

**University of Alabama, Tuscaloosa**  
(3;1,0,0,1,0,0)

### APPLIED STATISTICS

O'Rear, Michael Ross, *Hypothesis testing for the small sample, incomplete data, multivariate normal growth-wear curve problem: Comparison of alternative models and determination of critical values and power.*

### MATHEMATICS

Harris, James Kelly, *Invariants of posets under  $F$ -morphisms.*

von Bachhaus, Anton L. W., *A generalization of Hermite polynomials.*

## ARIZONA

**Arizona State University**  
(2;1,0,0,0,1,0,0)

### MATHEMATICS

Andrews, James Arthur, *Non-Markovian infinite particle systems.*

Mistiri, Fatallah Saleh, *Star-product and linear dynamical systems.*

**University of Arizona**  
(3;1,0,0,0,2,0,0)

### APPLIED MATHEMATICS

Doerr, Thomas, *An analysis of errors in the algebraic reconstruction technique with an application to geotomography.*

Przybytkowski, Stanislaw, *Unsteady transonic flow in wind tunnels.*

### MATHEMATICS

Jacobson, Eliot Thomas, *Green functor constructions in the theory of associative algebras.*

## ARKANSAS

**University of Arkansas**  
(1;1,0,0,0,0,0,0)

### MATHEMATICS

Smith, Robert Colman, *Uniform algebras: Localization and algebras of sequences induced by bounded analytic functions.*

## CALIFORNIA

**California Institute of Technology**  
(4;1,0,0,0,3,0,0)

### APPLIED MATHEMATICS

Fawcett, John Alan, I. *Three dimensional ray-tracing and ray-inversion in layered media.* II. *Inverse scattering and curved ray tomography with applications to seismology.*

Hagstrom, Thomas Michael, *Reduction of unbounded domains to bounded domains for partial differential equation problems.*

Prendergast, Michael David Myers, *Linear programming methods for the numerical solution of parabolic equations backwards in time.*

### MATHEMATICS

Hart, Dean Robert, *Disjointness preserving operators.*

**Claremont Graduate School**  
(1;1,0,0,0,0,0,0)

### MATHEMATICS

Jow, Richard Leon, *Some contributions to the theory of random sets.*

**Stanford University**  
(38;4,16,0,12,2,0,4)

### ENGINEERING-ECONOMIC SYSTEMS

Chion-Chacon, Sergio, *Some explanations for the recurrent problems in the balance of payments of developing countries.*

Fortes, Lauro, *Effects of consumer information on product selection and innovation.*

Horan-Hecker, Avshalom, *Air defense strategies: Analysis by differential games.*

Kim, Soung-Hie, *Markovian methodology for encoding and updating the prior probability assessment on dynamic processes.*

Martin, Alberto, *A concave discrete resource allocation.*

Mori, Shozo, *A theory of bargaining process: A game theoretical approach.*

Oh, Hyung Sik, *Product differentiation in markets with congestion.*

Parkinson, Thomas W., *Using complex profit models in decision analysis.*

Powell, Stephen, *The transition to non-depletable energy.*

Stoughton, Neal, *Corporate mergers and capital structure: Theory of financial market asymmetry.*

Tom, Jim, *Adaptive quota policies for the survival control of fisheries.*

Yamada, Takeo, *Structural controllability and observability of linear time-invariant descriptor systems.*

## MATHEMATICS

Goodman, Jonathan Bernard, *Initial boundary value problems for hyperbolic systems of conservation laws.*

Nunan, Kevin Craig, *Effective properties of composite media containing periodic arrays.*

Williams, Ruth Jeannette, *Brownian motion in a wedge with oblique reflection at the boundary.*

Wiskott, Bettina, *Scattering theory and spectral representation of short-range perturbation in hyperbolic space.*

## OPERATIONS RESEARCH

Abrahamson, Philip Gager, *A nested decomposition approach for solving staircase linear programs.*

Duvall, Steven Grant, *Parametric algorithms for the linear complementarity problem.*

Glynn, Peter Winston Gunnar, *Simulation output analysis for general state space Markov chains.*

Jow, Yung-Li Lily, *An autoregressive method for simulation output analysis.*

Sierra, Hector Francisco, *Price rigidities in a general equilibrium model for the Mexican economy.*

Wittrock, Robert James, *Advances in a nested decomposition algorithm for solving staircase linear programs.*

Wood, Alan Paul, *Multistate reliability.*

## STATISTICS

Choi, Byoung-Seon, *A conditional limit characterization of the maximum entropy spectral density.*

Crager, Michael Richard, *Exponential tail quantile estimators for air quality data.*

Fairley, David, *Statistical analysis of ambient oak pollen concentrations: San Francisco Bay area case study.*

Galfond, Glenn Joseph, *Robust estimation of extreme quantiles.*

Gong, Gail Diane, *Cross-validation, the jackknife, and the bootstrap: Excess error estimation in forward logistic regression.*

Halpern, Jerry Ward, *Robust quantal assay, censored regression, and maximally selected chi-squared statistics.*

Huffer, Fred, *The moments and distributions of some quantities arising from random arcs on the circle.*

Iyengar, Satish, *On the evaluation of certain multivariate normal probabilities.*

Kuk, Anthony Y. C., *A mixing distribution approach to estimating particle size distributions.*

Orav, Endel John, *Discrete time alternating processes and effects due to noise.*

- Peters, Stephen C., *Bootstrapping a regression equation: Some empirical results.*
- Sellke, Thomas Martin, *Large sample theory for sequential analysis of the proportional hazards model.*
- Takemura, Akimichi, *A statistical approach to zonal polynomials.*
- Verducci, Joseph S., *Discriminating between two populations on the basis of ranked preferences.*
- Wenocur, Michael Louis, *A production network model and its diffusion approximation.*
- University of California, Berkeley**  
(45;15,9,2,10,6,0,3)
- BIOSTATISTICS**
- Johnson, Laura Derelle, *The geographic and statistical analysis of air quality data in the United States.*
- Kaldor, John Martin, *Statistical procedures for the design and analysis of in vitro mutagenesis assays.*
- Skurnick, Joan Hardy, *A class of bivariate distributions for paired continuous and discrete variables.*
- INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH**
- Agrawal, Avinash, *Reliability analysis of rooted directed networks.*
- Boysen, Joerg, *Aggregate project model for resource allocation within multiproject construction systems.*
- Evnine, Jeremy Joseph, *Three essays in the use of option pricing theory.*
- Perez-Galindo, Hector, *An explicit enumeration algorithm for distribution systems planning.*
- Sevilla, Agustin Ramos, *A Lagrange-multiplier/surrogate-constraint model for resource allocation problems.*
- Shachter, Ross D., *The economics of a difference of opinion: An incentive approach to eliciting probabilities.*
- Wood, Roger Kevin, *Polygon-to-chain reductions and extensions for reliability evaluation of undirected networks.*
- MATHEMATICS**
- Agahi, Massoud, *Second order differential partial equations of mixed type.*
- Bao, David Dai-Wai, *Some aspects in the dynamics of super gravity.*
- Chang, Mei-Chu, *Some results on stable rank 2 vector bundles and reflexive sheaves on  $P^3$*
- Dehnert, James Craig, *The analysis of errors in context free languages.*
- Dussault, Robert William, *Picture and 3-dimensional homology classes.*
- Dyck, Stephen Douglas, *Some applications of positive formulas in descriptive set theory and logic.*
- Ghahramani, Saeed, *Finiteness of busy period moments of queueing systems.*
- Janke, Steven John, *Recurrent sets for transient Levy processes.*
- Langer, Therese, *Some self-dual  $SO(3)$  solutions of the Yang-Mills equation and a note on harmonic maps.*
- Langlois, Jean-Pierre Patrick, *Repeated play in non-cooperative game theory.*
- Lissauer, Jack Jonathan, *Dynamics of Saturn's rings.*
- Lott, John William, *Applications of heat kernel expansions of quantum field theory.*
- McMillen, Robert William, *Contractive and hypercontractive estimates on the unit circle.*
- Nakata, Masaomi, *Quasi-linear evolution equations in non-reflective Banach spaces and applications to hyperbolic systems.*
- Nakata, Mie, *Harmonic analysis on local fields.*
- Palacios, José Luis, *The exchangeable sigma-field of Markov chains.*
- Renegar, James Milton, *On the computational complexity of simplicial algorithms in approximating zeroes of complex polynomials.*
- Schorow, David James, *Dihedral branched covers in knots in  $S^3$*
- Shallit, Jeffrey Outlaw, *Metric theory of Pierce expansions.*
- Shokranian, Saladoddin, *Results on the dimension of the space of cusp forms on classical domains of type IV.*
- Smith, Wayne Stewart, *BMO( $p$ ) and Carlson measures.*
- Taylor, Derek Roy, *Analysis of the look ahead Lanczos algorithm.*
- Tong, Po, *Coding for band-limited channels.*
- Tschantz, Steven Thomas, *Constructions in clone theory.*
- Wells, Benjamin Franklin, *Pseudorecursive varieties and their implications for word problems.*
- Willis, Catherine Marie, *Inverse eigenvalue problems with torsional modes.*
- STATISTICS**
- Bolfarine, Heleno, *On combining experts' assessments.*
- Burman, Prabir, *Smoothing in discrete multivariate analysis.*
- Folledo, Manuel, *Robust/resistant methods in the estimation of the evoked response curve.*
- Kemphorne, Peter James, *Variable selection and parameter estimation for normal linear regression models.*
- Sagalovsky, Benjamin Dario Jarupskin, *Maximum likelihood and related estimation methods in point processes and point process systems.*
- Ture, Tahsin Erkan, *On the construction and optimality of balanced treatment incomplete block designs.*
- Veitch, James Garfield, *Minimum distance procedures in stationary time series.*
- Wakim, Paul, *A Bayesian method for model discrimination using the Kalman filter.*
- Wong, Chi-Wing, *Transformation of independent variables in regression models.*
- University of California, Davis**  
(6;5,0,0,1,0,0)
- MATHEMATICS**
- Akis, Vladimir Nicholas, *Fixed-point theorems and almost continuity.*
- Feitosa, Edison De Castro, *Sets of constant width and inequalities in Minkowski spaces.*
- Ghandehari, Mostafa, *Geometric inequalities in the Minkowski plane.*
- Missel, Colin Hugh, *A complete structure theory for  $P^{w+1}$  projective Abelian p-groups.*
- O'Donnell, Mark Allen, *Boundary and interior layer behavior in singularly perturbed nonlinear systems.*
- Pfiefer, Richard Edward, *The extrema of geometric mean values.*
- University of California, Irvine**  
(1;1,0,0,0,0,0,0)
- MATHEMATICS**
- Stanke, Ronald Jay, *Intertwining operators and uniformly bounded representations of  $SU(1, n+1)$ ,  $n > 0$ .*
- University of California, Los Angeles**  
(9;3,3,0,0,3,0,0)
- BIOSTATISTICS**
- Mickey, Ruth, *Estimation of partial association from many small strata.*
- Morgan, Timothy Mack, *Value of covariates in randomized clinical trials.*
- Schluchter, Mark Dale, *Distribution-free tests for randomized block designs when observations are subject to right censorship.*
- MATHEMATICS**
- Cole, Susan L. Epps, *Near critical free surface flow past an obstacle.*
- Frazier, Michael Wallace, *Functions of bounded mean oscillation characterized by a restricted set of martingale or Riesz transforms.*
- Jackson, Stephen Craig, *A calculation of  $\delta_{\frac{1}{5}}$ .*
- Maxey, Gilbert Charles, *Automorphic representation of the classical modular symbol.*
- Prue, Howard Michael, *On the existence of travelling-wave solutions of second order nonlinear hyperbolic systems of conservation laws with singular viscosity matrices.*
- Schleinger, Gilberto Fontenla, *Study of non-axisymmetric flows in a gas centrifuge.*
- University of California, Riverside**  
(4;2,0,0,0,2,0,0)
- MATHEMATICS**
- Chang, Derek Kong, *Bimeasures, harmonizable processes and filtering.*
- Iroz, Juana Mary, *Associated primes, attached primes and cograde.*
- Palosaari, Gary Clayton, *Spectral decomposition for non-selfadjoint perturbations of singular Bessel differential operators.*
- Parsons, Bradley Niel, *General K-part stationary iterative solutions to linear solutions.*
- University of California, San Diego**  
(3;2,0,0,0,0,1)
- MATHEMATICS**
- Chen, Young-Ming, *Combinatorial algorithms for plethysm.*

Finston, David Robert, *The algebra of polynomial functions on a non-associative algebra.*

Pritchard, Frank Leon, *Behavior of zeros of polynomials with coefficients in a finite dimensional  $k$ -algebra.*

**University of California,  
Santa Barbara**  
(6;3,2,0,0,1,0,0)

#### MATHEMATICS

Abram, Thomas Joseph, *Parts in the maximal ideal space of  $H^\infty$ , a harmonic analysis approach.*

Hu, Shu-Ping, *Subset selection with inverse-sampling procedures and Dirichlet distributions.*

Huffman, Mark Randall, *Boundary behavior of harmonic functions.*

Kidman, Kent Owen, *Stochastic matrices and unitarily invariant norms.*

Sadek, Ibrahim Said, *Theory and application of a maximum principle for optimal control of systems with distributed parameters.*

Schweitzer, Robin Lesley, *On tests for the two-sample problem based on higher order spacing frequencies.*

**University of California,  
Santa Cruz**  
(2;2,0,0,0,0,0,0)

#### MATHEMATICS

Migliore, Edward T., *Determination of the maximal subgroup of  $G_2(q)$ ,  $q$  odd.*

Pierce, John, *Morse theory in the context of elastostatics: A prototypical problem.*

**University of Southern California**  
(1;1,0,0,0,0,0,0)

#### MATHEMATICS

Hulbert, Douglas Strong, *Asymptotic behavior of solutions to nonlinear Volterra integral equations in Banach spaces.*

### COLORADO

**Colorado State University**  
(6;1,2,0,0,3,0,0)

#### MATHEMATICS

Aston, Martha B., *An implicit scheme for water wave problems.*

Bowers, Kenneth L., *A mathematical model of oil shale retorting.*

Kouba, Duane A., *Regularization with  $n$ th order linear boundary value problems using  $m$ th order differential operators.*

Vogel, Curtis Rainer, *Probabilistic methods for the inversion of first kind integral equations.*

#### STATISTICS

Buonaccorsi, John Philip, *Inference and design for ratios of linear combinations in the general linear model.*

Ebong, Daniel Wilson Udo, *Some general statistical inferences on the 'hidden periodicity' model.*

**University of Colorado**  
(2;0,1,0,0,1,0,0)

#### MATHEMATICS

Halasi, Kadosa, *Numerical solution of two dimensional potential problems using Fourier analysis, boundary integral equations and near-far concepts.*

Koslov, Judith W., *Confidence bounds for autoregressive spectral estimates.*

**University of Denver**  
(1;0,0,0,0,1,0,0)

#### MATHEMATICS AND COMPUTER SCIENCE

Lahlou, Mourad, *Highly accurate inversion methods for 3-D stratified media.*

**University of Northern Colorado**  
(3;1,1,0,0,1,0,0)

#### MATHEMATICS AND APPLIED STATISTICS

Abdel-Megeed, Samir, *Monte Carlo study of psychometric effects of scaling levels on the Pearson product moment correlation coefficient.*

Beran, David Frank, *A study of solution methods, stability properties, and applications of difference equations.*

Sawasdikosol, Kamol, *Techniques and applications of finding the indefinite integral of rational and other functions.*

### CONNECTICUT

**Wesleyan University**  
(1;1,0,0,0,0,0,0)

#### MATHEMATICS

Mulvey, Irene T., *Periodic, recurrent and non-wandering points for continuous maps of the circle.*

**Yale University**  
(10;8,2,0,0,0,0,0)

#### MATHEMATICS

Benson, Frederick Challoner, *Characteristic classes for symplectic foliations.*

Carlin, Kevin Joseph, *Extensions of Verma modules.*

Lee, Jyh-hao, *Analytic properties of Zakharov-Shabat inverse scattering problems with a polynomial spectral dependence of degree 1 in the potential.*

Marker, David Ellis, *Degree coding models of arithmetic.*

Michalek, Gary Edwin, *A formulation of a generalized Borel-Weil theorem.*

Murray, Margaret Anne-Marie, *Non-linear operators and multilinear convolutions commuting with dilations.*

Ratcliff, Gail Dawn Loraine, *A symbolic calculus for 3-step nilpotent Lie groups.*

Tongring, Nils Ronald, *Multiple points of Brownian motion.*

#### STATISTICS

Arnold, Jonathan, *Statistics of natural populations: Seasonal variation in inversion frequencies of Mexican *Drosophila pseudoobscura*.*

Barry, Daniel Gerard, *Non-parametric Bayesian regression.*

### DELAWARE

**University of Delaware**  
(3;1,0,0,0,2,0,0)

#### MATHEMATICAL SCIENCES

Dallas, Allan Gill, *On the scattering of electromagnetic waves by perfectly conducting bodies moving in vacuum.*

Esham, Benjamin Franklin, Jr., *A singular perturbation problem for a nonlinear evolution equation.*

Smith, Robert Thomas, *A class of inverse scattering problems in acoustics.*

### DISTRICT OF COLUMBIA

**American University**  
(4;0,4,0,0,0,0,0)

#### MATHEMATICS, STATISTICS AND COMPUTER SCIENCE

Matthews, Peter, *New techniques for discrimination with nominal level variables.*

Samuhel, Michael E., *A general approach to the missing data problem.*

Schloss, Louis, *Weighted agreement with categorical data.*

Welsh, Anne Kramer, *A generalized covariance estimator for the analysis of asymmetric time series.*

**George Washington University**  
(6;3,0,0,3,0,0,0)

#### MATHEMATICS

Arwini, Ali Saleh, *Order compactness and complete regularity in topological preordered spaces.*

Haynes, Tyler Henry, Jr., *Invariant means on semi-topological transformation semigroups.*

Pandian, Ramaiah Devadoss, *Relatively almost periodic and distal semigroup compactifications and related fixed point theorems.*

#### OPERATIONS RESEARCH

Arsham, Hossein, *Poisson process approximations of confidence regions for distribution functions based upon generalized K-S statistics.*

Mazzuchi, Thomas Andrew, *Some non-parametric Bayesian estimates of the failure rate function.*

Roqué, Diego Reyes, *Queueing networks structured via interacting overflow lines: A new perspective on queues.*

### FLORIDA

**Florida State University**  
(8;3,4,0,0,1,0,0)

#### MATHEMATICS AND COMPUTER SCIENCE

Jou, Jong-Jhy, *Compositionally convective and morphological instabilities of a fluid layer of binary alloy with freezing at the lower boundary.*

Kutter, Mary, *Manifold factors that are the cell-like image of a manifold.*

Repovs, Dusan, *Topology of generalized three-manifolds with zero-dimensional singularities.*

#### STATISTICS

Brindley, Dennis Alfred, *Some results on the distribution of Grubbs estimators.*

Chaganty, Narasinga Rao, *Large deviation local limit theorems, with applications.*

Kim, Jee Soo, *Ranking and selection procedures for exponential populations with censored observations.*

Park, Dong Ho, *Testing whether new is better than used of a specified age.*  
 Sinclair, Dennis F., *Tests of displacement and ordered mean hypotheses.*

**University of Florida**  
 (8;5,2,0,0,0,0,1)

INDUSTRIAL AND SYSTEMS  
 ENGINEERING

Sencer, Yeralan, *Analysis of serial production lines that are subject to breakdown.*

MATHEMATICS

Dow, Stephen John, *Some problems in incidence geometry.*

Kenoyer, David B., *Generalizations of ideal theory.*

Mason, Dorothy Alice, *Open mappings and dimension.*

Wijesinha, Alexander L., *Minimal class theorems in measure theory.*

Toledo, Manzur Juan, *Finite and compact actions on chainable and tree-like continua.*

STATISTICS

Schollenberger, John, *Categorical data analysis with an ordinal response variable and interval explanatory variable.*

Suissa, Samy, *Exact unconditional tests for  $2 \times 2$  contingency tables.*

**University of Miami**  
 (6;3,0,0,0,0,0,3)

MATHEMATICS AND  
 COMPUTER SCIENCE

Demsky, Scott Harvey, *Generalizations of addition sets and related structures.*

Drost, John L., *Unramified extensions of normal domains.*

Montes de Oca, Ana, *Unicoherence in topological spaces.*

Montes de Oca, Francisco, *Nonconstant periodic solutions of nonlinear differential equations.*

Sarmiento, Jorge, *Generalized Hadamard matrices.*

Shershin, Carmen Baytan, *Mathematics in cryptography and communication.*

## GEORGIA

**Georgia Institute of Technology**  
 (3;1,0,0,0,2,0,0)

MATHEMATICS

Bielecki, Daria Jan, *Initial value problems for some two and three dimensional arrays of harmonic oscillation.*

Raddatz, William Daniel, *Bounds and estimates for the linearly perturbed eigenvalue problem.*

Withers, William Douglas, *Extensions of the concept of derivative to all monotone functions.*

**University of Georgia**  
 (4;0,4,0,0,0,0,0)

STATISTICS AND  
 COMPUTER SCIENCE

Badarinathi, Ravija, *Multivariate generalized classification statistics.*

Chen, Micah Yikman, *Modified moment and maximum likelihood estimators for parameters of the three-parameter inverse Gaussian distribution.*

Hungspruke, Rossukon, *Distribution of the largest and smallest characteristic roots: Evaluation, comparison with approximations and applications.*

Kim, Kee Young, *A study of the Dirichlet distribution family and applications.*

## HAWAII

**University of Hawaii**  
 (4;0,3,0,0,0,0,1)

PUBLIC HEALTH SCIENCES

Choe, Minja Kim, *Risks of infant and early childhood mortality: A multivariate analysis model with application to Korea 1960-1978.*

Chu, Susan Ying, *Assessment of the comparability of frequency and quantitative dietary intake measurements for epidemiologic studies of diet-disease associations.*

Joesoef, Mohamad, *Epidemiological model and resource allocation for tuberculosis control in the Republic of Korea.*

Meng, Kwang Ho, *Factors affecting the Korean secondary sex ratio—demographic and epidemiological consideration.*

## IDAHO

**Idaho State University**  
 (2;1,0,0,1,0,0,0)

MATHEMATICS

Olan, Michael John, *Mathematical modelling of inventory control.*

Oxenrider, Clinton John, *Dyad and Kronecker products of matrices.*

**University of Idaho**  
 (2;1,0,1,0,0,0,0)

MATHEMATICS AND  
 APPLIED STATISTICS

Ayers, Kathleen Louise, *An acceptor for semilinear bounded and other context-sensitive languages.*

Smith, Bryan, *Even pretzel knots and property P.*

## ILLINOIS

**Northwestern University**  
 (2;1,1,0,0,0,0,0)

MATHEMATICS

Alho, Juho, *Uncertain population forecasting.*

Schwartz, Mark David, *New proofs and application of a theorem of Komlos.*

**Southern Illinois University,  
 Carbondale**  
 (3;0,1,0,0,1,0,1)

MATHEMATICS

Holliday, Robert Lee, *Quasisymmetric block designs: Results concerning affine resolvability, parallelism properties and the case  $y = \lambda$ .*

Komanska, Henryka Krystyna, *Contributions to multipurpose and multivariate surveys.*

Setork, Ali, *Mathematical models and their numerical solutions for the flow field of high velocity water jets.*

**University of Chicago**  
 (12;7,3,0,0,2,0,0)

MATHEMATICS

Brandt, Jorgen, *Characteristic and table modules.*

Bump, Daniel, *Automorphic forms on  $GL(3, \mathbf{R})$ .*

Eie, Minking, *Dimension formulas for the vector spaces of Siegel's.*

Haerberly, Jean-Pierre, *Completions in equivariant K-theory.*

Krop, Leonid Jeffini, *Tensor-type representations of  $\text{Mat}_\infty(\mathbf{Z}_p)$ .*

Milnor, Fabio Augusto, *Mixed finite element methods of quasilinear second order elliptic problems.*

Ramanathan, Jayakumar G., *Harmonic maps from surfaces to the Grassmannians.*

Santos, Juan Enrique, *Finite element methods for the simulation of wave propagation in two-dimensional inhomogeneous elastic media.*

Uchiyama, Akihito, *The Fefferman-Stein decomposition of smooth functions and its application to  $H^p(\mathbf{R}^n)$ .*

STATISTICS

Schafer, Daniel William, *Use of the correction for attenuation estimator with judgemental information.*

Shott, Susan, *Limit theorems for mixing arrays.*

Tanner, Martin Abba, *Nonparametric estimation of the hazard function from censored data.*

**University of Illinois, Chicago**  
 (6;3,1,1,0,1,0,0)

MATHEMATICS, STATISTICS  
 AND COMPUTER SCIENCE

Grace, Thomas, *Graceful, harmonious, and sequential graphs.*

Hull, David, *toward a theory of bisexual Galton-Watson branching processes.*

Hwang, Huen-Luen, *On  $(k,t)$  trades and the construction of bib designs with repeated blocks.*

Mohrherr, Jeanleah, *Index sets and truth-table degrees in recursion theory.*

Ryan, Dennis, *Stochastic optimal control applied to harvesting of a renewable resource in a disastrous environment.*

Walker, James, *Operator theory in Hilbert space.*

**University of Illinois,  
 Urbana-Champaign**  
 (12;5,0,0,0,3,0,4)

MATHEMATICS

Blumer, Anselm Cyril, *Bounds on the redundancy of noiseless source coding.*

Dabrowski, André Robert, *Invariance principles for random processes generated by extrema and partial sums of random variables.*

Snader, Jon Christopher, *Bishop's condition beta and decomposable operators.*

Thomas, Mark Allen, *Generic reductions of an integrable g-structure and an infinitesimal version of Cartan-Sternberg reduction.*

Wingler, Eric Jeffrey, *Analytic unitary operators.*

Zimmerman, Jay James, *The occurrence of certain types of groups as automorphism groups.*

#### THEORETICAL AND APPLIED MECHANICS

Bowers, Glenn Lee, *The influence of pore fluid on the stability of a rock mass with a weakened zone.*

Kumar, Ranganathan, *Studies in unsteady thermal penetrative convection.*

Kuo, An-Yu, *Dynamic analysis of interfacial cracks in composite laminates.*

Lam, Poh-Sang, *Numerical analysis of stable crack growth in elastic-plastic materials in small scale and general yielding.*

Tung, Andrew Train-Chao, *Properties of conditional eddies in free shear flows.*

Yao, Chung-Sheng, *High Reynolds number unsteady thermal convection in a shallow layer.*

### INDIANA

#### Indiana University

(8;3,2,0,0,2,0,1)

#### MATHEMATICS

Barab, Jacqueline E., *Globular behavior of solutions to the Cauchy problem for some nonlinear wave equations and hyperbolic systems.*

Brunson, Barry W., *Martingales indexed by a partially ordered set.*

Carlson, Mark Arnold, *Central limit theorem for linear rank statistic process.*

Cheney, Margaret, *Quantum mechanical scattering and inverse scattering in two dimensions.*

Kwak, Jin Ho, *Stable parallelizability of lens-like spaces.*

Raphael, Marc, *Quasisimilarity and cyclic subnormal operators.*

Schovanec, Lawrence, *Crack problems in nonhomogeneous bodies and related existence results.*

Wu, Tzee-Jian, *Gaussian approximation of signed linear rank statistics process with applications.*

#### Purdue University

(21;7,2,1,7,2,0,2)

#### INDUSTRIAL ENGINEERING

Bengston, Neal Martin, *Development and use of operational analysis model error measures.*

Choi, Byoung Kyu, *CAD/CAM compatible tool-oriented process planning for machining centers.*

Dattero, Ronald Steven, *Stochastic models from event count data.*

Eswaran, P. K., *Interactive decision making with multiple criteria—algorithms and applications.*

Kachitvichyankul, Voratas, *Computer generation of Poisson, binomial, and hypergeometric random variables.*

Li, Cheng-Ming, *An integrated production planning and control system for steelmaking facilities with an energy conservation criterion.*

Malakooti, Behnam, *An interactive paired comparison method for multiple criteria decision making optimization.*

Sanii, Ezatollah, *A computerized process planning system using tool classification and coding.*

Suominen, Satu Marketta, *Impact of changes in physical fitness on the effectiveness of decision making.*

Swain, James Joseph, Monte Carlo estimation of the sampling distribution of nonlinear least squares.

#### MATHEMATICS

Chang, Chin-Huei, *Problems in partial differential equations and applications to several complex variables.*

Dykens, Wayne Robert, *Tensor product generalized alternating direction implicit methods for solving separable second order linear elliptic partial differential equations.*

Fenton, William Ellis, *Axiomatic convexity theory.*

Huerta, Ivan, *Optimal difference formulas.*

Mulay, Shashikant B., *Modification of local rings by quadratic transformations.*

Senger, Steven Orville, *The existential theory of concatenation over a finite alphabet.*

Shehadah, Adel Afeif, *Embedding theorems for semigroups with involution.*

Shen, Nien-Tsu, *Embeddings of Hilbert bimodules.*

Welstead, Stephen Thomas, *Orthogonal polynomials applied to the solution of singular integral equations.*

#### STATISTICS

Kao, Tzu-Cheng, *Maximum likelihood discrimination and logistic regression.*

Tollar, Eric Steven, *On a multi-compartment storage model.*

#### University of Notre Dame

(8;8,0,0,0,0,0,0)

#### MATHEMATICS

Bege, Ekin Mukadder, *On the spannedness and very ampleness of certain line bundles on the blowups of  $\mathbb{P}_C^2$  and  $F_r$ .*

Bradley, Michael J., *On the orders of automorphism groups of complex projective hypersurfaces.*

Cheng, Jih-Hsin, *Graded Lie algebras of the second kind.*

Coulton, Patrick, *A cylinder theorem for CR-manifolds.*

D'Souza, Harry, *Classification of three-folds whose hyperplane sections are elliptic surfaces.*

Livorni, E. Laura, *Classification of algebraic surfaces with the genus of a hyperplane section less than or equal to six.*

Patrizio, Giorgio, *Parabolic exhaustion for strictly convex domains.*

Spelley, James W., *The defect relation on polydiscs.*

### IOWA

#### Iowa State University

(15;1,13,0,0,1,0,0)

#### MATHEMATICS

Eucker, Bradley A., *Nonlinear resonances in spin-orbit coupling problems with three degrees of freedom.*

Gustafson, John Leroy, *Asymptotic formulas for elliptic integrals.*

#### STATISTICS

Amemiya, Yasuo, *Estimators for the errors-in-variables model.*

Auer, Richard E., *Shrinkage estimators for multiple parameters.*

Christenson, Peter David, *Variable selection in multiple regression.*

Fahrenholtz, Steven K., *Normal Bayesian two-armed bandits.*

Ihnen, Leigh A., *Computation of the incomplete beta function and the inverse incomplete beta function.*

Lin, Char-Lung, *Statistical computing support for  $L_p$  estimation in augmented linear models under linear inequality restrictions.*

Nkansa, Paul T., *Network p-median problems: theory and applications.*

Pantula, Sastry Gouripathi, *Properties of estimators of the parameters of autoregressive time series.*

Peixoto, Julio León, *Estimation of random effects in the balanced one-way classification.*

Ponder, Wendell, *Investigations of model validity using residuals.*

Rangachari, Lakshmi, *Aspects of the analysis of variance.*

Razmpour, Ahmed, *Estimation of common location and scale parameters.*

Yeo, Woon Bang, *Selection through an associated characteristic.*

#### University of Iowa

(7;3,3,0,0,0,0,1)

#### MATHEMATICS

Lin, Tzu-Chu, *The numerical solution of the Helmholtz equation using integral equations.*

Ortmeyer, William Albright, *Covering spaces of 3-manifolds.*

Pantoja-Marcari, José Eduardo, *Liftings of supercuspidal representations of  $GL_2$ .*

Smith, William Maclean, *An extension of cone techniques to wedges with applications to biological models.*

#### STATISTICS AND

#### ACTUARIAL SCIENCE

Iverson, Harald Karl, *Asymptotic properties of U-statistics with estimated parameters.*

Simon, Stephen David, *A class of non-iterative slope estimators in linear regression.*

Warrack, Anthony Giles, *Some hypothesis tests under order restrictions.*

### KANSAS

#### Kansas State University

(4;1,3,0,0,0,0,0)

#### MATHEMATICS

Chima, Javed, *Near n-gons with thin lines.*

#### STATISTICS

Levy, Martin Stuart, *On prediction functions.*

Neill, James William, *Testing regression function adequacy without replication.*

Schwenke, James Robert, *Using a hold-out data set in a cross-validation scheme to test for instability of regression estimates.*

**University of Kansas**  
(1;1,0,0,0,0,0,0)

MATHEMATICS

Darnel, Michael Roy, *Lattice-ordered groups.*

## KENTUCKY

**University of Kentucky**  
(3;2,0,0,0,1,0,0)

MATHEMATICS

Greenwell, Catherine Elizabeth, *Finite element methods for partial integro-differential equations.*

Metcalf, Scott, *Finding a boundary for a Hilbert cube manifold bundle.*

STATISTICS

O'Cinneide, Colm Art, *Some results for the infinite server queue in a random environment.*

## LOUISIANA

**Louisiana State University, Baton Rouge**  
(2;2,0,0,0,0,0,0)

MATHEMATICS

Kaiser, Raymond Joseph, *Eigenvalues of nuclear operators of diagonal type.*

Vicknair, J. Paul, *On valuation rings as homomorphic images of valuated domains.*

**Tulane University**  
(2;2,0,0,0,0,0,0)

MATHEMATICS

Dimitric, Radaslov, *Slenderness in Abelian categories.*

Franzen, Berthold, *On torsion-free modules over valuation domains.*

**University of Southwestern Louisiana**  
(1;1,0,0,0,0,0,0)

MATHEMATICS AND STATISTICS

Choate, David Beddoe, *Simple rings with idempotents.*

## MARYLAND

**Johns Hopkins University**  
(4;2,0,0,1,0,0,1)

MATHEMATICAL SCIENCES

Beattie, Christopher A., *Some convergence results for intermediate operators that displace essential spectra.*

Robertson, Alastair Douglas, *Selection of tests in medical screening.*

MATHEMATICS

Tai, Bing-sheng, *On a generalization of Kronecker's limit formula.*

Wachter, Ralph Franklin, *On zeta functions.*

**University of Maryland, Baltimore**  
(1;0,1,0,0,0,0,0)

MATHEMATICS AND COMPUTER SCIENCE

McCloskey, Joseph Paul, *Properties of  $r$ -potent matrices, extensions of Cochran's theorem, and distribution of complex quadratic forms.*

**University of Maryland, College Park**  
(11;7,0,0,0,4,0,0)

MATHEMATICS

David, Nancy, *A first order theory of regression with errors in the variables.*

Dorr, Milo, *Piecewise polynomial approximation in the  $P$ -version of the finite element method.*

Dougherty, Daniel Joseph, Jr., *Resolution, Gentzen systems and literal trees for propositional logic.*

Duchon, Nicholas, *Involutions on plumbed manifolds.*

Jankins, Mark, *The space of homomorphisms of a Fuchsian group to  $\text{PSL}(2, \mathbf{R})$ .*

Johnson, Thomas H., *On tangles and their polynomials.*

Joyner, William David, *The harmonic analysis of summation operators and the Riemann zeta function.*

Kramer, David, *Applications of Gauss's theory of reduced quadratic forms to zeta functions and modular forms.*

Tolstoy, Alexandra, *Influence of localized precipitation-induced  $D$ -region ionization enhancements on subionospheric VLF propagation.*

Trenholme, Alice Ruth, *Radial subalgebras of function algebras associated with the free group on  $n$  generators,  $\mathbf{Z}_3 * \mathbf{Z}_3$ , and  $\text{PSL}(2, \mathbf{Z})$ .*

Szymczak, William, *An adaptive finite element method for convection diffusion problems.*

## MASSACHUSETTS

**Boston University**  
(1;0,0,0,0,1,0,0)

MATHEMATICS

Pelikan, Stephen, *The dimension of attractors on surfaces.*

**Brandeis University**  
(6;6,0,0,0,0,0,0)

MATHEMATICS

Artale, Maria, *On the resolution of the cokernel of the generic map induced between Schur functors corresponding to a partition.*

Goldberg, Lisa Robin,  *$K$ -flat structures on manifolds and exotic characteristic classes.*

Kaiser, Barbara Knight, *Some algebraic problems arising from the study of class groups in  $\mathbf{Z}_p^2$  extensions.*

Knight, Karl, *Some invariants associated with deformations of hypersurface singularities.*

Schreyer, Frank Olaf, *Szygyies of curves with special pencils.*

Shimamoto, Don Harvey, *An integral version of the Brown-Gitler spectrum.*

**Clark University**  
(2;2,0,0,0,0,0,0)

MATHEMATICS

El-Zohny, Habiba A., *Splice algebras.*

Kably, Abdel-Karim, *Extensions of the classical index.*

**Harvard University**  
(19;6,3,3,0,4,0,3)

APPLIED SCIENCES

Cain, Kevin C., *Stock size estimation for commercial fish: Robust estimation and bounded influence regression applied to the groundfish survey data.*

Cassandras, Christos G., *Sample path analysis of discrete event dynamic systems.*

Feit, Elliot Jacob, *Procedures for fitting Gaussian linear time series models with independent and stationary components.*

Frankel, James L., *The architecture of closely-coupled distributed computers and their language processors.*

Herrmann, Jeffrey C., *Reference-based protection.*

Lai, Ming-Yee, *Multilevel concurrency control for database management systems.*

Newsam, Garry N., *Numerical reconstruction of partially known transforms.*

Papageorgiou, Nikolaos, *Nonsmooth and multivalued analysis with applications in optimization.*

Ramsdell, John Douglas, *Structural analysis of large sparse systems of nonlinear equations with application to fire modeling.*

Raubitschek, Ruth S., *Product differentiation and brand proliferation.*

BIOSTATISTICS

Parker, Robert A., *A Bayesian approach to the design and analysis of case-control studies.*

MATHEMATICS

Grinberg, Eric Liviu, *Integral geometry on compact symmetric spaces.*

Mantini, Lisa A., *An analog of the Penrose correspondence for representations of  $U(p, q)$  on  $L^2$ -cohomology.*

Neeman, Amnon, *Topics in algebraic geometry.*

Previato, Emma, *Hyperelliptic curves and solitons.*

Vojta, Paul Alan, *Integral points on varieties.*

Yang, Deane, *Involutive hyperbolic differential systems.*

STATISTICS

Ryan, Louise Marie, *Part I: The weighted normal plot. Part II: Efficiency of tests for carcinogenicity.*

Tomberlin, Thomas Jerome, *A statistical perspective on predicting losses in automobile insurance.*



**Massachusetts Institute of Technology**  
(25;16,2,1,4,1,0,1)

**MATHEMATICS**

Alexander, Kenneth Sidney, *Some limit theorems and inequalities for weighted and non-identically distributed empirical processes.*

Antoniano Mateos, Jose Luis Manuel, *Microlocal analogs of fractional integrals.*

Assmann, Susan Fera, *Problems in discrete applied mathematics.*

Bédard, Robert, *Brauer lifting of modular representations.*

Casian, Luis Guillermo, *A global Jacquet functor for Harish-Chandra modules.*

Colley, Susan Jane, *On the enumerative geometry of stationary multiple-points.*

Goerss, Paul G., *Results on Brown-Gitler spectra.*

Gupta, Rajiv, *Fields of division points of elliptic curves related to Coates-Wiles.*

Haran, Shai M. J., *p-adic L-functions for elliptic curves over CM fields.*

Harbourne, Brian, *Moduli of rational surfaces.*

Hriliac, Paul M., *The Neron-Tate height and intersection theory on arithmetic surfaces.*

Ierley, Glenn R., *Macrodynamics of alpha dynamos.*

Izen, Steven Henry, *Regularization of Sobolev norms of Lagrangian distributions.*

Johnson, Joseph Francis, *Lie algebra cohomology and representation theory.*

Landau, Susan E., *On computing Galois groups and its application solvability by radicals.*

Marcus, David Jeffrey, *Non-stable laws with all projections stable and relationships between Donsker classes and Sobolev spaces.*

Masujima, Michio, *Estimation of mean in the presence of inliers.*

Vardi, Ilan, *On the spectrum of the metaplectic group.*

Wu, Yihren, *Weighted homogeneous filtration on rings of pseudodifferential operators.*

Yao, Yi-Ching, *Estimation in the presence of noise, of a signal which is flat except for jumps.*

Yukich, Joseph Elliott, *Convergence of empirical probability measures.*

**OPERATIONS RESEARCH**

Bier, Vicki M., *A measure of uncertainty importance for components in fault trees.*

Chandru, Vijaya, *Complexity of the supergroup approach to integer programming.*

Constantopoulos, Panagiotis Christos, *Computer-assisted control of electricity usage by consumers.*

Huang, Kuan-Tsae, *Query optimization in distributed databases.*

**Northeastern University**

(2;1,0,0,0,0,1)

**MATHEMATICS**

Georges, John P., *Decomposable graphs and edge colorings of 3-regular graphs with small number of vertices.*

St. Vincent, Michael, *Some results on phase-locking of forced oscillators.*

**University of Massachusetts, Amherst**

(5;4,0,0,0,1,0,0)

**MATHEMATICS AND STATISTICS**

Fettes, Susan Elizabeth, *On the representation theory of the symmetric and general linear groups.*

Guy, Robert, *Singular points of nonlinear operators.*

Rosen, Jerry David, *Generalized rational identities and rings with involution.*

Rosen, Mary Peles, *Isomorphisms of a certain class of prime Lie rings.*

Seaman, Walter Iaan, *Hypersurfaces of constant mean curvature in euclidean space and groups of Heisenberg type.*

**MICHIGAN**

**Michigan State University**

(6;3,0,0,0,3,0,0)

**MATHEMATICS**

Assiff, Thomas C., *Studies on the bending of elastic plates.*

Dizaji, Ahmad F., *Unfoldings of a class of singular free boundaries for the four dimensional axi-symmetric obstacle problem.*

Doan, Hai Thanh, *Invariant curves for numerical methods and the Hopf bifurcation.*

MacCluer, Barbara D., *Holomorphic self-maps of the unit ball iteration and composition operators.*

Shute, Gary M., *Ascending unions of Chevalley groups.*

Tingley, Daryl William, *The geometry of multidimensional scaling.*

**University of Michigan, Ann Arbor**

(27;16,6,1,3,0,0,1)

**BIOSTATISTICS**

Burns, Trudy Lynn, *Sampling considerations for the determination of genetic transmission mechanisms in quantitative traits.*

Feingold, Marcia, *Distribution of a test statistic based on combined intra- and inter-block treatment contrast estimates.*

Greenhouse, Joel Bruce, *The analysis of survival data when a proportion of patients are cured: A mixture model.*

Jolayemi, Emanuel T., *A  $C_p$  method to select a log linear model.*

Rodriguez Vera, Angel, *Multipurpose optimal sample allocation using mathematical programming.*

**INDUSTRIAL AND OPERATIONS ENGINEERING**

Anderson, Charles Kevin, *A biomechanical model of the lumbosacral joint for lifting activities.*

Gana, Akli, *Studies in the linear complementarity problem.*

Marcellus, Richard L., *Markov chain disorder problems.*

Thomasma, Timothy Dale, *The triangulation graph as a data structure for computer aided design.*

**MATHEMATICS**

Bercovici, Hari, *The structure of  $C_0$  operators.*

Canjar, Robert M., *Model theoretic properties of countable ultraproducts without the continuum hypothesis.*

Carstensen, Patricia J., *The complexity of some problems in parametric linear and combinatorial programming.*

Chang, Dar Jen, *Boundary value problems for a quasilinear elliptic equation.*

Foote, Robert, *Curvature estimates for Monge-Ampère foliations.*

Hailat, Mohammad Qassem, *Structure of symmetrized sets.*

Heckman, Nancy, *Repeated significance tests with random allocation.*

Hesarakaki, Mahmud, *Structure of shock waves in magnetohydrodynamics.*

Kazemi, Mohammad, *Necessary conditions for optimality of systems governed by ordinary and partial differential equations.*

Krisnangkura, Yati, *On harmonic measure level curves in  $k$ -domains.*

Langsam, Joseph, *Some results on (BCP)-operators.*

Lazerson, Earl, *The Jacobson radical of generalized polynomial rings.*

Ozluk, Ali, *Pair correlations of zeros of Dirichlet  $L$ -functions.*

Plantholt, Michael, *Coloring the lines of a graph.*

Robel, Gregory Frank, *On the structure of (BCP)-operators and related results.*

Stark, Christopher Warren, *Structure sets vanish for certain bundles over Seifert manifolds.*

Townsend, Michael, *The polynomial jump operator and complexity for type two relations.*

Walker, Janice, *Closure and expansions in series of complex exponentials.*

**Western Michigan University**

(1;0,0,0,0,0,0,1)

**MATHEMATICS**

Fink, John Frederick, *Random factors and isofactors in graphs and digraphs.*

**MINNESOTA**

**University of Minnesota, Minneapolis**

(8;3,3,0,0,1,0,1)

**MATHEMATICS**

DeLong, Richard Peter, Jr., *Killing tensors and the Hamilton-Jacobi equation.*

Johnson, Gene Douglas, *Criteria for stability of minimal surfaces in  $n$ -dimensional Euclidean spaces.*

March, Peter Des Barres, *Fatou's theorem for harmonic functions of two-dimensional Ornstein-Uhlenbeck processes.*

Nerurkar, Mahesh G., *Generic theorems for lifting dynamical properties in the class of continuous cocycles.*

Takahashi, Jodi, *Partition and saturation properties of ideals.*

**STATISTICS**

Jennings, Dennis E., *Inference and diagnostics for logistic regression.*

Runger, George C., *Permutation tests in multivariate analysis.*  
 Wang, Pe-Cheng, *Diagnostics in regression models.*

## MISSOURI

**University of Missouri, Columbia**  
 (3;0,2,0,0,1,0,0)

### MATHEMATICS

Luxon, Bruce Arlie, *Parameter estimation: Mathematical modeling of hepatic transport kinetics.*

### STATISTICS

Bachhuber, John, *Distribution free tests for comparing two multivariate populations relative to a one sided shift alternative.*

Feltz, Carol J., *Nonparametric maximum likelihood estimation of stochastically ordered survival functions.*

**University of Missouri, Kansas City**  
 (1;1,0,0,0,0,0,0)

### MATHEMATICS

Davila, Norbil, *On numerical ranges and norm isometries.*

**University of Missouri, Rolla**  
 (3;0,3,0,0,0,0,0)

### MATHEMATICS AND STATISTICS

Danial, Edward Joul, *Extension, generalizations, characterizations and testing for independence through infinite divisibility.*

Magel, Rhonda Cheryl Lank, *Topics in isotonic regression.*

Shiue, Wei-Kei, *Experiment size for Poisson and negative binomial sampling, approximations of ratios of F-variables and tests of equal gamma scale parameters.*

**Washington University**  
 (8;6,1,0,0,1,0,0)

### MATHEMATICS

Brega, Alfredo Oscar, *On uniformly bounded representations of the Lorentz groups.*

Carrington, Walter A., Jr., *Moment problems and ill-posed operator equations with convex constraints.*

Cifuentes, Patricio,  *$H^p$  classes on rank one symmetric spaces of noncompact type.*

Cogswell, Richard L., *Leaves with growth dominating the quadratic function in foliations of codimension one.*

Colzani, Leonardo, *Hardy and Lipschitz spaces on unit spheres.*

Fernández, José Luis, *Coefficients of Bloch functions.*

Soria, Fernando, *Classes of functions generated by blocks and associated Hardy spaces.*

Van Eerdewegh, Paul, *Statistical selection in multivariate systems with applications in quantitative genetics.*

## MONTANA

**Montana State University**  
 (2;0,1,0,0,1,0,0)

### MATHEMATICAL SCIENCES

Chew, Robert, *Estimating toxicity curves by fitting a compartment-based model to median survival times.*

Winslow, Dennis Numan, *Interlacing theorems for interface Sturm-Liouville systems.*

**University of Montana**  
 (1;0,1,0,0,0,0,0)

### MATHEMATICAL SCIENCES

Rothan, Sister Adele, *A distribution-free scale test of the Kolmogorov-Smirnov type.*

## NEW HAMPSHIRE

**Dartmouth College**  
 (1;0,0,0,0,0,0,1)

### MATHEMATICS

Lenhart, William J., *Generalized quotient families and balanced incomplete block designs.*

**University of New Hampshire**  
 (1;1,0,0,0,0,0,0)

### MATHEMATICS

Hofmann, Mark Challis, *On a conjugate class of subgroups determined by a formation.*

## NEW JERSEY

**Princeton University**  
 (12;12,0,0,0,0,0,0)

### MATHEMATICS

Bando, Shigetoshi, *On the classification of three-dimensional compact Kaehler manifolds of nonnegative bisectional curvature.*

Bartnik, Robert, *Existence theorems for maximal surfaces.*

Friedman, Eduardo Carlos, *Iwasawa invariants and Iwasawa theory for several primes.*

Grayson, Matthew Aaron, *Geometry and growth in three dimensions.*

Hook, Julian Lee, *A many-sorted approach to predicative mathematics.*

Jablow, Eric Robert, *Quadratic vector classes and invariance properties of the Riemann constant under the Torelli transformation group.*

Low, Erik, *Inner functions and boundary values in  $H^\infty(\Omega)$  and  $A(\Omega)$  in smoothly bounded pseudoconvex domains.*

Mosher, Lee D., *Pseudo-Anosovs on punctured surfaces.*

Nance, Dana Walter, *A priori integral geometric estimates for nonpositively curved surfaces.*

Noell, Alan Virgil, *Properties of peak sets in weakly pseudoconvex boundaries in  $\mathbb{C}^2$ .*

Orloff, Tobias Benjamin, *Analytic continuation of Dirichlet series associated to automorphic forms on unitary groups.*

Post, Steven, *Finite type and subelliptic estimates for the  $\bar{\partial}$ -Neumann problem.*

**Rutgers University, New Brunswick**  
 (9;5,1,0,0,1,0,2)

### MATHEMATICS

Amgott, Steven M., *Separable ringoids.*

Jiang, Jin-Sheng, *A Lagrange multiplier finite element for the stationary Stokes problem.*

Kadas, Zsuzsanna Margit, *Two species reaction-diffusion systems: A piecewise linear activator-inhibitor model.*

Keller, Carol Ann, *Cohomology and two-categories.*

Kwon, Kil Hyun, *Analytic hypoellipticity for a class of analytic pseudodifferential operators with double characteristics.*

Misra, Kailash Chandra, *Structure of the standard modules for  $A_n^{(1)}$  and  $C_n^{(1)}$ .*

Monk, Peter B., *Some finite element methods for the approximation of the biharmonic equation.*

Siegel, Alan, *Smith equivalence of pseudo-free representations for cyclic groups of order  $2^a$ .*

### STATISTICS

Davis, Linda June, *A comparative study of methods of estimating the parameter in a linear logistic regression model for binomial response data.*

## NEW MEXICO

**University of New Mexico**  
 (1;0,1,0,0,0,0,0)

### MATHEMATICS AND STATISTICS

Cornez, Richard Neil, *Markov chains in random environments with feedback.*

## NEW YORK

**Adelphi University**  
 (1;0,0,0,0,0,0,1)

### MATHEMATICS AND COMPUTER SCIENCE

Impagliazzo, John, *Deterministic models in mathematical demography.*

**Columbia University**  
 (5;5,0,0,0,0,0,0)

### MATHEMATICS

Cherowitzo, William Edward, *On the extension of harmonic pre-oval configurations.*

Klein, Peter, *The trace on  $SL(2, \mathbb{C})$ .*

Kumar, Parameswaran, *Einstein series, Selberg trace formula and Rankin convolutions.*

McCarthy, John David, *Subgroups of surface mapping class groups.*

Resnicoff, Gita, *On a non-standard integral equation.*

**Cornell University**  
 (22;9,0,0,6,7,0,0)

### APPLIED MATHEMATICS

Bales, Laurence Albert, *Semidiscrete and single step fully discrete approximations for second order hyperbolic equations with time dependent coefficients.*

- Belair, Jacques, *Phase locking in linearly coupled relaxation oscillators.*
- Byers, Ralph, *Hamiltonian and symplectic algorithms for the algebraic Riccati equation.*
- Chávez, Patrick F., *Automatic procedures in evolutionary finite element calculations: Restoration of deteriorated meshes, data transfer between meshes and mesh refinement.*
- Friedman, Mark J., *Finite element formulation of the general magnetostatic problem in the space of solenoidal vector functions.*
- McConaughy, Helen V., *Three topics in combustion theory.*
- MATHEMATICS**
- Bayer, Margaret Mary, *Facial enumeration in polytopes, spheres and other complexes.*
- Bienenfeld, Mel, *Zeta- and L-functions at zero: The case of a non-totally imaginary algebraic number field.*
- Bloch, Ethan David, *Pulling apart simplexwise linear near-embeddings of 2-disk in  $\mathbb{R}^2$ .*
- Bohorquez, Jaime Alejandro, *On the effective content of the theory of modules.*
- Boyer, Steven Patrick, *Shake-slice knots.*
- Desrochers, Maryse Camille, *Self-duality of integers rings as Galois modules.*
- Ghosh, Nilotpal, *On the convergence of the boundary element method.*
- Ikenaga, Bruce Masso, *Homological dimension and Farrell cohomology.*
- Kazez, William Hilal, *On equivalence of branched coverings and their action on homology.*
- Key, Eric Stephen, *Recurrence and transience criteria and a limit law for random walk in a random environment.*
- Scowcroft, Philip Henry, *The real-algebraic structure of Scott's model of intuitionistic analysis.*
- OPERATIONS RESEARCH AND INDUSTRIAL ENGINEERING**
- Alten, Susan Ellen, *An analysis of a multi-location, indented inventory system for repairable items under nonstationary demand.*
- Chang, Gerard, *K-domination and graph covering problems.*
- Mandelbaum, Avishai, *Linear estimation of the mean of a Gaussian distribution on a Hilbert space.*
- Marcotte, Odile, *Topics in combinatorial packing and covering.*
- Tenga, Robert, *Testing goodness-of-fit to restricted families of distributions with complete and censored data.*
- New York University, Courant Institute (14;8,0,0,0,6,0,0)**
- MATHEMATICS**
- Bourgeade, Antoine, *An analysis of three dimensional compressors.*
- Chern, I-Liang, *On the perturbation of a strong wave of systems of hyperbolic conservation laws in one space dimension.*
- Dee, Dick, *Computational aspects of adaptive filtering and applications to numerical weather prediction.*
- Efrat, Isaac, *Selberg trace formulae, rigidity and cusp forms.*
- Epstein, Charles, *Spectral theory of geometrically periodic hyperbolic three manifolds.*
- Fogelson, Aaron, *A mathematical model and numerical study of platelet adhesion and aggregation in the early stages of blood clotting.*
- Li, Luen-chau, *The Toda flow with infinitely many particles.*
- Lin, Chang-shou, *The local isometric embedding in  $\mathbb{R}^3$  of two dimensional Riemannian manifolds with Gaussian curvature changing sign cleanly.*
- Linfield, David, *On the relative determinacy of infinite games.*
- Marcal, Michael, *Magnetic and drift surfaces in toroidal plasma equilibria.*
- Micallef, Mario, *Stable minimal surfaces in Euclidean space.*
- Ponce, Gustavo, *Long time stability of solutions of nonlinear evolution operators.*
- Scovel, James, *Geometry of some nonlinear differential operators.*
- Weinstein, Michael, *Self-focusing and modulational analysis for nonlinear Schrödinger equations.*
- SUNY at Albany (2;1,1,0,0,0,0,0)**
- MATHEMATICS AND STATISTICS**
- Li, Lung-An, *Decomposition theorems, conditional probability, and finite mixture distributions.*
- Subramanian, Ganesan, *On amenability of semigroup of probability measures on topological groups.*
- SUNY at Binghamton (2;1,1,0,0,0,0,0)**
- MATHEMATICAL SCIENCES**
- Dimovski, Dončo, *Non-simply connected Casson handles.*
- Menton, Ronald Glen, *A population model for calibration.*
- SUNY at Buffalo (5;3,1,0,0,1,0,0)**
- MATHEMATICS**
- Abdullah, Saleh, *On solvability and entire ellipticity of convolution equations in the space of Beurling's distributions.*
- El-Henawy, Ibrahim, *Multiple steady states of buoyancy induced flow in cold water and their stability.*
- Hemasinha, Rohan, I. *The symmetric tensor algebra of a Banach space. II: Probability measures on Bergman space.*
- Marzuq, Maher, *Properties of functions on bounded star-shaped circular domains in  $C^N$  ( $N > 1$ ).*
- STATISTICS**
- Bristol, David Ray, *Some selection procedures for comparison with a standard or a control.*
- SUNY at Stony Brook (17;9,2,0,5,0,0,1)**
- APPLIED MATHEMATICS AND STATISTICS**
- Chen, Kim-Joan, *Estimation of parameters in underdetermined systems.*
- Durinovic, Sanja, *On multiple objective Markov decision processes.*
- Gupta, Suchitra, *On interpolation methods for boundary value ordinary differential equations.*
- Johri, Pravin K., *On maximizing first passage probabilities in Markov chain models.*
- Koshy, Mathew, *Quasi-Newton methods for unconstrained optimization of functions with sparse Hessians.*
- Levine, Alan, *On the optimal operation of queueing systems—Asymptotic results.*
- Lin, Zein Cheng, *Sequential test of composite hypothesis with normal population.*
- Shankar, Shiva, *Singular nonlinear differential equations.*
- Wilson, Donna, *Algorithms for coloring some classes of perfect graphs.*
- Wu, Tsong-Ho, *An efficient algorithm for deciding circular-arc graph isomorphism.*
- MATHEMATICS**
- Agrawal, Om P., *Invariant subspaces of shift operators for the quarter plane.*
- Almeida, Sebastiao, *The geometry of manifolds of nonnegative scalar curvature.*
- Chou, Arthur Wei-chung, *The Dirac operator on singular spaces.*
- Durumeric, Oguz, *Manifolds with almost equal diameter and injectivity radius.*
- Itokawa, Yoe, *On certain Riemannian manifolds with positive Ricci curvature.*
- Misra, Gadadhar, *Curvature inequalities and extremal properties of bundle shifts.*
- Vidaurrazaga, Julio, *Biquotients of compact Lie groups and their curvature.*
- University of Rochester (7;3,3,0,0,0,0,1)**
- MATHEMATICS**
- Astheimer, Jeffrey, *Holomorphy in abstract harmonic analysis.*
- Cowles, Jonathan, *Energy localization for Schrödinger operators derived from quadratic forms.*
- Dotto, Oclide José, *Dilations and stochastic processes.*
- Wathen, Judith, *On the loops of a certain family of very nice spaces.*
- STATISTICS**
- Gheva, David, *Biplot approximate display of contingency table analysis.*
- Huang, Wei-Min, *Parameter estimation when there are nuisance functions.*
- Mathiason, David J., *Large sample procedures in the presence of nuisance parameters.*
- NORTH CAROLINA**
- Duke University (1;1,0,0,0,0,0,0)**
- MATHEMATICS**
- Prussner, Laird Drew, *Rigidity of stationary submanifolds of spheres: two examples.*
- North Carolina State University, Raleigh (10;2,4,0,2,0,0,2)**
- MATHEMATICS**
- Holladay, Philip Michael, *Unitary matrices, matrix equations, and partial orderings.*

Lyons, David Michael, *A moving boundary problem modelling diffusion with nonlinear absorption.*

#### OPERATIONS RESEARCH

Dodd, Steven Louis, *Algorithms for shape-preserving bivariate interpolation and shape-preserving approximation in the plane.*

Dodin, Bajis M., *On the completion time of stochastic PERT networks.*

#### STATISTICS

Aguirre-Torres, Victor Manuel-Armando, *Testing nonnested multivariate nonlinear regression models with and without specification of the error distribution.*

Cantrell, Rayford Stephen, *Utilization, income and health: An economic analysis of U.S. urban-rural mortality rates.*

Dix, Lynn Dana Palmer, *Minimum norm quadratic variance-covariance estimation in a general multivariate one-way random model.*

Dohse, Lothar Albrecht, *A discrete model simulating the interfield movement of a multihost phytophagous beetle.*

Lieth, Johann Heinrich, *Light interception, growth dynamics and dry matter partitioning in a phytotron-grown snap bean (*Phaseolus vulgaris* L.) crop: A modeling analysis with reference to air pollution effects.*

Lopez-Alvarez, Maria Teresa Concepcion, *Synthetic estimation when only partial symptomatic information is available.*

#### University of North Carolina, Chapel Hill (24;5,19,0,0,0,0)

#### BIostatISTICS

Amara, Ingrid, *Strategies for multivariate randomization analyses and applications to health sciences data.*

Boyd, Michael Neal, *UI-IMP rank tests against restricted alternatives.*

Brooks, Camilla Anita, *A probabilistic survey error model with double sampling to correct for nonresponse.*

Christiansen, David H., *Algorithms for the generation of design and definitional matrices in linear models for crossed-factor designs.*

Connor, Michael John, *The implications of ecological inference on parameter estimates in health services research.*

Dat, Nguyen, *Tests for time-space clustering of disease.*

Feeney, Gregory, *Extreme value theory for non-stationary sequences with application to air pollution standards.*

Feuer, Eric J., *Linear and long-linear models of population heterogeneity for Markov chains.*

Gaynor, Jeffrey, *A framework that incorporates repeated measurements into the hazard.*

Ingram, Deborah, *A test for concordant nonrandom patterns among series with epidemiologic applications.*

Johnson, Robert E., *A comparison of error probabilities for two standard analyses of variance in unbalanced two way designs.*

Kempthorne, Wanda Joan, *The analysis of clustered attribute data from nested and/or classification designs using random effects models.*

Knuckles, Bettie N., *Strategies for investigating health outcome patterns and an extension of Mantel's generalized regression approach: Application to homicide and suicide data.*

Kovar, Mary Grace, *A methodological study of factors associated with whether children receive adequate medical care.*

McCanless, Imogene, *Analysis of covariance by matching for the K sample problem.*

Mendoza, Ophelia, *Taylor series variance estimation for selected indirect demographic estimators.*

Robinson, Rhonda, *The error-in-variables problem in the logistic regression model.*

Sollecito, Bill, *The time reversed crossover design in health services research.*

Steinberg, Seth Michael, *Confidence intervals for functions of quantiles using linear combinations of order statistics.*

#### MATHEMATICS

Gordon, Gary Peter, *Representations of matroids over prime fields.*

Kossowski, Marek, *Local differential geometry of transverse metric singularities.*

McMahon, Elizabeth W., *Separable extensions of noncommutative rings.*

Patterson, Samuel Eugene, *SL-stable limit set explosions.*

Umble, Ronald, *A computer assisted study of meta-stable primitivity in finite H-towers.*

#### OHIO

#### Bowling Green State University (2;1,1,0,0,0,0)

#### MATHEMATICS AND STATISTICS

Javier, Walfredo R., *On the distributions of certain random matrix variates and their functions.*

Myers, Gary Thomas, *Upper bound graphs of partially ordered sets.*

#### Case Western Reserve University (7;0,2,0,5,0,0)

#### BIOMETRY

Helmuth, Dennis, *A general order Markov chain model for the progression of chronic disease.*

McLaren, Christine Ellen Owens, *Statistical analysis of red blood cell volume distributions.*

#### OPERATIONS RESEARCH

Boukaabar, Boudjelal, *A multi-item multi-component two-echelon model for reusable items in a health care setting.*

Chitariance, Sedrak, *A long-range planning model for branch bank development.*

Lee, Chung Ung, *Principles for evaluating and selection of alternative systems.*

Paparrizos, Konstantinos, *Monotonic algorithms for the linear complementarity problem.*

Shusang, Prasert, *Functional approximation approach to multistate control problems.*

#### Kent State University (3;3,0,0,0,0,0)

#### MATHEMATICAL SCIENCES

Atwa, Mahmoud, *Core filing sequence transformations.*

Stanek, Gary L., *Studies in the iterated logarithm law for nonstationary processes and applications.*

Wilson, David Lynn, *Slidings in handlebodies.*

#### Ohio State University (11;5,4,0,0,0,2)

#### MATHEMATICS

Bonar, Stanford, *Weighted mean convergence of Lagrange interpolation.*

Carothers, Neal, *Symmetric structures in Lorentz spaces.*

Costello, Patrick, *Classification and construction of positive definite integral quadratic forms over  $\mathbb{Z}$  and  $\mathbb{Z}[(1+\sqrt{5})/2]$ .*

D'Mello, Joseph, *Class groups of  $\mathbb{Z}_l$ -extensions and solvable automorphism groups of algebraic function fields.*

Hajela, Dhananjay, *On counting points in hypercubes, additive sequences and  $\Lambda(p)$  sets.*

Mahoney, Carolyn Ray, *On unimodality of the independent set numbers of a class of matroids.*

Shih, Ching-Hsien, *On graphic subspaces of graphic spaces.*

#### STATISTICS

Mishra, Satya Narayan, *Selection of extreme populations.*

Stefansson, Gunnar, *Multiple comparisons under order restrictions.*

Taneja, Baldeo, *Ranking and selection in designed experiments.*

Yousry, Iman Abdalla, *On a class of generalized distributions with applications.*

#### Ohio University (1;1,0,0,0,0,0)

#### MATHEMATICS

Ruth, Rickey Eugene, *Complete  $\Sigma$ -spaces and  $\theta$ -space.*

#### University of Cincinnati (3;1,2,0,0,0,0)

#### EPIDEMIOLOGY AND BIostatISTICS

Dietrich, Kathleen Carpenter, *Shelf life estimation from nonaccelerated data.*

#### MATHEMATICAL SCIENCES

Ceritto, Patricia A. B., *Random walks and measures on topological groups and semigroups.*

Heeg, Richard A., *Jordan automorphisms on semiprime ratings.*

#### University of Toledo (1;0,0,0,0,1,0)

#### MATHEMATICS

Bick, Richard Yee, *Continuous alphabet channels: The  $\bar{p}$ -topology,  $\bar{p}$ -finite memory and block coding.*

## OKLAHOMA

**Oklahoma State University**  
(3;0,3,0,0,0,0)

### STATISTICS

Abdullah, Mat Yusoff, *Bayesian inferences with the poly-t distribution.*

Al-Mahmeed, Mohammad Abdulhadi, *The analysis of autoregressive processes: The identification and the prior, posterior, and predictive analysis.*

Chou, Wen-Shen, *Selecting the best treatment through likelihoods.*

**University of Oklahoma**  
(2;2,0,0,0,0,0)

### MATHEMATICS

Anderson, Stuart Neal, *A study of generalized absolute neighborhood retracts.*

Walker, Anita M. Ransdell, *Generalized iterative methods and nonlinear functional equations.*

## OREGON

**Oregon State University**  
(9;4,3,0,0,2,0,0)

### MATHEMATICS

Bashir, Mohammed Ali, *Zero-rest-mass fields from the formula of the volume of a tube in complex projective three-space.*

Gerlach, Jürgen, *A free boundary value problem for the gas dynamic equations.*

Mohamed, Fouad, *Nonlinear free boundary problems arising from soil freezing in a bounded region.*

Ojha, Murari Prasad, *Smooth approximations and Quermassintegrals.*

Scarborough, Stephen Douglas, *A moment rate characterization for stochastic integrals.*

Treuden, Micheal L., *Asymptotically compact operator approximation theory.*

### STATISTICS

Gray, Robert J., *Goodness-of-fit tests for censored survival data.*

Thomas, Dana L., *Confidence bands for percentiles in the linear regression model.*

Wildman, Valerie Jean, *A new estimator of effective area surveyed in wildlife studies.*

**University of Oregon**  
(1;1,0,0,0,0,0)

### MATHEMATICS

Bahrampour, Yousef, *Subtransversality.*

## PENNSYLVANIA

**Carnegie-Mellon University**  
(6;0,3,0,1,2,0,0)

### MATHEMATICS

Haieh, Ying-Hen, *Demographic prediction under varying vital statistics.*

Polak, George Gregory, *Multihour multi-commodity design synthesis under queueing demand for flows.*

Trutzel, Victor, *Existence and asymptotic stability for solutions to stochastic hereditary equations.*

### STATISTICS

Buhite, Sally Greenberg, *A decision theoretic approach to optimal selection from a candidate pool.*

Chmelynski, Harry James, *A new multivariate error structure for multiple regression based on a Bayesian analysis of the gamma process.*

Fung, Kon, *Criterion functions for regression selection.*

**Drexel University**  
(1;0,0,0,0,1,0,0)

### MATHEMATICAL SCIENCES

Soyka, Michael George, *Computer-aided applications of non-Markovian macro-simulation models to the study of human populations.*

**Lehigh University**  
(1;1,0,0,0,0,0,0)

### MATHEMATICS

Shiskowski, Kenneth Michael, *Euler-Poincaré characteristic and higher order sectional curvature.*

**Pennsylvania State University**  
(2;2,0,0,0,0,0,0)

### MATHEMATICS

Almeida, Jorge Manuel Meneses Guimaraes, *Some algorithms related to the star operation applied to finite and rational languages.*

Sunderland, Benjamin Bruce Jr., *Generalized totient functions in two variables.*

**University of Pennsylvania**  
(1;0,1,0,0,0,1,0,0)

### STATISTICS

Shoemaker, Anne Clarke, *Effects of misspecification of the link function in models for binomial data.*

**University of Pittsburgh**  
(14;3,2,0,0,1,0,8)

### BIOSTATISTICS

Barton, Bruce Alan, *The assessment of the growth rate of human breast tumors.*

Guo, Shu-Mei, *Some new mathematical models of exposure to a carcinogen in the multistage theory with application to an epidemiologic study.*

Lee, Seung Wok, *An investigation of dependence of latent periods on dose levels in occupation-related lung cancer.*

Seth, Anand K., *Statistical analysis of incomplete data on weight of cleft palate children.*

Sieber, William Karl, *Statistical evaluation of prehospital emergency medical care.*

### MATHEMATICS AND STATISTICS

Cha, Anna En-Tzu, *Analysis of Krzhivitski and Ladyzhenskaya discretization of the stationary Navier-Stokes equations.*

Currie, Melvin R., *A metric characterization of the irrationals via a group operation.*

DeSilva, Santhushtha, *Non-linear superposition of gravitational plane waves.*

Ellison, John H., *Analysis of finite difference discretizations of Navier-Stokes problems on mapped domains.*

Kent, Steven L., *Yang-Mills theory in null path space.*

Krishna, Kottekkai, *Commutativity of differentiation and discretization with special reference to finite element and finite difference discretizations.*

Nguyen, Truc T., *Positive dependence of the bivariate discrete distributions.*

Saigol, Shakeel Ahmed, *Point-countable k-networks and  $k_1$ -spaces.*

Weissfeld, Lisa Anderson, *Bounds on efficiencies of commonly used non-parametric statistics.*

## RHODE ISLAND

**Brown University**  
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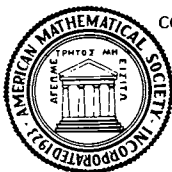
The following entry supplements the list of thesis titles published in the November 1982 *Notices*, pages 639-653, and in the April 1983 *Notices*, page 359.

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# Educating Americans for the 21st Century:

*A plan of action for improving mathematics, science and technology education for all American elementary and secondary students so that their achievement is the best in the world by 1995*

## Executive Summary

The Nation that dramatically and boldly led the world into the age of technology is failing to provide its own children with the intellectual tools needed for the 21st century.

We continue to lead because our best students are still unsurpassed. We continue to lead because our universities, industries, resources and affluence attract the finest talent from throughout the world. But this is a precarious advantage. The world is changing fast. Technological know-how is spreading throughout the world—along with the knowledge that such skills and sophistication are the basic capital of tomorrow's society.

Already the quality of our manufactured products, the viability of our trade, our leadership in research and development, and our standards of living are strongly challenged. Our children could be stragglers in a world of technology. We must not let this happen; America must not become an industrial dinosaur. We must not provide our children a 1960s education for a 21st century world.

We must return to basics, but the "basics" of the 21st century are not only reading, writing, and arithmetic. They include communication and higher problem-solving skills, and scientific and technological literacy—the *thinking* tools that allow us to understand the technological world around us.

These new basics are needed by *all* students—not only tomorrow's scientists—not only the talented and fortunate—not only the few for whom excellence is a social and economic tradition. All students need a firm grounding in mathematics, science and technology. What follows is a difficult and demanding plan to achieve this, but it must be accomplished. Our children are the most important asset of our country; they deserve at least the heritage that was passed on to us.

**EDITOR'S NOTE.** The report *Educating Americans for the Twenty-first Century* . . . is excerpted here as a companion to the report *A Nation at Risk* . . . which was reprinted in the October issue of the *Notices*. The present report was prepared by the National Science Board Commission on Precollege Education in Mathematics, Science and Technology, and is described as a report to the American People and the National Science Board. Names of the members of the commission will be found on the facing page. The parts included here are the "Executive Summary" and the list of recommendations. Readers interested in the complete report are referred to the National Science Foundation for information on obtaining copies.

•By 1995, the Nation must provide, for all its youth, a level of mathematics, science and technology education that is the finest in the world, without sacrificing the American birthright of personal choice, equity and opportunity.

This goal can be achieved. The best American students are the equal of any in the world. Indeed, the best schools in the world emulate the best of America. We have the know-how.

The Commission proposes sweeping and drastic change: in the breadth of student participation, in our methods and quality of teaching, in the preparation and motivation of our children, in the content of our courses, and in our standards of achievement. We propose to initiate this difficult change through a strategy of (1) building a strong and lasting national commitment to quality mathematics, science and technology education for all students; (2) providing earlier and increased exposure to these fields; (3) providing a system for measuring student achievement and participation; (4) retraining current teachers, retaining excellent teachers and attracting new teachers of the highest quality and the strongest commitment; (5) improving the quality and usefulness of the courses that are taught; (6) establishing exemplary programs—landmarks of excellence—in every community to foster a new standard of academic excellence; (7) utilizing all available resources, including the new information technologies and informal education; and (8) establishing a procedure to determine the costs of required improvements and how to pay for them.

In this Report we emphasize the teaching and learning of mathematics, science and technology in elementary and secondary schools; that the Commission's charge. We recognize, however, that this area cannot be separated from the teaching and learning of many other important subjects, such as English, foreign languages and history. We hope that glaring deficiencies in these other areas will be met with the same sense of urgency.

### Leadership

Reaching a new standard of academic excellence by 1995 requires clear educational objectives, strong leadership and firm commitment at all levels. Goals must be set and progress toward those goals assessed. We must recognize the necessary investment, assess the cost, and accept the responsibility for participation at Federal, state and local levels, in both the public and private sectors. We call upon our national leaders to begin and maintain the process.

•The President should immediately appoint a National Education Council, reporting directly to him, to identify national educational goals, to recommend and monitor the plan of action, to ensure

that participation and progress are measured, and to report regularly to the American people on the standards and achievements of their schools.

- The States should establish Governors' Councils to stimulate change, develop state educational goals, and monitor progress.

- Local school boards should foster partnerships with business, government and academia to encourage, aid and support in solving the academic and financial problems of their schools.

- The Federal government should finance and maintain a national mechanism for measuring student achievement and participation in a manner that allows national, state and local evaluation and comparison of educational progress.

#### **Focus on All Students**

This Commission's plan is not only for the affluent or gifted. While it provides the quality and intensity of education needed to continue their development, it also addresses the needs and potential of all other students. It recognizes that substantial portions of our population still suffer from the consequences of racial, social and economic discrimination, compounded by watered standards, "social promotion," poor guidance and token efforts. The Commission has found that virtually every child can develop an understanding of mathematics, science and technology if appropriately and skillfully introduced at the elementary, middle and secondary levels.

- The Nation should reaffirm its commitment to full opportunity and full achievement by all. Discrimination, and the lingering effects thereof, due to race, gender and other such irrelevant factors must be eradicated completely from the American educational system. "Excellence and elitism are not synonymous."

#### **Quality Teaching and Earlier and Increased Exposure**

Here and in other countries, programs that produce excellence and high achievement have similar characteristics. Education in mathematics, science and technology begins early, is taught by qualified, committed teachers, and provides a consistent course of study, beginning before elementary school and continuing in a coherent pattern through high school.

This "vertical" curriculum emphasizes early "hands-on" experience, disciplined and rigorous study, and a substantial amount of time-on-task and homework at all levels. Above all, it includes strong motivation and commitment. Parents, students and the system are all dedicated to high achievement from every student. Finally, successful systems have skilled and well-trained teachers who are supported by skilled administrators, good facilities and specialized assistance.

This is true of major competitors like Japan, and it is true of America's scattered but equally impressive model programs. Unfortunately, it is not true of most of our schools.

- Top priority must be placed on retraining, obtaining and retaining teachers of high quality in mathematics, science and technology, and providing them with a work environment in which they can be effective.

- Top priority must be placed on providing earlier, increased and more effective instruction in mathematics, science and technology in grades K-6.

- Considerably more time should be devoted to mathematics, science and technology throughout the elementary and secondary grades. This will require that the school day, week and/or year be substantially lengthened.

#### **Models for Change**

The potential of exemplary or model programs has been demonstrated in cities and localities throughout the country. Typically, they exhibit high achievement from students of every background, have strong links to local resources, and set an example that should be emulated and replicated in every school. As a first step toward change we recommend that such landmarks of excellence for mathematics, science and technology education be established in every community.

- The Federal government should encourage and finance, in part, the establishment of exemplary programs in mathematics, science and technology in every community, which would serve as examples and catalysts for upgrading all schools.

- State governments should promote and local school districts should establish such programs as a major strategy toward upgrading all schools.

We recommend that initially 1,000 such secondary schools and 1,000 such elementary schools be established throughout the country. The Commission estimates the cost to the Federal government to do so is \$829 million disbursed at the rate of \$276 million per year over a three-year period.

#### **Solutions to the Teaching Dilemma**

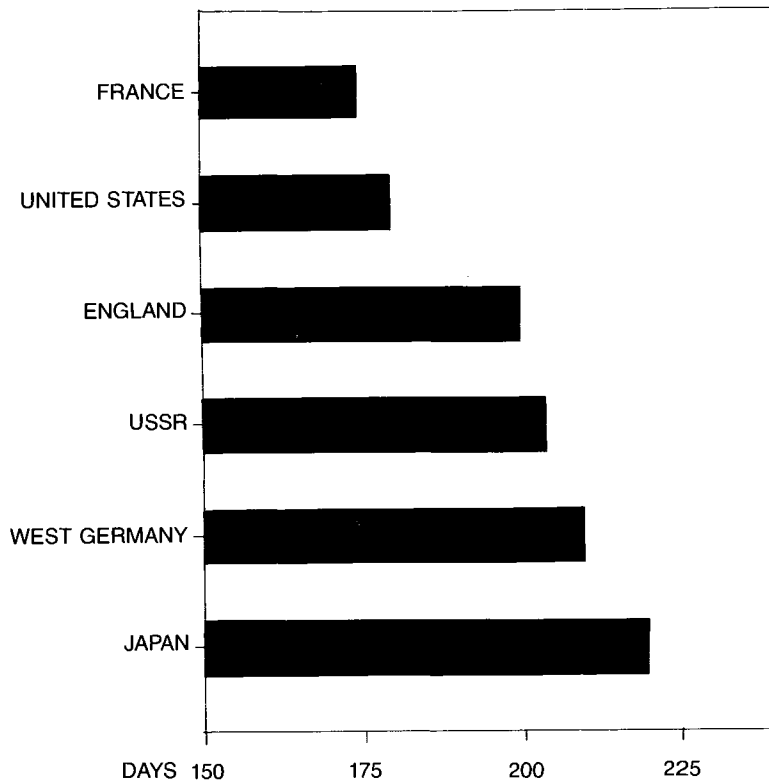
Ultimately, quality begins in the classroom; the teacher is the key. Unfortunately, we currently have severe shortages of qualified mathematics, science and technology teachers throughout the Nation, and many of today's teachers in these fields badly need retraining.

Many of the teachers in elementary schools are not qualified to teach mathematics and science for even 30 minutes a day. A significant fraction of our

#### **Members of the NSB Commission on Precollege Education in Mathematics, Science and Technology**

The members of the NSB Commission on Precollege Education in Mathematics, Science and Technology are WILLIAM T. COLEMAN, JR., O'Melveny and Myers; CECILY CANNAN SELBY, New York; LEW ALLEN, JR., Jet Propulsion Laboratory; VICTORIA BERGIN, Associate Commissioner of Education for the State of Texas; GEORGE BURNET, JR., Iowa State University; WILLIAM H. COSBY, JR.; DANIEL J. EVANS, The Evergreen State College; PATRICIA ALBERG GRAHAM, Harvard University; ROBERT E. LARSON, Optimization Technology, Inc.; GERALD D. LAUBACH, Pfizer Inc.; KATHERINE P. LAYTON, Beverly Hills High School; RUTH B. LOVE, The Chicago Board of Education; ARTURO MADRID II, University of Minnesota; FREDERICK MOSTELLER, Harvard University; M. JOAN PARENT, National School Boards Association; ROBERT W. PARRY, University of Utah; BENJAMIN F. PAYTON, Tuskegee Institute; JOSEPH E. ROWE, Gould, Inc.; HERBERT A. SIMON, Carnegie-Mellon University; and JOHN B. SLAUGHTER, University of Maryland, College Park.

## TOTAL DAYS IN SCHOOL YEAR



**Note:** The average length of the school day in the U.S. is  $5\frac{1}{2}$  hours, whereas it ranges from 6 to 8 hours in the other countries. In Japan, more time is spent with after school tutoring and homework than in the U.S. 36% of Japanese high school seniors report spending more than 10 hours per week on homework contrasted with only 6% of U.S. seniors. In the U.S., 52% of seniors report spending less than 5 hours per week, in Japan only 8% of seniors report spending less than 5 hours per week. (Source: William B. Fetters, Jeffery A. Owings, Larry E. Suter and Ricky T. Takai, *Schooling experiences in Japan and the U.S.: A cross-national comparison of high school students*, a paper presented at the 1983 Annual Meeting of the American Educational Research Association in Montreal, Canada, 13 April 1981.)

**Source:** *A challenge for American precollege education: Scientific literacy in Japan, China, the Germanies and the Soviet Union*, edited by Margarete Klein and F. James Rutherford, The Macmillan Company, New York (in press). Data on school year also provided by the Embassy of France and the British Embassy, Washington, D.C., August 1983.

secondary school teachers are called upon to work in subjects for which they were never trained. Even the most seasoned and experienced veterans must deal with subjects that are in a state of constant change; no one can remain knowledgeable in science without constant refreshing.

- State governments should develop teacher training and retraining programs in cooperation with colleges and universities. The potential of science museums as sites for such programs should be recognized, encouraged and supported.

- It is a Federal responsibility to assure that, in the present crisis, appropriate retraining is available. In-service and summer training programs should be established with Federal support. The Commission estimates the cost to the Federal government of initiatives for retraining mathematics, science and technology teachers to be \$349 million per year for five years.

- For the long term, teacher training by the States should continue as an ongoing process.

- Every State should establish at least one regional training and resource center where teachers can obtain supporting services such as computer instruction and software and curriculum evaluation.

- The National Science Foundation should provide seed money to develop training programs using the new information technologies.

At the same time that we improve the quality of current teaching, we must raise our standards for new teachers. We must attract and retain superior talent, and must provide better training, better working conditions, and better compensation for high quality teachers, together with more demanding standards.

- States should adopt rigorous certification standards, but not standards which create artificial bars to entry of qualified individuals into teaching.

- Elementary mathematics and science teachers should have a strong liberal arts background, college training in mathematics and the biological and physical sciences, a limited number of effective education courses, and practice teaching under a qualified teacher.

•Secondary school mathematics and science teachers should have a full major in college mathematics and science, a limited number of effective education courses, and practice teaching under a qualified teacher.

•Both elementary and secondary teachers should be computer literate. Teacher training should incorporate the use of calculators and computers in mathematics and science instruction.

•Liberal arts colleges and academic departments need to assume a much greater role in training elementary and secondary teachers. Basic education courses should be revised to incorporate current findings in the behavioral and social sciences.

In the short run, the pool of those presently qualified and teaching must be enlarged.

•State and local school systems should draw upon the staffs of industry, universities, the military and other government departments, and retired scientists to provide sources of qualified teaching assistance. Local systems should take actions to facilitate the entry and classroom training of such special teachers.

Compensation for mathematics, science and technology teachers must be appropriate to their important role in "academic excellence," their small numbers, and their alternatives for employment. Highly qualified and competent mathematics, science and technology teachers should receive overall rewards that are fair and relatively competitive with those received by comparable professionals in other sectors. Ultimately, the public will get what it pays for. At the same time, many teachers and teacher unions will have to reexamine their views about differential salaries in areas of shortage and systems of pay based on factors other than merely years of service and credits for "staff development."

•School systems should explore means to adjust compensation in order to compete for and retain high quality teachers in fields like mathematics, science and technology. Compensation calculations must include consideration of intangible benefits such as the length of the work year, promotion potential, and similar factors.

•State and local governments should provide means for teachers to move up a salary and status ladder without leaving the classroom.

•Local school systems, military and other governmental entities, and the private sector should all explore ways to extend the employment year while providing supplementary income and revitalizing experience.

•Professional societies, schools, States and the Nation should find ways to recognize the performance and value of the excellent teacher.

Finally, we must take action to make the classroom a place where teachers can teach and children can learn—an exciting place with more opportunity for student-teacher interaction. We must build a professional environment that will attract and hold talented and well-trained teachers, despite the allure of the private sector.

•State and local governments should work to improve the teaching environment. This includes greater administrative and parental support of discipline and attendance, fewer classroom interruptions, and higher academic standards, as well as the provision of needed equipment, materials and specialized support staff.

## Improving What is Taught and Learned

We have too long regarded mathematics and science as the exclusive domain of a talented elite—a preserve for only the gifted. By focusing on education of the well-prepared, we have both ignored and discouraged large numbers with potential talent and widened the gap between the sciences and the public they serve. There is no excuse for citizens in our technological society to say "I don't really know anything about science!"

While increasing our concern for the most talented, we must now also attend to the need for early and sustained stimulation and preparation of *all* students so that we do not unwittingly excude potential talent and so that we produce citizens, political leaders, teachers, managers, workers and other decision makers who are prepared to deal with the age of technology. Significant, immediate progress can be made by simply increasing the amount of exposure students get to mathematics, science and technology—although more persistent change will require a more elaborate process of review and revision of educational objectives.

•Local school districts should revise their elementary school schedules to provide consistent and sustained attention to mathematics, science and technology: a minimum of 60 minutes per day of mathematics and 30 minutes per day of science in grades K-6; a full year of mathematics and science in grades 7 and 8.

•Every State should establish rigorous standards for high school graduation, and local school districts should provide rigorous standards for grade promotion. We should curtail the process of social promotion.

•All secondary school students should be required to take at least three years of mathematics and of science and technology, including one year of algebra and one semester of computer science. All secondary schools should offer advanced mathematics and science courses. This requirement should be in place by September 1, 1985.

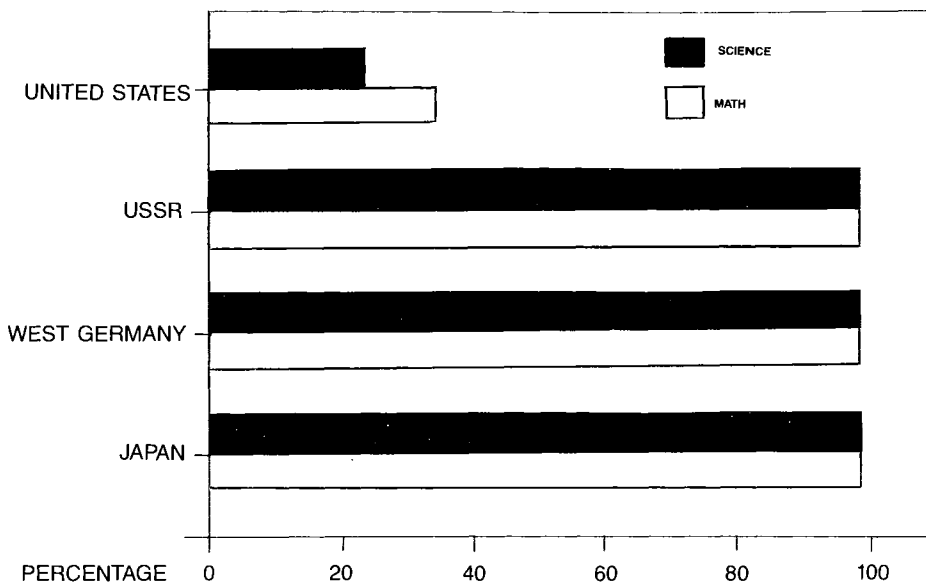
•Colleges and universities should phase in higher mathematics and science entrance requirements, including four years of high school mathematics, including a second year of algebra, coursework covering probability and statistics, four years of high school science, including physics and chemistry, and one semester of computer science.

•Specific school personnel should be obligated to inform students of these rigorous requirements. School districts and community colleges should cooperate in assisting students whose preparation is inadequate to allow them to take the next steps in their education.

For the long term, we must establish a pattern of education that will develop familiarity, skills and understanding consistently and coherently throughout the years of elementary and secondary education. This does not imply either a lockstep or "national" curriculum; local diversity and variation is a key strength of American education. Rather, we call for a consensus on new educational objectives and a coherent national *pattern*—a framework for consistent education within which alternative curricula and materials and local interpretation are encouraged.

•The National Science Foundation should take a leadership role in promoting curriculum evaluation and development for mathematics, science and

## PERCENTAGE OF "HIGH SCHOOL" STUDENTS TAKING 3 YEARS OF SCIENCE AND MATHEMATICS



**Note:** While all students study mathematics and science (at least one course) each year in the upper secondary school in Japan, West Germany and the U.S.S.R., the most recent NAEF data (1983) indicate 84% of U.S. students *do not* take physics, 65% *do not* take chemistry, 62% *do not* take Algebra II, 48% *do not* take geometry and 23% *do not* take biology. [The National Assessment of Educational Progress, Denver, Colorado, begun in 1968, was conceived as a comprehensive measure of the results of American education. Goals, objectives and banks of specific test items were developed to cover the range of subjects taught in elementary and secondary schools. These activities were initially supported by the Department of Health, Education and Welfare and then, after its creation, by the Department of Education.]

**Source:** National Center of Educational Statistics, *High school and beyond*, National Center for Educational Statistics (NCES 81-244), April 1981, Washington, D.C., and *A challenge for American precollege education: Scientific literacy in Japan, China, the Germanies and the Soviet Union*, edited by Margarete Klein and F. James Rutherford, The Macmillan Company, New York (in press).

technology. It should work closely with classroom teachers, technical experts from business and government, school boards and educational researchers, as well as with professional societies. Representatives of publishers and higher education associations should become involved as the work proceeds, to encourage development and transfer of these ideas to actual material for the classroom.

- The Federal government should support research into the processes of teaching and learning at both the basic level and the level of classroom application.

In the body of this Report, we provide a broad and preliminary outline of the content that should be included in this new pattern of education for all students. More importantly, we indicate the kinds of problem solving *insight* and *skills* that must be provided. We offer this not as a conclusion, but as a beginning—a place to start the long process of defining and developing programs that prepare students for a wide range of roles and needs.

### New Information Technologies

Computers are revolutionizing many areas of our lives; they may well do the same for education. They and other new technologies offer the potential

to work patiently with every student, regardless of level or sophistication. They also offer a means to relieve teachers of much of the drudgery of routine exercise and record keeping. Furthermore, computers offer a wealth of interactive learning resources, including access to word processing, data bases, graphic capabilities and a host of related means to expand students' learning potential.

If this promise is fulfilled, computers could simultaneously provide a new standard of achievement and lower the cost of education.

- The National Science Foundation should lead in evaluating progress in the application of new technologies, supporting prototype demonstrations, disseminating information, and supporting research on integration of educational technologies with the curriculum. These plans should not interfere with private initiatives now underway.

- States should establish regional computer centers for teacher education and encourage the use of computers in the classroom for both teaching and administration.

- Top executives in the computer, communication, and information retrieval and transfer industries

should develop plans which, in a good, economical and quick way, enable school systems to use the technology.

- The national and state education councils and school boards should work with school districts and schools to develop plans for implementing these technologies in the classroom.

#### **Informal Education**

A great deal of education takes place outside the classroom. The most fortunate students receive experiences in museums, clubs and independent activities. All children are strongly conditioned and motivated by their early experiences and impressions. The child who has regularly visited zoos, planetaria and science museums, hiked along nature trails and built model airplanes and telescopes is infinitely better prepared for, and more receptive to, the mathematics and science of the classroom.

Formal education should be preceded and supplemented by a wide range of such informal learning experiences.

- Youth organizations, museums, broadcasters and other agents of informal education should endeavor to make the environment for informal learning as rich as possible.

- Science broadcasts warrant continued and substantial Federal support as well as corporate and other private support. Federal regulation of commercial stations should include a required period of educational programming for children.

- The Federal government should provide supplementary support to encourage a full spectrum of community and educational activities by science museums.

- Businesses and broadcasters should help to promote and publicize the efforts of institutions like science museums and public broadcasting.

- Local business groups and organizations with related interests should work with museums to supplement and encourage their activities and to create new programs that let children see science and technology in the real world.

#### **Finance**

This Commission has not avoided the difficult issue of cost. Change requires investment. In the end, it may well be that a better educational system will yield greater efficiency, long-term economies and a more valuable output. But in the near future, our recommendations require substantial net investment at all levels.

In particular, as the leader and driving force to encourage change, we believe that the Federal government should anticipate an initial investment of approximately \$1.51 billion for the first full year the recommended Federal initiatives are in place (\$829 million of this amount will be disbursed over three years at the rate of \$276 million per year). During succeeding years the Federal appropriation will decline—to approximately \$680 million in the second year and \$331 million in the sixth year. We do not consider this an excessive investment in our Nation's human capital. In fact, the cost is small compared to the much larger efforts and investments of local school systems, which ultimately carry most of the burden, responsibility and authority for the quality of our children's education. The Federal government should study ways to protect the States and local communities from any anticompetitive effects on the States and local communities of increasing taxes for educational purposes.

Before we shrink from our responsibility, consider the heritage that was passed to us. We must not do less for our children and future generations.

## **Recommended Federal Action in Science Education, and the Costs**

The following is a list of the commission's major recommendations for federal action and an indication of the annual costs, above current estimates of spending, needed to implement each.

1. The President should immediately appoint a National Education Council made up of representatives from a cross-section of national interests. This council should report regularly to the President. It should provide leadership in developing, coordinating, and implementing plans to improve and maintain the quality of the nation's elementary and secondary education in mathematics, science, and technology.

The President's National Education Council should, on a continuing basis,

- (1) identify educational goals and recommend the changes needed in the form and content of education to reach those goals;

- (2) insure that the assessment mechanism described below is developed and maintained for measuring and comparing student achievement, participation, and progress toward these goals in every state, school district, and school; and

- (3) monitor and report annually to the American people on the status of American education and progress toward achieving these educational goals.

It should also facilitate the sharing of information about successful mathematics, science, and technology educational programs.

Finally, the President's National Education Council should recommend incentives to encourage state, local and private investment in education.

**Cost: \$2.75-million**

2. The federal government should finance and maintain a national mechanism to measure student achievement and participation in a manner that allows national, state, and local evaluation and comparison of educational progress. This assessment mechanism should be overseen by the President's National Education Council. The actual assessment, however, should be performed by the groups responsible for the National Assessment of Educational Progress or other such entities experienced in testing procedures and techniques.

**Cost: \$5-million**

3. The unique national role of the federal government (including important Department of Education and National Science Foundation programs) in insuring access in its broadest sense to educational opportunity must continue.

**Cost: \$157-million**

4. The federal government should encourage and finance, in part, the establishment of exemplary schools or programs in mathematics, science, and technology in each community throughout the nation to serve as examples and catalysts for upgrading all schools. The federal government should evaluate current resource allocation policies, entertain redistribution and, where necessary, appropriate funds to support the development of such programs.

The federal government should appropriate funds to aid the establishment of at least 1,000 of such exemplary schools at the secondary level and at least 1,000 such schools at the elementary level throughout the country. **Cost: \$829-million**

5. The Department of Education and the National Science Foundation should support and facilitate the dissemination of information to help build this national network of exemplary programs.

**Cost: \$0 added**

6. The federal government has a responsibility to insure that such [teacher] training is available and should provide funding for in-state teacher training programs in mathematics, science, and technology. Summer and in-service institutes, supported by the National Science Foundation, provide a proven model for upgrading of teacher skills. **Cost: \$349-million**

7. The National Science Foundation should provide seed money to develop and establish statewide or regional on-site teacher training programs using the new information technologies. **Cost: \$30-million**

8. The National Science Foundation, which has recognized expertise in leading curriculum development, should again take the leadership role in curriculum evaluation and development for mathematics, science, and technology. The National Science Foundation should set up a process to evaluate existing curricula, identify good curricula, disseminate information, act as a clearinghouse and promote the development of guidelines for new curricula as necessary. [Also] The National Science Foundation should support the development of courses to meet this need [courses dealing with technology at grades 8 and 9].

To achieve this objective, the commission suggests, as one mechanism for the National Science Foundation to consider, that a Mathematics, Science, and Technology Curriculum Council be established in the National Science Foundation. It should appoint and coordinate the activities of [4] specific committees.

The responsibility for each committee should include: determination of the best course content for its subject area; critical review of the available texts and other teaching materials; publication through the National Science Foundation of the results of the critical evaluation; identification of the areas where improved materials and totally new course materials are needed; identification of the areas where future research is needed in curriculum development and the processes of teaching and learning. The council and committees should work with widely dispersed demonstration centers to test new curriculum.

**Cost: \$52-million**

9. Research into the processes of teaching and learning should be supported with federal funds at both the basic level and the level of classroom application. This research should further the recent progress in the cognitive sciences, and particular research projects should investigate the integration of educational technologies into the processes of teaching and learning. **Cost: \$10.5-million**

10. The National Science Foundation should again take the leadership role in evaluating the status of developments in this area [educational applications of new technologies]. This should include such actions as determining needed initiatives, supporting prototype demonstrations, disseminating information on model materials and practices, and supporting research on integration of educational technologies with the curriculum. To achieve this, the commission suggests, as one mechanism for the National Science Foundation to consider, that a Council for Technology Application in Education be established. This group would advise the National Science Foundation on initiatives of this area including: supporting research into the fundamental aspects of the integration of modern technology into the processes of teaching and learning; developing mathematics, science, and technology curricula that can integrate computer systems and supporting materials effectively; promoting private industry, colleges, and universities to collaborate in training in-service teachers in the utilization of high technology systems [e.g., out-of-school and in-service training programs, computer conferences, training programs for schools of education]; encouraging and assisting school systems to acquire computers, software, instructional materials, and science equipment [e.g., via tax incentives]; assisting in making the highest quality software available on the broadest possible scale. **Cost: \$36-million**

11. Science broadcasts are an important and cost-effective vehicle of informal learning, which warrant continued and substantial federal investment and support. **Cost: \$13-million**

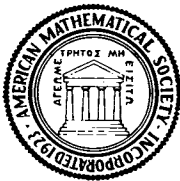
12. Federal regulation of commercial [broadcasting] stations should include a required period of educational programming for children. **Cost: \$0 added**

13. The federal government should provide supplementary support for museum education activities in mathematics, science, and technology at a level that will encourage a rich spectrum of activities and options. **Cost: \$25-million**

14. Private industry and government agencies should create programs and opportunities which let children see science and technology in actual operation in their plants and installations. **Cost: \$0 added**

**TOTAL COST: \$1.51-billion**





## PROCEEDINGS OF SYMPOSIA IN PURE MATHEMATICS

### The Mathematical Heritage of Henri Poincaré

Felix E. Browder, Editor

On April 7-10, 1980, the American Mathematical Society sponsored a Symposium on the Mathematical Heritage of Henri Poincaré, held at Indiana University, Bloomington, Indiana. This volume presents the written versions of all but three of the invited talks presented at this Symposium (those by W. Browder, A. Jaffe, and J. Mather were not written up for publication). In addition, it contains two papers by invited speakers who were not able to attend, S. S. Chern and L. Nirenberg.

If one traces the influence of Poincaré through the major mathematical figures of the early and mid-twentieth century, it is through American mathematicians as well as French that this influence flows, through G. D. Birkhoff, Solomon Lefschetz, and Marston Morse. This continuing tradition represents one of the major strands of American as well as world mathematics, and it is as a testimony to this tradition as an opening to the future creativity of mathematics that this volume is dedicated.

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# Nonacademic Employers of Mathematicians

by David H. Bailey

SRI International, Menlo Park, California

As anyone who has tried to find employment recently will attest, the job market for persons with mathematical backgrounds has undergone dramatic changes in the last decade. Until about 1970, university departments hired almost all new Ph.D.'s in mathematics and many M.S. graduates as well. Since then a combination of demographic and economic factors has reduced the number of available teaching positions to a trickle. In recent years even highly capable graduates have faced great difficulty finding acceptable employment in the academic world. Furthermore, the lucky ones who did land teaching-research positions at leading universities a few years ago now for the most part face uncertain prospects for tenure and collect disappointingly low salaries.

On the other hand, prospects for employment in the nonacademic world have never been brighter. The burgeoning growth of micro-electronics, computers, and other information-age technologies has produced strong demand for mathematically trained persons who are willing to apply their skills to technical problems. Employers are still reluctant to hire mathematicians whose interests are purely theoretical, and many candidates discover too late that the narrow coursework and research they have pursued have virtually no relevance to the "real" world. But for those mathematicians who have prepared themselves well, having gained a broad background not only in mathematics, but in some allied fields as well, bountiful opportunities are now available.

One obstacle has stood in the way for many of those wishing to explore these new nonacademic employment opportunities: at present it is rather difficult to find detailed information on the numerous research laboratories, private firms, and government agencies that hire persons with degrees in mathematics. Some company names, but no addresses, may be found in the *Combined Membership List* published by the mathematical societies. A few addresses may be found in the *Mathematical Sciences Professional Directory* published by the AMS. But neither of these pretends to be a complete list, and some of the best possibilities are not mentioned in either place.

Having personally experienced the frustration of searching for reliable nonacademic employment information, the author has over the last few years assembled the list of employers below. This information was compiled from a number of

different sources, including newspapers, technical journals, and personal recommendations. By no means is it an absolutely exhaustive list, but the author believes that it includes the names and addresses of all major employers of persons with degrees in mathematics. Such a list is not the final answer to this lack of information, but it is hoped to be a step in that direction.

Since most people prefer to focus their employment search on a particular geographical area, employers within the same state have been grouped together. The number following the name of the employer is an estimate of the number of persons employed with degrees in mathematics. Use these numbers for comparison only—your counts may vary. The mailing addresses shown are believed correct, but are not guaranteed since many organizations (especially smaller ones) frequently move to new facilities.

One important caveat to keep in mind is that few of these employers engage in the sort of erudite mathematical work done in most universities. Indeed, some employers are interested in hiring mathematicians principally because these candidates are evidently highly skilled in solving difficult analytical problems. In most cases employers train mathematicians in work that is at least partly non-mathematical after hiring them. For this reason it is highly recommended that job seekers be flexible in the sort of work they would be willing to perform. Persons who insist on working exclusively on arcane mathematical problems will find their employment opportunities quite limited. The best bet for them would be the mathematical research department of a large organization, such as Bell Laboratories, the IBM Watson Research Laboratory, or the National Security Agency. However, even in such relatively "pure" environments, mathematicians will be expected to do work that has definite applications to the real-world problems at hand.

## List of Nonacademic Employers of Mathematicians

The number in parentheses following the name of the employer is an estimate of the number of persons employed with degrees in mathematics.

### Alabama

NASA-MSFC (15) Huntsville, AL 35812

Teledyne-Brown Engineering (12) Cummings Research Park, Huntsville, AL 35812

General Research (5) 307 Wynn Drive, Huntsville, AL 35812

*Arizona*

GTE R&D Center (5) 2500 W. Utopia Road, Phoenix, AZ 85027

Honeywell, Inc. (10) 13430 N. Black Canyon Hwy., Phoenix, AZ 85017

Hughes Missile Systems (5) P. O. Box 11337, Tucson, AZ 85734

Motorola, Inc. (10) 5005 E. McDowell Road, Phoenix, AZ 85017

*California—Northern:*

(San Francisco, "Silicon Valley" and environs)

Apple Computer Co. (5) 20525 Mariani Avenue, Cupertino, CA 95014

Chevron Research Co. (5) P. O. Box 1627, Richmond, CA 94802

ESL, Inc. (10) 495 Java Drive, Sunnyvale, CA 94086

Ford Aerospace & Comm. (10) 3939 Fabian Way, Palo Alto, CA 94303

Hewlett-Packard Co. (20) 1501 Page Mill Road, Palo Alto, CA 94304

IBM Corp. (30) 5600 Cottle Road, San Jose, CA 94114

Intel Corp. (10) 3065 Bowers Avenue, Santa Clara, CA 95051

Lawrence Berkeley Labs. (15) Berkeley, CA 94720

Lawrence Livermore Labs. (50) Livermore, CA 94550

Lockheed Missiles & Space (40) 1111 Lockheed Way, Sunnyvale, CA 94086

Lockheed Palo Alto Research Lab. (15) 3251 Hanover Street, Palo Alto, CA 94304

NASA (10) Moffett Field, CA 94035

Sandia Labs. (20) Livermore, CA 94550

SRI International (20) 333 Ravenswood Avenue, Menlo Park, CA 94025

Stanford Lin. Accel. Center (10) Stanford, CA 94305

System Control Technology (10) 1801 Page Mill Road, Palo Alto, CA 94304

Tandem Computers (5) 19333 Valco Parkway, Cupertino, CA 95014

Xerox Palo Alto Research Center (10) 3333 Coyote Hill Road, Palo Alto, CA 94304

*California—Southern:*

(Los Angeles, San Diego and environs)

Aerospace Corp. (50) 2350 E. El Segundo Blvd., El Segundo, CA 90245

General Dynamics (10) 5001 Kearney Villa Road, San Diego, CA 92138

General Research (10) 5383 Hollister Avenue, Santa Barbara, CA 93105

Gould Inc. (5) 4323 Arden Drive, El Monte, CA 91731

Hughes Corp. (15) 8433 Fallbrook Avenue, Canoga Park, CA 91304; (30) 2060 E. Imperial Highway, El Segundo, CA 90245; (20) P. O. Box 3310, Fullerton, CA 92634

Hughes Research Labs. (15) 3011 Malibu Canyon Road, Malibu, CA 90265

Jet Propulsion Lab (30) 4800 Oak Grove Drive, Pasadena, CA 91103

McDonnell Douglas (10) 5301 Bolsa Avenue, Huntington Beach, CA 92646

Naval Undersea R&D Center (10) San Diego, CA 92132

Naval Weapons Center (30) China Lake, CA 93555

Physical Dynamics Inc. (5) 1250 Prospect Street, La Jolla, CA 92037

Rand Corporation (10) 1700 Main Street, Santa Monica, CA 90406

Rockwell International (10) 3370 Miraloma Avenue, Anaheim, CA 92803; (10) 8900 DeSoto Avenue, Canoga Park, CA 91304

Science Applications, Inc. (20) 1200 Prospect Street, La Jolla, CA 92037

TRW, Inc. (50) One Space Park, Redondo Beach, CA 90277

*Connecticut*

ITT Advanced Technology (10) One Research Drive, Shelton, CT 06484

Naval Undersea Center (20) New London, CT 06320

United Technologies (15) 400 Main Street, East Hartford, CT 06120.

*Colorado*

Marathon Oil Co. (10) 7400 S. Broadway, Denver, CO 80201

Martin Marietta (15) 12250 S. Highway 75, Denver, CO 80201

National Center for Atmospheric Research (15) Boulder, CO 80302.

*Delaware*

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# Queries

Edited by Hans Samelson

QUESTIONS ARE WELCOMED from AMS members regarding mathematical matters such as details of, or references to, vaguely remembered theorems, sources of exposition of folk theorems, or the state of current knowledge concerning published or unpublished conjectures.

REPLIES from readers will, when appropriate, be edited into a composite answer and published in a subsequent column. All answers received will be forwarded to the questioner.

QUERIES and RESPONSES should be typewritten if at all possible and sent to Professor Hans Samelson, American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940.

## Queries

**288. Seymour Kass** (Science Building, University of Massachusetts, Boston, Massachusetts 02125). A triangle-like inequality due to H. Bohr (quoted in Hardy, Littlewood and Polya, page 61) states that

$$|a + b|^2 \leq (1 + c)|a|^2 + (1 + 1/c)|b|^2,$$

where  $c > 0$  and  $a$  and  $b$  are real or complex. Are there generalizations for exponents greater than two, or for sums of more than two terms? In particular, since  $(1 + c)^{-1} + (1 + c^{-1})^{-1} = 1$ , are there generalizations in which the sum of the reciprocals of the coefficients is 1?

**289. Ira Gessel** (Department of Mathematics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Who first discovered the matrix formula  $\det \exp A = \exp \text{trace } A$ ? The formula has been attributed to Jacobi, but I believe it could not have been discovered before his death in 1851.

**290. Albert A. Mullin** (506 Seaborn Drive, Huntsville, Alabama 35806). Unless I am mistaken, the largest known Fermat composite is  $F_{1945} = 2^{2^{1945}} + 1$ . (1) Is  $F_{1945}$  bicomposite (i.e., the product of two distinct primes)? Note that the "base" 1945 is bicomposite. (2) What is the largest known Fermat bicomposite? (3) What is the largest known Fermat bicomposite with a bicomposite "base"? Similarly, the largest known Mersenne composite is  $M_{86249} = 2^{86249} - 1$ , I believe; the exponent being prime. (4) Is  $M_{86249}$  bicomposite? (5) What is the largest known Mersenne bicomposite? (6) What is the largest known Fibonacci bicomposite?

**291. Louis Funar** (Department of Mathematics, University of Craiova, Craiova, Romania). For an arbitrary plane figure  $F$  let  $h : (0, 1] \rightarrow \mathbb{Z}$  be defined by:  $h(\lambda)$  is the minimal number of domains  $F_i$ , homothetic to  $F$  with ratio  $\lambda$ , such that  $\bigcup F_i$  cover  $F$ . Prove or disprove: if  $F$  is convex then  $h(\lambda)$  takes all integer values 4, 5, 6, 7, ... iff  $F$  is not a parallelogram.

**292. J. M. Sanz-Serna** (Departamento Ecuaciones Funcionales, Facultad de Ciencias, Universidad de Valladolid, Valladolid, Spain). Consider the differential system  $y' = f(y)$ , where  $f$  is smooth and Lipschitz continuous in  $R^n$ , with Lipschitz

constant  $L$ . A first integral  $G : R^n \rightarrow R$  of the system is known. How can this fact be used in bounding the difference  $y_1(t) - y_2(t)$  between two solutions of the system in terms of  $y_1(0) - y_2(0)$ ? For large values of  $t$ , standard error bounds involving  $\exp(Lt)$  are far from sharp if the surfaces  $G = \text{constant}$  are compact.

**293. M. S. Brandly** (Route 3, Liberty, Indiana 47353). Does literature exist regarding details of *Perfect Competitions*? A Perfect Competition involves  $m$  players,  $m \geq 4$ , where at each individual competition two players are matched against two other players. An entire tournament arrangement has every possible team combination playing versus every other possible team combination once. Obviously when  $m \geq 8$ , two or more individual competitions may take place simultaneously. The formula is known that defines the total number of competitions necessary to complete this task:  $NP(m)$ . I would like to know if formulas exist that define the minimum number of rounds necessary to complete these competitions where  $m > 8$ . It seems clear that when  $m \equiv 0 \pmod{4}$ , the minimum number of rounds equals  $4 \cdot NP(m)/m$ . Any clues to literature would be appreciated.

## Responses

The editor would like to thank all those who sent in replies.

**273. (Volume 30, page 302, April 1983, David Mescheloff)** Inversion of  $y = x + \sin x$  near  $x = \pi$ . **Reply:** Because of continued interest in the problem, we give some details. Bessel's classical solution amounts to

$$x = y + 2 \sum_{n=1}^{\infty} \frac{1}{n} J_n(-n) \sin ny, \quad 0 \leq y \leq 2\pi,$$

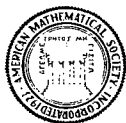
with  $J_n = n$ th Bessel function. The elementary ("Puisseux") solution is obtained by rewriting the equation as

$$\begin{aligned} y - \pi &= x - \pi - \sin(x - \pi) \\ &= \frac{1}{3!}(x - \pi)^3 \left( 1 - \frac{1}{20}(x - \pi)^2 + \dots \right) \end{aligned}$$

and inverting this in the standard fashion as power series in  $(y - \pi)^{1/3}$ . A third method uses complex variables and a Riemann problem (Burniston and Siewart, *Celestial Mech.* 6 (1972),

294-304). (Contributed by Burniston, Holland, Grossman, Lotan, Luxemburg, Ross, Todorov)

283. (Vol. 30, p. 491, August 1983, Michael K. Mills) The Calculus of Indications and G. Spencer-Brown's *Laws of form*. Reply: In *On G. Spencer-Brown's laws of form* (Notre Dame J. Formal Logic 18 (1977), 507-509), B. Banaschewski establishes the (intuitively obvious) equivalence of Spencer-Brown's primary algebra with the theory of join and symmetric difference of Boolean algebras. (Contributed by Richard Russell Wood)



### The Existence of Multi-dimensional Shock Fronts

Andrew Majda

#### Abstract

The short-time existence of discontinuous shock-front solutions of a system of conservation laws in several space variables is proved under suitable hypotheses. These shock-front solutions are nonlinear progressing wave solutions associated with the non-linear wave fields. The results developed here apply to the equations of compressible fluid flow in two or three space variables with standard equations of state where the initial data can have shock discontinuities of arbitrary strength which lie on a given smooth initial surface with arbitrary geometry. These shock-front solutions are constructed via a classical iteration scheme so that the shock fronts for the physical equations are extremely stable and do not exhibit a "loss of derivatives." Two of the main tools used in the proof of convergence are estimates from Friedrichs' theory of positive symmetric systems and the linearized stability theory for shock fronts developed recently by the author. The convergence proof for the iteration scheme utilizes exponentially weighted square-integrable norms in space-time together with a judicious choice of these weights as the time interval tends to zero.

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## American Mathematical Society

### Translators Wanted

The fee paid by the Society for producing acceptable typewritten translations of Russian mathematical papers has recently risen from an average of \$9 per Russian page to \$13 per Russian page. For qualified mathematicians wishing to take advantage of this increase the distribution of need according to subject classification is as follows.

The most heavily trafficked area is differential equations, especially PDE. The best prepared translators will be familiar with applications of Schwartz distributions, as well as recent research on pseudodifferential operators. Contributions to the global theory are also beginning to appear.

Other areas in which good translators are needed are logic and computer science (much of the work involves recursion theory and algorithms), number theory (both analytic and algebraic), ring theory (including homological methods and K-theory), algebraic geometry, nonassociative algebras (mostly Lie algebras and Jordan algebras), group theory (discrete and topological), several complex variables, integral equations, differential geometry (mostly global theory), optimization and mathematical programming, statistics, and numerical analysis. In applications the most prominent areas are elasticity and fluid mechanics.

Areas that are already well covered involve classical analysis and functional analysis, i.e. greater or lesser portions of the categories 26-XX, 28-XX, 30-XX, 40-XX, 42-XX, 44-XX, 46-XX, 47-XX in the subject classification scheme used by *Mathematical Reviews*.

Interested applicants are asked to respond to the Translations Department, American Mathematical Society, Post Office Box 6248, Providence, RI 02940 with a specific description of their area of mathematical competence. A brief trial excerpt will then be sent by which the applicant can demonstrate the combination of such competence with the requisite language skills.

## A-21

On 4 January, the Council of the AMS passed a valuable resolution concerning problems which arose out of Circular A-21 and effort reports, and recommended some action. We are happy to report that at Yale, we regard the problem as having been solved. The administration has received authorization from the auditing agency HHS (Health and Human Services, formerly HEW before the E was taken out), to use fixed rates for departmental administration, and eliminate effort reports for overhead charges. This agreement is valid for two years. As to direct costs, the mathematics department proposed various certifications to the administration, including that of the Council as reported in the *Notices*, February 1983, page 231. Following the recommendation of the University Committee on Sponsored Research, the Yale administration has accepted one of the statements for the certification of summer salary (the only one of concern to us) namely:

I certify that the allocation of salary during the specified period to the project identified above is proper.

We are very pleased with these developments, and feel that common sense has prevailed. We hope that this solution will be used as a precedent, and a basis for a satisfactory solution of the effort reporting problem elsewhere.

Robert H. Szczarba  
Yale University

## Letters of Recommendation

The Committee on Employment and Educational Policy of the Society has been asked to comment on the growing practice of some colleges and universities of requesting an inordinate number of letters of recommendation for promotion and/or tenure. It is our experience that mathematicians are extremely conscientious in writing such letters, and in offering a careful and thoughtful analysis. To ask for ten or fifteen letters of recommendation for each candidate is to place an unfair burden on the mathematical community. As has been remarked: "Five different proofs of the same theorem ought to be sufficient." We will not comment on the practice within other disciplines nor offer a canonical number for mathematics except to emphasize that in general letters of recommendation in the mathematical community are carefully constructed with full attention to the candidate's work.

Donald C. Rung,  
Chairman  
AMS Committee on  
Employment and  
Educational Policy

## Bulletin

I wish to add my voice to those who

1) like Ivar Ekeland applaud the research-expository articles in the *Bulletin*;

2) like Armand Borel decry the upgrading of the *Notices* by the inclusion of articles of (possibly) lasting value. These new articles also should go into the *Bulletin*.

Roger Howe  
Yale University

## José Luis Massera

A Seminar on Fourier Analysis was held at El Escorial, Madrid, Spain, from June 28 to July 5, 1983, organized by the Asociación Matemática Española.

The Seminar was attended by A. P. Calderón, J.-P. Kahane, E. M. Stein, G. L. Weiss and sixty other mathematicians from the United States, Spain, France, Italy, Sweden, Austria and Argentina. The participants signed the enclosed letter, on behalf of Professor J. L. Massera, imprisoned since 1974 in Uruguay, that was sent to the Uruguayan authorities.

The publication of this letter in the *Notices* will contribute to the campaign for the liberation of Professor Massera.

Cora Sadosky  
Howard University

The participants of the Seminar on Fourier Analysis send their best wishes to Professor Massera of Uruguay who, for ideological reasons, has been imprisoned for the last 7 years. They also add their support to all the efforts being made to free their fellow mathematician.

EDITORS' NOTE. This was signed by Cora Sadosky and more than 75 others.

## Assessments of Graduate Programs

Between September 1982 and January 1983 the Conference Board of Associated Research Councils published a five-volume assessment of various graduate programs including mathematics. Volume 1, published in October 1982, assessed the mathematical and physical sciences. This survey is the fourth such survey since the first in 1957, the second in 1964, and the third in 1970. The 1982 survey is a somewhat more elaborate assessment than the previous surveys. Even so, due to my cumulative experience and knowledge, I found it so unreasonable in its conclusions that I wonder why funds are invested in ratings of graduate programs by simply associating rational numbers to them. Assessments by such methods are irrelevant tasks, and highly misleading from the viewpoint of the administration. The school of

mathematics of the USA is brilliant and powerful, hence a model to inspire other countries; but the assessments of its graduate programs by the "techniques" used so far should not proliferate internationally, I hope!...

Leopoldo Nachbin  
Rio de Janeiro, Brazil  
and University of Rochester

### Defining "Mathematical"

A popular college dictionary is the *Webster's New Collegiate Dictionary*, based on the famous 3rd *International* of the Merriam-Webster Company. It gives our students the following definition, among others, for the word *mathematical*: "possible but highly improbable". As justification is offered the following phrase to illustrate this use of the word: (only a mathematical chance).

Doubtless this usage has its place in the sports pages, nor do I object, but it does seem to me that from the point of view of definition, the burden of the meaning here is carried by the word 'only' rather than by 'mathematical'.

Let us offer the lexicographers of *Webster's* some analogous possibilities for their 4th Edition, e.g.

*Grammatical* (adj) Trivial, quibbling (only a ~ distinction).

Ralph A. Raimi  
University of Rochester

### Policy on Letters to the Editor

Letters submitted for publication in the *Notices* are reviewed by the Editorial Committee, whose task is to determine which ones are suitable for publication. The publication schedule requires from two to four months between receipt of the letter in Providence and publication of the earliest issue of the *Notices* in which it could appear.

Publication decisions are ultimately made by majority vote of the Editorial Committee, with ample provision for prior discussion by committee members, by mail or at meetings. Because of this discussion period, some letters may require as much as seven months before a final decision is made.

The committee reserves the right to edit letters.

The *Notices* does not ordinarily publish complaints about reviews of books or articles, although rebuttals and correspondence concerning reviews in the *Bulletin of the American Mathematical Society* will be considered for publication.

Letters should be mailed to the Editor of the *Notices*, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940, and will be acknowledged on receipt.

## NEW AMS POSITION OPEN

### Acquisitions Editor

One of the principal functions of the Society is to publish first-rate mathematics books at reasonable prices. To further that goal, the Executive Committee and Trustees have authorized the creation of a position of a kind new to the Society, that of Acquisitions Editor. This person would be charged with actively seeking out excellent authors (potential, budding or actual) and encouraging them to submit their ideas or manuscripts to the editorial committees of either the Surveys and Monographs Series or of the Colloquium Series. While the acquisitions editor would be an associate editor *ex officio* of both of these editorial committees, he or she would not have the power to accept manuscripts; but with manuscripts of the level envisaged this would presumably not be a problem.

The acquisitions editor will receive (a) travel and subsistence costs for attending the two national meetings each year, if interviews with authors are scheduled, (b) reimbursement for incidental expenses, and (c) an annual payment of the greater of \$2,000 or a royalty on books he or she has procured.

Obviously desirable qualifications include broad understanding of contemporary research mathematics, wide acquaintanceship among currently active mathematicians, and willingness to pursue the expressed goal vigorously.

Interested persons should write to Dr. W. J. LeVeque, Executive Director, American Mathematical Society, Post Office Box 6248, Providence, RI 02940, outlining their backgrounds and qualifications.



### AMS Research Fellowships

The terms of the AMS Postdoctoral Research Fellowship are being changed. It has been the case that fellowships were open to individuals who had recently received the Ph.D. degree. This was ordinarily interpreted by the judging panel as meaning no more than four years past the Ph.D. degree. The new version of the fellowship will be open to persons in early mid-career. This will ordinarily be interpreted as meaning four to ten years past the Ph.D. (or equivalent), regardless of age, but below the academic rank of professor. Moreover, the vita must include some postdoctoral work experience, i.e. non-fellowship years.

The stipend has been set by the Trustees of the Society at \$30,000 for eleven months of full-time research or its equivalent. In addition, there will be an expense allowance of \$1,000. Applicants must be citizens or permanent residents of a country in North America. Fellowships may be held at any institution the Fellow selects or at more than one in succession. There is flexibility in the choice of time interval(s) and manner in which the Fellow may draw funds. For instance, given the opportunity, a Fellow may elect to hold a half-time academic appointment with a teaching responsibility not exceeding one course per term while holding the fellowship at one-half stipend over a two-year period. The Fellow should consult the Secretary of the Society to learn whether the proposed arrangement is acceptable to the Society.

The deadline for receipt of applications is December 1, 1983. Awards will be announced late in January 1984.

For further information and application forms, write to William J. LeVeque, Executive Director, American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02940.

### The Pierre Robillard Award 1984

The objective of this award is to recognize the best Ph.D. thesis defended at a Canadian university in 1983 and written in a field covered by *The Canadian Journal of Statistics*. Submitted theses will be evaluated by a panel of judges appointed by the President of the Statistical Society of Canada. Judging will be on the basis of the level of originality in the ideas and techniques, the possible applications and their treatment, and the potential impact on the statistical sciences. The award consists of a certificate, a monetary prize, and a free one-year membership in the Statistical Society of Canada. The winner will be invited to present a communication based on the thesis at the 1984 annual meeting of the

Statistical Society of Canada; assistance with expenses to attend the meeting may be provided. The winner will also be invited to submit a paper based on the thesis to *The Canadian Journal of Statistics*; the thesis supervisor could be co-author of the paper. The Award Coordinator must receive four (4) copies of the thesis together with a covering letter from the thesis supervisor indicating why the thesis is suitable as an entry in the competition (description of the problem, techniques and results, potential impact ...), by January 16, 1984. Official confirmation that the thesis has been defended in 1983 must also be provided. Award Coordinator: John Petkau, Department of Statistics, University of British Columbia, 2075 Wesbrook Mall, Vancouver, B.C. V6T 1W5, Canada; 604-228-4673.

### William H. Roever Lectures in Geometry

The second series of William H. Roever Lectures in Geometry will be held on January 9–13, 1984 at Washington University, St. Louis, Missouri. They will be given by Phillip A. Griffiths of Harvard University and entitled *Differential systems and*

### AMS Research Fellowship Fund *Request for Contributions*

The AMS Research Fellowship Fund was established in 1973. From this fund AMS Research Fellowships are awarded annually to individuals who have received the Ph.D. degree, who show unusual promise in mathematical research, and who are citizens or permanent residents of a country in North America.

Twenty-six Research Fellowships have been awarded including one granted for 1983-1984 and one for 1982-1983 (see the announcements in the April 1983 *Notices*, pages 304-305, and in the April 1982 issue, page 247). The number of fellowships awarded depends on the contributions the Society receives. The Society contributes a minimum of \$9,000 to the Fund each year, matching one-half of the funds in excess of \$18,000 raised from other sources, up to a total contribution by the Society of \$20,000. Each member of the Society is requested to contribute to the fund.

Contributions to the AMS Research Fellowship Fund are tax deductible. Checks should be made payable to the American Mathematical Society, clearly marked "AMS Research Fellowship Fund," and sent to the American Mathematical Society, Post Office Box 1571, Annex Station, Providence, Rhode Island 02901.

*isometric imbeddings*. The lectures, which are open to the public, have been established by his sons to honor William H. Roever, Professor of Mathematics at Washington University from 1908 until his death in 1951, and Chairman of the Department of Mathematics from 1932–1944.

## NRC Announces 1984-1985 Minority Fellowships

The National Research Council (NRC) plans to award approximately thirty-five Postdoctoral Fellowships for Minorities in a program designed to provide opportunities for continued education and experience in research to American Indians and Alaskan Natives (Eskimo or Aleut), Black Americans, Mexican Americans/Chicanos, and Puerto Ricans. Fellowship recipients will be selected from among scientists, engineers, and scholars in the humanities who show greatest promise of future achievement in academic research and scholarship in higher education.

In this national competition sponsored by The Ford Foundation, citizens of the United States who are members of one of the designated minority groups, who are preparing for or already engaged in college or university teaching, and who hold doctoral degrees may apply for a fellowship award of one year's duration. Stipends will be awarded in two categories: Regular Postdoctoral, \$20,000; Senior Postdoctoral, \$26,000. In addition, a travel allowance up to a maximum of \$2,000 is allowed.

Awards will be made in the areas of behavioral and social sciences, humanities, engineering sciences, mathematics, physical sciences, life sciences, and for interdisciplinary programs of

study. Awards will not be made in professions such as medicine, law, or social work, or in such areas as educational administration, curriculum supervision, or personnel and guidance. Tenure of fellowship provides postdoctoral research experience at an appropriate nonprofit institution of the Fellow's choice, such as a research university, government laboratory, national laboratory, privately-sponsored nonprofit institute, or a center for advanced study.

The deadline for the submission of applications is January 16, 1984; awards will be announced in mid-March 1984. Further information and application materials may be obtained from the Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, D.C. 20418.

–NRC News Release

## Gubins Appointed SIAM Treasurer

Samuel Gubins has been appointed Treasurer of the Society for Industrial and Applied Mathematics (SIAM), the Philadelphia-based, non-profit scientific society with a worldwide membership of applied mathematicians in business, government and academic careers. He is Senior Vice President and Treasurer of the Academy of Natural Sciences of Philadelphia, a position he has held since 1981. Previously, he had been Vice President for Finance and Treasurer of Haverford College, where he also held the position of Chairman of the Department of Economics. He has taught economics at Haverford College, the Bryn Mawr Graduate School of Social Work and Social Research, and Goucher College.

–SIAM News Release

## Spectral Theory of Functions and Operators. II

N. K. Nikol'skii, Editor

### Abstract

The papers comprising this collection are devoted to the connections of spectral theory with the theory of functions of a complex variable. The classical problem of interpolation by uniformly convergent Fourier or Taylor series is illuminated, and imbedding theorems dual to interpolation problems are proved; a constructive characterization of Besov and Sobolev classes, well-known and widely used in analysis, is given; an analogue of von Neumann's inequality is obtained by a combination of spectral theory methods, combinatorial constructions and complex analysis; positive projections in Banach lattices are described.

S. A. Vinogradov, *A strengthening of Kolmogorov's theorem on the conjugate function and interpolation properties of convergent power series*

E. M. Dyn'kin, *A constructive characterization of the classes of S. L. Sobolev and O. V. Besov*

S. V. Kislyakov, *The Fourier coefficients of the boundary values of functions analytic in the disk and in the bidisk*

V. G. Kulakova, *Positive projections in symmetric KB-spaces*

V. V. Peller, *An analogue of an inequality of J. von Neumann, isometric dilation of contractions and approximation by isometries in spaces of measurable functions*

S. V. Khrushchev, *Men'shov's correction theorem and Gaussian processes*

1980 *Mathematics Subject Classifications*: 42, 46, 47, 60, 30, and others

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### NSF Mathematical Sciences Postdoctoral Research Fellowships

Postdoctoral Research Fellowships in the mathematical sciences will be offered only to persons who 1) are U.S. citizens or nationals as of January 1, 1984, 2) will have earned by the beginning of their fellowship tenure a doctoral degree in one of the mathematical sciences, 3) will have held the doctorate for no more than five years as of January 1, 1984, and 4) will not previously have held any other NSF postdoctoral fellowship.

Deadline for applications is November 15, 1983. All applications should be sent to the American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02940.

For information, contact Dr. Alvin Thaler, Mathematical Sciences Section, National Science Foundation, 202-357-9764; or Dr. William J. LeVeque, American Mathematical Society, 401-272-9500.

—NSF Bulletin

### Competition for Three Fellowship Programs

The National Science Foundation (NSF) plans to award approximately 650 fellowships in the spring of 1984 for advanced study to help meet the continuing national need for qualified scientific personnel. Included are 540 NSF Graduate Fellowships, 60 NSF Minority Graduate Fellowships, and up to 50 NATO Postdoctoral Fellowships. Application materials now are available for all three programs.

Competition for these fellowship awards is open to citizens and nationals of the United States. Awards are made on the basis of merit for full-time graduate study in all fields of science, including interdisciplinary and multidisciplinary science areas.

**NSF Graduate Fellowships** are awarded for full-time study leading to a master's or doctoral degree in science and engineering, at any non-profit United States or foreign institution of higher education offering advanced degrees in science or engineering. Fellows receive a stipend of \$8,100 for 12 months of tenure (\$675 per month). A cost-of-education allowance of up to \$4,900 per year is provided to the institution chosen by the Fellow in lieu of tuition and fee charges. Graduate Fellowships are renewable for up to three years subject to satisfactory academic progress and the availability of NSF funds. Application is limited to individuals with no more than 20 semester or 30 quarter hours credit of postbaccalaureate study in science or engineering at the time of application.

**NSF Minority Graduate Fellowships** are available to students of minority groups under-represented in the sciences, who may apply to either or both of the graduate-level fellowship programs. Other eligibility requirements, stipends and allowances for Minority Graduate Fellowships are the same as for the NSF Graduate Fellowship program.

**North Atlantic Treaty Organization (NATO) Postdoctoral Fellowships** are awarded for advanced study outside the U.S. in a country that is either a member of or cooperating with NATO. These fellowships were established by NATO to advance science and technology and to promote closer collaboration among NATO nations. Each member country administers these fellowships for its own nationals; NSF administers this NATO-funded program in the U.S. at the request of the Department of State. The fellowships provide a stipend of \$1,500 per month for periods of tenure up to 12 months. Limited travel support and dependency allowances are also provided.

Program Information:

**NSF Graduate Fellowships Announcement** (NSF 83-64) and application forms, now available; Application deadline, November 23, 1983; Award date, mid-March 1984. Copies of the announcement and application materials are available from the Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, DC 20418; 202-334-2872.

**NSF Minority Graduate Fellowships Announcement** (NSF 83-65) and application forms, now available; Application deadline, November 23, 1983; Award date, mid-March 1984. Copies of the announcement and application materials are available from the Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, DC 20418; 202-334-2872.

**NATO Postdoctoral Fellowships Announcement** (NSF 83-63) and application forms, now available; Application deadline, November 8, 1983; Award date, late February 1984.

Copies of the announcement and application materials are available from the Fellowships Section, Office of Scientific and Engineering Personnel and Education, National Science Foundation, Washington, DC 20550; 202-357-7536.

—NSF News Release

### Graduate Fellowships for 1984-1985

The National Research Council will again advise the National Science Foundation in the selection of candidates for the Foundation's program of Graduate Fellowships. Panels of

eminent scientists and engineers appointed by the National Research Council will evaluate qualifications of applicants. Final selection of the Fellows will be made by the Foundation, with awards to be announced in March 1984.

Eligibility in the NSF Graduate Fellowship Program is limited to those individuals who, at the time of application, have not completed more than 20 semester hours (30 quarter hours), or equivalent, of study in any of the science and engineering fields listed below following completion of their first baccalaureate degree in science or engineering. Subject to the availability of funds, new fellowships awarded in March 1984 will be for maximum tenured periods of three years, the second and third years on certification to the Foundation by the fellowship institution of the student's satisfactory progress toward an advanced degree in science or engineering.

These fellowships will be awarded for study or work leading to master's or doctoral degrees in the mathematical, physical, biological, engineering, and social sciences, and in the history and philosophy of science. Awards will not be made in clinical, law, education, or business fields, in history or social work, for work leading to medical, dental, or public health degrees, or for study in joint science-professional degree programs. Applicants must be citizens of the United States, and will be judged on the basis of ability. The annual stipend for Graduate Fellows will be \$8,100 for a twelve-month tenure with no dependency allowances.

Applicants will be required to take the Graduate Record Examinations designed to test aptitude and scientific achievement. The examinations, administered by the Educational Testing Service, will be given on December 10, 1983 at designated centers throughout the United States and in certain foreign countries.

The deadline for submission of applications for NSF Graduate Fellowships is November 23, 1983. Further information and application materials may be obtained from the Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, DC 20418. —NRC Release

### **Minority Graduate Fellowships for 1984-1985**

The National Research Council will again advise the National Science Foundation in the selection of candidates for the Foundation's program of Minority Graduate Fellowships. Panels of eminent scientists and engineers appointed by the National Research Council will evaluate qualifications of fellowship candidates. Final selection of Fellows will be made by the Foundation, with awards to be announced in March 1984.

The NSF Minority Graduate Fellowship Program is open only to persons who are citizens

of the United States at the time of application, and members of an ethnic minority group underrepresented in the advanced levels of the Nation's science talent pool—i.e., American Indian, Black, Hispanic, Native Alaskan (Eskimo or Aleut), or Native Pacific Islander (Polynesian or Micronesian).

Eligibility is limited to those individuals who, at the time of application, have not completed more than 20 semester hours (30 quarter hours), or equivalent, of study in any of the science and engineering fields listed below following completion of their first baccalaureate degree in science or engineering. Subject to the availability of funds, new fellowships awarded in March 1984 will be for maximum tenured periods of three years, the second and third years contingent on certification to the Foundation by the fellowship institution of the student's satisfactory progress toward an advanced degree in science or engineering.

These fellowships will be awarded for study or work leading to master's or doctoral degrees in the mathematical, physical, biological, engineering, and social sciences, and in the history and philosophy of science. Awards will not be made in clinical, law, education, or business fields, in history or social work, for work leading to medical, dental, or public health degrees, or for study in joint science-professional degree programs. Applicants will be judged on the basis of ability. The annual stipend for Minority Graduate Fellows will be \$8,100 for a twelve-month tenure with no dependency allowances.

Applicants will be required to take the Graduate Record Examinations designed to test aptitude and scientific achievement. The examinations, administered by the Educational Testing Service, will be given on December 10, 1983 at designated centers throughout the United States and in certain foreign countries.

The deadline for submission of applications for NSF Minority Graduate Fellowships is November 23, 1983. Further information and application materials may be obtained from the Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, DC 20418.

—NRC Release

### **NATO Postdoctoral Fellowships**

The National Science Foundation (NSF) administers the NATO Postdoctoral Fellowships Program for U.S. citizens at the request of the U.S. Department of State. Approximately fifty awards will be offered for further research and/or study in the sciences at institutions outside the United States. These fellowships were established by NATO to promote the progress of science and to promote closer collaboration among the scientists of NATO nations.

These fellowships will be awarded for appropriate work in the mathematical, physical,

biological, engineering and social sciences, as well as interdisciplinary areas comprised of two or more of these fields. Awards will not be made in clinical, education or business fields, nor in history, social work or public health. NATO Postdoctoral Fellowships in Science will be offered only to persons who are citizens or nationals of the United States as of the closing date for applications, will have earned by the beginning of their fellowship tenures a Ph.D. in one of the fields of science listed above or have had research training and experience equivalent to that represented by a Ph.D. in one of those fields, and will have held the doctorate for no more than five years as of the closing date for applications. Women and minority scientists who meet the eligibility criteria are specifically encouraged to apply.

A Fellow may elect a full-time tenure of 9 to 12 months; in no case may it be less than 6 nor more than 12 months. The tenure of a Fellowship may be interrupted, but no single period of tenure may be less than 4 months. A recipient of a postdoctoral fellowship in this competition must begin tenure by September 1985. The total time from date of award to termination of the fellowship may not exceed 30 months.

The stipend for a NATO Postdoctoral Fellow is \$1,500 per month for up to 12 months. Limited travel support and a monthly dependency allowance of \$100 per dependent, up to three, are available.

The application deadline is November 8, 1983, and awards will be announced in late February 1984.

For copies of the announcement (NSF 83-63) and application materials, contact NATO Fellowship Program Office, Division of Scientific Personnel Improvement, National Science Foundation, Washington, DC 20550; 202-282-7154.

### NSF Awards Visiting Professorships for Women

The National Science Foundation (NSF) has announced thirty-two awards designed to help make full use of the Nation's scientific and technical resources by encouraging women to develop careers in science and engineering research.

The awards, called Visiting Professorships for Women, total nearly \$2 million and will enable experienced women scientists and engineers to participate in the research and teaching programs of a host institution. The visiting professors will also serve as advisors and counselors to students and provide encouragement to other women to pursue careers in science. Among the recipients are ten mathematical scientists. These scientists, their fields of study and the institutions they will attend are as follows:

JENNIFER J. ANDERSON (Boston University), *Empirical Bayes estimation with applications in health care financing*, Harvard University;

LENORE BLUM (Mills College), *Randomness, complexity and finite dynamics*, City University of New York, Graduate Center; MARY ELLEN BOCK (Purdue University), *Problems in statistical decision theory*, Stanford University; MARIANNE L. GARDNER (Worcester Polytechnic Institute), *Hidden generalized networks*, Massachusetts Institute of Technology; MARLIES GERBER (Indiana University), *Construction of examples in smooth ergodic theory*, Mathematical Sciences Research Institute, Berkeley; ELOISE HAMANN (Elmhurst College), *Problems in commutative algebra*, Northwestern University; MELANIE L. LENARD (Boston University), *Optimization models in decision support systems*, University of California, Los Angeles; TILLA K. MILNOR (Rutgers University), *Surfaces in space-times*, University of Maryland; CORA SADOSKY (Howard University), *Weighted inequalities and moment problems*, Institute for Advanced Study; and KAREN VOGTMANN (Columbia University), *Cohomology of linear groups over rings of imaginary quadratic integers*, Cornell University.

### Algebraic K-theory and Localised Stable Homotopy Theory

Victor P. Snaith

#### Abstract

This paper continues the theme initiated in [Mem. Amer. Math. Soc. (1979), number 221]. There is a homomorphism from the stable homotopy of the classifying space of the group of units in a ring to its algebraic K-theory. When the ring has enough roots of unity a "Bott element" exists in these groups (taken with coefficients). We compute the groups obtained by inverting the Bott element. This computation, in successively more elaborate guises, is used, in conjunction with the homomorphism mentioned above, to construct algebraic K-theory classes and to give upper bounds on K-theory with the Bott element inverted.

1980 *Mathematics Subject Classifications*: 55N15, 18F25, 55P42

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1980 *Mathematics Subject Classifications*: 05, 10, 51, 52 and others

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# Louisville Meetings, January 25–28, 1984

## Second Announcement

The January 1984 Joint Mathematics Meetings, including the 90th Annual Meeting of the AMS and the 67th Annual Meeting of the Mathematical Association of America will be held January 25–28 (Wednesday–Saturday), 1984, in Louisville, Kentucky. The meetings will be preceded by the AMS Short Course on January 23–24 (Monday–Tuesday), 1984. Sessions will take place in the Commonwealth Convention Center and the Hyatt Regency Louisville.

The members of the Local Arrangements Committee are W. Wistar Comfort (ex-officio), Roger H. Geeslin (publicity director), Thomas L. Holloman, William J. LeVeque (ex-officio), David P. O'Toole, David P. Roselle (ex-officio), Richard Werle, and W. Wiley Williams (chairman).

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### IMPORTANT DEADLINES

AMS Abstracts, For consideration for special sessions Of contributed papers	Expired November 2
Employment Register (Applicants & Employers)	December 5
Preregistration and Housing	December 5
Motions for AMS Business Meeting	December 27
Preregistration cancellations (50% refund)	January 22
Dues credit for nonmembers/students	February 29

## 90th Annual Meeting of the AMS January 25–28, 1984

### Fifty-seventh Josiah Willard Gibbs Lecture

The 1984 Gibbs lecture will be presented at 8:30 p.m. on Wednesday, January 25, by HERBERT A. SIMON of Carnegie-Mellon University. Professor Simon will speak on *Computer programs that model the process of scientific and mathematical discovery*.

### Colloquium Lectures

There will be a series of four Colloquium Lectures presented by BARRY MAZUR of Harvard University. The title of this lecture series is *On the arithmetic of curves*. The lectures will be given at 1:00 p.m. daily, Wednesday through Saturday, January 25–28.

### Bôcher Prize

The 1984 Bôcher Memorial Prize will be awarded at 4:00 p.m. on Thursday, January 26.

### Invited Addresses

By invitation of the Program Committee, there will be eight invited one-hour addresses. The names of the speakers, their affiliations, the dates and times of their talks, and their titles follow:

GUNNAR CARLSSON, University of California, San Diego, *Segal's Burnside ring conjecture*, 2:15 p.m. Wednesday; PERSI DIACONIS,



Herbert A. Simon, Gibbs Lecturer

## Preregistration

**Preregistration.** Preregistration for these meetings **must be completed by December 5, 1983.** Those wishing to preregister must complete the form which appears at the back of this issue and submit it together with the appropriate preregistration fee(s) to the Mathematics Meetings Housing Bureau in Providence by **December 5.**

Preregistration fees do not represent an advance deposit for lodgings. One must, however, preregister for the meetings in order to obtain confirmed hotel accommodations through the Mathematics Meetings Housing Bureau, as outlined on the facing page.

As stated in the section titled **Housing**, all requests for hotel accommodations **must be accompanied by one night's room deposit for each room requested.** A separate check made out to the Louisville Convention and Visitors Bureau and/or a major credit card number for this deposit must accompany the Preregistration/Housing form should housing be required.

Checks for preregistration fees should be made payable to the AMS; Canadian checks must be marked for payment in U.S. funds. Those who preregister for the Joint Mathematics Meetings pay fees which are 30 percent lower than those who register at the meetings. The preregistration fees are as follows:

### AMS Short Course

Student/Unemployed	\$ 5
All Others	\$25

### Joint Mathematics Meetings

Member of AMS, MAA	\$47
Emeritus Member of AMS, MAA	\$12
Nonmember	\$71
Student/Unemployed	\$12
Employer, Employment Register	\$50
Applicant, Employment Register	no charge

### MAA Minicourses (payable at meeting) \$20 each

There will be no extra charge for members of the families of registered participants, except that all professional mathematicians who wish to attend sessions must register independently.

All **full-time** students currently working toward a degree or diploma qualify for the student registration fees, regardless of income.

The unemployed status refers to any person currently unemployed, actively seeking employment, and who is not a student. It is not intended to include any person who has voluntarily resigned or retired from his or her latest position.

The emeritus status refers to any person who has been a member of the AMS or MAA for twenty years or more, and is retired on account of age from his or her latest position.

A \$4 charge will be imposed for all invoices prepared when Preregistration/Housing forms are submitted without accompanying check(s) for the preregistration fee(s) and room deposits, or are accompanied by an amount insufficient to cover the total fee(s). Preregistration/Housing forms received well before the deadline of **December 5** which are not accompanied by correct payment will be returned to the participant with a request for resubmission and full payment.

A 50 percent refund of the preregistration fee(s) will be made for all cancellations received in Providence no later than January 22. **No refunds will be granted for cancellations received after that date,** or to persons who do not attend the meetings.

The only exception to this rule is someone who preregisters for the Joint Mathematics Meetings only in order to attend an MAA Minicourse, and is too late to obtain a slot in the Minicourse. In this case, full refunds will be made of the Joint Mathematics Meetings preregistration fee(s), **provided the preregistrant has checked the box** on the Preregistration/Housing form that this was his or her intent. Individuals who preregister for both the Joint Meetings and a Minicourse and who intend to attend the Joint Meetings, even if the Minicourse is not available, should, of course, **not** check the box on the Preregistration/Housing form. In this case the Joint Meetings preregistration will be processed.

Those who wish to preregister for the Employment Register should read carefully the special article titled "Mathematical Sciences Employment Register" which follows this announcement of the Louisville meetings. The attention of applicants is particularly directed to the box regarding the December issue of *Employment Information in the Mathematical Sciences*.

Those who preregister for the AMS Short Course will be able to pick up their badges and other material in Louisville after 11:00 a.m. on Monday, January 23, during the hours that the AMS Short Course registration desk is open.

Those who preregister for either the Joint Mathematics Meetings or the MAA Minicourses or both will be able to pick up their badges and other material in Louisville after 4:00 p.m. on Tuesday, January 24, during the hours the Joint Mathematics Meetings registration desk is open.

Please read the facing page titled **Housing** carefully before completing the Preregistration/Housing form.

**N.B.: Place your AMS or MAA mailing label on the Preregistration/Housing form where indicated. If you do not have a label readily available, please supply complete name, address, and AMS or MAA member code.**



## Housing

**Mathematics Meetings Housing Bureau.** The Preregistration/Housing form for requesting hotel accommodations will be found at the back of this issue. Use of the services offered by the Mathematics Meetings Housing Bureau requires preregistration for the meetings. Persons desiring confirmed hotel accommodations should complete the form, or a reasonable facsimile, and send it to the Mathematics Meetings Housing Bureau, Post Office Box 6887, Providence, Rhode Island 02940, **so that it will arrive no later than December 5, 1983.**

Please read carefully the section on **Hotels** before completing the form. Forms sent to the wrong address and thus incurring delay in delivery to the Housing Bureau until after the deadline cannot be accepted and will, therefore, be returned.

The Mathematics Meetings Housing Bureau has initiated a new policy whereby participants requesting hotel accommodations in Louisville are required to submit housing deposits when preregistering. Each deposit must be equal to the daily room rate for each room requested, and may be submitted either by personal check (**made out to the Louisville Convention and Visitors Bureau**) and/or a major credit card as indicated in the last column of the housing form. The method of payment differs with each of the participating hotels, and careful attention must be given to these requirements when submitting deposits. **Please do not include housing deposits in the same check with preregistration fees.**

Since requirements vary from hotel to hotel, participants will be informed if there is a difference in the amount of the deposit submitted and the rate of the room actually assigned. **N.B.: Participants will receive an acknowledgement of their room deposits from the Louisville Convention and Visitors Bureau followed by a confirmation of their room reservations from the hotel to which they have been assigned.**

All reservation requests must be received in writing and be processed through the Housing Bureau in Providence. Telephone requests will not be accepted. Please do not contact the hotels directly. Blocks of rooms and special rates have been set aside for the Housing Bureau, and the hotel will either refer you back to the Housing

Bureau, or give you a room outside of the block, which may be at a higher rate.

The number of rooms being held by the Louisville hotels at each rate is limited. Housing assignments are made on a first-come, first-served basis, so participants desiring low-cost accommodations are urged to get their housing requests in as early as possible. Participants should also be aware that the special rates being offered in the section titled **Hotels** may not be available **after December 5. Housing requests received after the deadline of December 5 most surely cannot be honored.**

Participants are strongly urged to rank **every** hotel on the housing form in the order of preference, and circle the type of room and the rate desired. Reservations will be made in accordance with preferences indicated on the reservation form insofar as this is possible. Participants who rank only a few of the hotels may find themselves assigned to a hotel which is not satisfactory. If not all hotels are ranked, and all rooms have been filled at the ranked hotels, the assignment will be made at an unranked hotel with the next lowest rate.

Participants who are able to do so are urged to share a room whenever possible as this procedure can be economically beneficial. The housing form should be fully completed to ensure proper assignment of rooms. Participants planning to share accommodations should provide the name(s) of the person(s) with whom they plan to occupy a room. Each participant should, however, complete a separate Preregistration/Housing form. In order to avoid confusion or disappointment, parties planning to share rooms should send their forms together in the same envelope.

Please make all changes to or cancellations of hotel reservations with the Housing Bureau in Providence **before January 15, 1984, by calling 401-272-9500, extension 239.** After that date, changes or cancellations should be made with the Louisville Convention and Visitors Bureau by calling 502-584-2144.

Please read the facing page titled **Preregistration** carefully before completing the Preregistration/Housing form.

**Please be sure to send housing deposits with Preregistration/Housing form.**

**N.B.: Place your AMS or MAA mailing label on the Preregistration/Housing form where indicated. If you do not have a label readily available, please supply complete name, address, and AMS or MAA member code.**



Barry Mazur, Colloquium Lecturer

Stanford University, *Card shuffling and group representations*, 2:15 p.m. Friday; SIMON K. DONALDSON, The Mathematical Institute, Oxford, England, *The Yang-Mills equations as a non-linear Hodge theory*, 9:00 a.m. Wednesday; ROBERT D. MACPHERSON, Brown University, *Intersection homology and some applications*, 2:15 p.m. Saturday; ANDREW MAJDA, University of California, Berkeley, *Vorticity and fluid dynamics*, 9:00 a.m. Thursday; M. SUSAN MONTGOMERY, University of Southern California, *Group actions on rings and generalized inner automorphisms*, 3:30 p.m. Friday; LEON SIMON, Australian National University, *Some recent results concerning minimal surfaces*, 3:30 p.m. Wednesday; and ROBERT E. TARJAN, Bell Laboratories, Murray Hill, *Design and analysis of self-adjusting data structures*, 10:15 a.m. Wednesday.

### Special Sessions

By invitation of the same committee, there will be twelve special sessions of selected twenty-minute papers. The topics of these special sessions, the tentative days they will meet, the names and affiliations of the mathematicians arranging them, and some partial lists of anticipated speakers are as follows:

*Homotopy theory*, DONALD W. ANDERSON, and GUNNAR CARLSSON, University of California, San Diego, Wednesday and Thursday morning, and Friday afternoon. E. Friedlander, Nick Kuhn, Ben Mann, H. Miller, and R. Thomason.

*Incompressible fluid flow*, J. THOMAS BEALE, Duke University, Wednesday, Friday, and Saturday afternoons. Charles Amick, Petre Constantin, Ronald DiPerna, Avron Douglis, Ciprian

Foias, John Heywood, Jong Uhm Kim, John Neu, John Reeder, Michael Renardy, Marvin Shinbrot, and Bruce Turkington.

*Function theoretic operator theory*, JOHN B. CONWAY, Indiana University, Wednesday morning and afternoon. Jim Agler, Sheldon Axler, Hari Bercovici, Scott Brown, Kevin F. Clancey, John B. Conway, Carl Cowen, Jim Dudziak, William Helton, Thomas L. Kriete III, C. R. Putnam, Jim Thomson, Tavan Trent, and Charles Voas.

*Random walks on finite groups*, PERSI DIACONIS, Stanford University, Thursday morning. David Aldous, Fan Chung, Persi Diaconis, Leo Flatto, Ron Graham, and Mehrdad Shahshahani.

*Ordered algebraic structures*, ANDREW M. W. GLASS, Bowling Green State University, Thursday morning, Friday and Saturday afternoons. P. F. Conrad, M. Darnel, J. Dauns, T. Evans, A. W. Hager, M. Henriksen, M. Huss, S. Larson, J. T. Lloyd, J. J. Madden, J. Martinez, S. H. McCleary, F. Point, W. B. Powell, A. H. Rhemtulla, S. Steinberg, and C. Tsinakakis.

*Vector field systems and control*, HENRY HERMES, University of Colorado, Boulder, and HECTOR SUSSMANN, Rutgers University, Wednesday morning and afternoon, and Friday afternoon. S. Albrecht, William Boothby, Alberto Bressan, R. Brockett, M. Freeman, R. Gardner, K. Grasse, Robert Grossman, Henry Hermes, R. Hirschorn, R. Hunt, V. Jurdjevic, A. Krener, A. Lundell, Antonio Sanchez, E. Sontag, H. Sussmann, and William Shadwick.

*Partial differential operators*, MARK A. KON, Boston University, Wednesday morning and afternoon, and Friday afternoon. Harold E. Benzinger, Thomas Branson, Rene Carmona, Paul R. Chernoff, Jeffrey M. Cooper, Allen Devinatz, Jerome A. Goldstein, David Gurarie, Evans M. Harrell, Robert N. Hill, Rhonda J. Hughes, Gerhard K. Kalish, Ian W. Knowles, Richard B. Lavine, Stephen Paneitz, A. G. Ramm, and Clasine van Winter.

*Partial differential equations and optimal control problems*, SUZANNE M. LENHART, University of Tennessee, Wednesday, Friday, and Saturday afternoons. J. Baras, S. A. Belbas, G. Blankenship, M. Chipot, G. Diaz, L. C. Evans, R. Jensen, K. Loparo, R. Rishel, M. Robin, S. Shreve, P. Souganidis, A. Sulem.

*Ring theory*, M. SUSAN MONTGOMERY, University of Southern California, and LANCE SMALL, University of California, San Diego, Wednesday morning and afternoon and Thursday morning. M. Cohen, J. Fisher, Joel K. Haack, A. Heinicke, I. N. Herstein, Leonid Makar-Limanov, W. S. Martindale III, D. S. Passman, A. Regev, R. Resco, M. K. Smith, and R. Snider.

*Commutative algebra*, IRA J. PAPICK, University of Missouri, Columbia, Wednesday morning and afternoon and Thursday morning. Dan Anderson, David Anderson, Luchezar Avramov,

American Mathematical Society Short Course Series

*Introductory Survey Lectures on*  
**Mathematics of Information Processing**

Louisville, Kentucky, January 23–24, 1984

The American Mathematical Society, in conjunction with its ninetieth annual meeting, will present a one and one-half day short course titled *Mathematics of Information Processing* on Monday afternoon and Tuesday morning and afternoon, January 23 and 24, 1984, at the Hyatt Regency Louisville. The program is under the direction of Michael Anshel of CUNY, City College, and William Gewirtz of Bell Laboratories, Holmdel.

The course will cover a number of areas in which mathematical techniques have led to a deeper understanding of Information Processing. The earliest applications of mathematics were in the design and analysis of algorithms and in the modeling of systems performance. Motivated by the challenge to use effectively the capabilities resulting from dramatically increased system capacity, multi-programming, parallel processing, and distributed computing environments, mathematics continues to play an important role in the design and analysis of computer systems.

While mathematical logic and related disciplines have traditionally been intimately related to the foundations of computing, areas of more practical application have arisen in recent years. Specifically, in the area of database systems, both database languages and database design techniques have seen important applications of mathematical logic and related subjects.

Synopses of the talks and accompanying reading lists appeared on pages 661–662 of the October 1983 *Notices*. The course will consist of six lectures. Fan R. K. Chung (Bell Laboratories, Murray Hill) will speak about the diameters of communication networks; Hector Garcia-Molina (Princeton University) about transaction management; Barry E. Jacobs (University of Maryland) about fundamental database issues; Victor S. Miller (IBM, Yorktown Heights) about compression algorithms; Avgustin Tuzhilin (CUNY, City College at Staten Island) about applications of category theory of structural sets to information systems and Moshe Y. Vardi (IBM, San José) about the theory of data dependencies. Time will be allocated for summarizing and integrating the material presented in the lectures.

The short course is open to all who wish to participate upon payment of the registration fee. There are reduced fees for students and unemployed individuals. Please refer to the pages titled **Preregistration** and **Housing** and the section on **Registration at the Meetings** for details.

The short course was recommended by the Society's Committee on Employment and Educational Policy, whose members are Lida K. Barrett, Lisl Novak Gaal, Irwin Kra, Robert W. McKelvey, Donald C. Rung (chairman), and Barnet M. Weinstock. The short course series is under the direction of the CEEP Short Course Subcommittee, whose members are Stefan A. Burr (chairman), Lisl Novak Gaal, Robert W. McKelvey, Cathleen S. Morawetz, Barbara L. Osofsky, and Philip D. Straffin, Jr.

James Brewer, Doug Costa, Paul Eakin, E. Graham Evans, Jr., Richard Fedder, Robert Gilmer, Sarah Glaz, William Heinzer, Melvin Hochster, Evan Houston, James Huckaba, Craig Huneke, Ming-chang Kang, Andrew Kustin, David Lantz, Bernd Ulrich, and Wolmer Vasconcelos.

*Ill-posed problems*, WILLIAM L. PERRY, Texas A & M University, Wednesday morning and afternoon and Friday afternoon. J. R. Cannon, P. DuChateau, C. W. Groetsch, F. A. Grünbaum, D. Lee, Sung L. Lee, H. A. Levine, M. Madych, J. McLaughlin, M. Z. Nashed, R. Newton, L. Payne, W. Rundell, R. Showalter, L. A. Shepp, W. Symes, and M. Vogelius.

*Semigroup theory*, W. WILEY WILLIAMS, University of Louisville, Thursday morning, Friday and Saturday afternoon. D. R. Brown, E. Byleen, H. Cohen, M. P. Drazin, C. Eberhart, J. M. Howie, P. R. Jones, Y. Kobayashi, R. J. Koch, G. Lallemand, K. D. Magill, B. Madison, R. Oehmke, Mohan S. Puchta, N. R. Reilly, B. M. Schein, J. Stepp, and W. Williams.

**October 12 was the deadline for submission of abstracts for consideration for inclusion in these special sessions.**

#### Contributed Papers

There will be sessions for contributed papers Wednesday morning and afternoon, Thursday morning, Friday afternoon, and Saturday afternoon. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in departments of mathematics, and should be sent to the American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940, so as to arrive by the **abstract deadline of November 2**. Members are reminded that a charge of \$12 is imposed for retyping abstracts that are not in camera-ready form.

**Late papers will not be accepted.**

#### Other AMS Sessions

AMS Committee on Employment and Educational Policy

A Panel Discussion, moderated by LIDA K. BARRETT, on the supply of mathematical science researchers in the 1990's will be held from 4:30 p.m. to 6:00 p.m. on Friday, January 27.

#### Council Meeting

The Council of the Society will meet at 2:00 p.m. on Tuesday, January 24, in the Hyatt Regency Louisville.

#### Business Meeting

The Business Meeting of the Society will take place immediately following the award of the Bôcher Prize at 4:00 p.m. on Thursday, January 26. The secretary notes the following resolution of the Council: Each person who attends a Business Meeting of the Society shall be willing and able to identify himself as a member of the Society. In further explanation, it is noted that *each person*

*who is to vote at a meeting is thereby identifying himself as and claiming to be a member of the American Mathematical Society.* For additional information on the Business Meeting, please refer to the box titled Committee on the Agenda for Business Meetings.

## 67th Annual Meeting of the MAA January 26–28, 1984

### Retiring Presidential Address

RICHARD D. ANDERSON, Louisiana State University, Baton Rouge, will deliver his Retiring Presidential Address on *Reflections on the mystique of R. L. Moore* at 9:00 a.m. on Saturday, January 28.

### Invited Addresses

There will be seven invited fifty-minute addresses. The list of speakers, their affiliations, the dates and times of their talks, and their titles follow:

#### Committee on the Agenda for Business Meetings

The Society has a Committee on the Agenda for Business Meetings. The purpose is to make Business Meetings orderly and effective. The committee does not have legal or administrative power. It is intended that the committee consider what may be called "quasi-political" motions. The committee has several possible courses of action on a proposed motion, including but not restricted to

- (a) doing nothing;
- (b) conferring with supporters and opponents to arrive at a mutually accepted amended version to be circulated in advance of the meeting;
- (c) recommending and planning a format for debate to suggest to a Business Meeting;
- (d) recommending referral to a committee;
- (e) recommending debate followed by referral to a committee.

There is no mechanism that requires automatic submission of a motion to the committee. However, if a motion has not been submitted through the committee, it may be thought reasonable by a Business Meeting to refer it rather than to act on it without benefit of the advice of the committee.

The committee consists of Everett Pitcher (chairman), Marian B. Pour-El, David A. Sanchez, and Guido L. Weiss.

In order that a motion for the Business Meeting of January 26, 1984 receive the service offered by the committee in the most effective manner, it should be in the hands of the secretary by December 27, 1983.

Everett Pitcher, Secretary

### Minicourses

Minicourse #1: *Linear programming*, CHARLES E. HAFF, University of Waterloo.

Minicourse #2: *Discrete algorithmic mathematics*, STEPHEN B. MAURER, Swarthmore College.

Minicourse #3: *Teaching problem solving*, ALAN H. SCHOENFELD, University of Rochester.

Minicourse #4: *Applications of discrete mathematics*, FRED S. ROBERTS, Rutgers University.

Minicourse #5: *Problems from industry*, JEANNE L. AGNEW and MARVIN S. KEENER, both of Oklahoma State University.

Minicourse #6: *Applications of computer graphics*, JOAN WYZKOSKI, Bradley University.

Minicourse #7: *CONDUIT microcomputer software*, DAVID A. SMITH, Duke University.

Minicourse #8: *NonCONDUIT microcomputer software*, DAVID A. SMITH, Duke University.

*Beta and gamma functions from Euler to Selberg and beyond*, RICHARD A. ASKEY, University of Wisconsin, 10:00 a.m., Saturday; *Turning good mathematics into good TV*, DONALD BERMAN and ROSS L. FINNEY both of COMAP, noon, Saturday; *Nonexpansive maps*, ANDREW M. GLEASON, Harvard University, 11:00 a.m. Saturday; *The computer as a grader*, MELVIN MARON, University of Louisville, 9:00 a.m., Friday; *Mathematics in industry—How do problems arise?*, HENRY O. POLLAK, Central Staff Organization for the Regional Bell Operating Companies, 10:00 a.m., Friday; *Some examples of combinatorial averaging*, HERBERT S. WILF, University of Pennsylvania, 9:00 a.m., Friday; *Computational geometry: Paradigms and applications*, FRANCES YAO, Xerox Corporation, 11:00 a.m., Friday.

### Minicourses

The MAA will give eight Minicourses. Please refer to the box titled **Minicourses** for titles and organizers.

The Minicourses are open only to persons who have registered for the Joint Mathematics Meetings and paid the Joint Meetings registration fee.

The Minicourses have separate registration fees of \$20 each, and are limited to 30 participants each. Payment of the fee(s) must be made to the Minicourse Cashier at the meeting registration desk in Louisville two hours prior to the beginning of the Minicourse or the reservation will be relinquished to someone on the waiting list. When making payment, the participant should present the confirmation to the cashier. "Standby" reservation confirmations will be issued to participants whose preregistration was received after the Minicourse was filled. These individuals should check with the Minicourse Cashier one

hour prior to the Minicourse to see if any openings have occurred.

If the only reason for registering for the Joint Meetings is to gain admission to a Minicourse, this should be indicated by checking the appropriate box on the preregistration form. Then, if the minicourse is full, full refund can be made of the Joint Mathematics Meetings preregistration fees. Otherwise, the Joint Meetings preregistration will be processed, and then be subject to the 50 percent refund rule.

### Other MAA Sessions

There will be a Panel Discussion at 11:00 a.m. on Friday, January 27. The moderator will be JOAN LEITZEL of Ohio State University. The topic is *Issues in remediation*.

The Committee on Corporate Members will hold a session at 10:00 a.m. on Saturday, January 28. The moderator will be JERRY LYONS of Prindle, Weber and Schmidt. The topic is *Mathematics publishing, copyright, and software*. Two of the speakers will be Carol Rischer and Robert Sickles.

There will be a Panel Discussion at 11:00 a.m. on Saturday, January 28. The moderator will be MARTHA SIEGEL of Towson State University. The topic is *Beginning integration: Calculus and discrete mathematics in the first two years*.

The Committee on Retraining for Computer Sciences will hold a Panel Discussion at 3:30 p.m. on Saturday, January 28. The moderator will be DONALD L. KREIDER of Dartmouth College. The topic is *Progress report on the Clarkson Institute for Retraining in Computer Sciences Conducted Under the Auspices of the Joint ACM/MAA Committee on Retraining for Computer Sciences*.

### Business Meeting

The Business Meeting of the MAA will take place at noon on Friday, January 27, at which the 1984 Award for Distinguished Service, the Chauvenet Prize, and the Lester R. Ford Awards for expository writing will be presented.

### Board of Governors

The MAA Board of Governors will meet at 9:00 a.m. on Thursday, January 26.

### Section Officers

There will be a Section Officers' meeting at 4:00 p.m. on Friday, January 27.

### ACTIVITIES OF OTHER ORGANIZATIONS

The Association for Women in Mathematics (AWM) will sponsor a Panel Discussion on *Lipman Bers, a mathematics mentor* at 11:15 a.m. on Thursday, January 26. Speakers include Jane P. Gilman, Linda Keen (moderator), Irwin Kra, Tilla Klotz Milnor, Rubi E. Rodriguez, and Leslie Sidnor. The AWM Business Meeting will follow the Panel Discussion at 12:30 p.m.

A party is being planned for Thursday evening, January 26.

The fifth annual AWM Emmy Noether Lecture will be given at 10:00 a.m. on Friday, January 27, by MARY ELLEN RUDIN. Her title is *Paracompactness*.

The **National Association of Mathematicians** (NAM) will receive the William W. S. Claytor Lecture at 10:15 a.m. on Thursday, January 26, from A. T. BHARUCHA-REID, who will speak on *Some notions and applications in probability theory-numerical methods*.

NAM will sponsor a Panel Discussion titled *Some approaches for providing computer literacy for students in small colleges and universities* at 11:15 a.m. on Friday, January 27. The list of speakers includes Melvis Atkinson, Samuel H. Douglas (moderator), Henry L. Hardy, John Harris, and Nelloise Watkins.

The NAM Business Meeting will take place at 1:30 p.m. on Friday, January 27.

The **National Science Foundation** (NSF) will sponsor an address on Thursday, January 26 at 2:15 p.m. The speaker is JUDITH S. SUNLEY, Acting Head of the Mathematical Sciences Section of NSF; her title is *The Mathematical Sciences at the National Science Foundation*.

The NSF will again be represented at a booth in the exhibit area. NSF staff members will be available to provide counsel and information on NSF programs of interest to mathematicians from 9:00 a.m. to 5:00 p.m., Thursday and Friday, January 26-27.

The **Rocky Mountain Mathematics Consortium** (RMMC) will sponsor a symposium on *The mathematics of large scale simulation* at 2:15 p.m. on Friday, January 27.

The RMMC Board of Directors will meet at 2:00 p.m. on Thursday, January 26.

## OTHER EVENTS OF INTEREST

### Book Sales

Books published by the AMS and MAA will be sold for cash prices somewhat below the usual prices when these same books are sold by mail. **These discounts will be available only to registered participants wearing the official meeting badge.** VISA and MASTERCARD credit cards will be accepted for book sale purchases at the meeting. The book sales will be open the same days and hours as the Joint Mathematics Meetings registration desk (except on Saturday, January 28, when they will close at 2:00 p.m.) and are located in Exhibit Space C of the Commonwealth Convention Center.

### Exhibits

The book and educational media exhibits are located in Exhibit Space C of the Commonwealth Convention Center and will be open Wednesday, January 25, through Saturday, January 28. The exhibits will be open from 1:00 p.m. to 5:00 p.m. on Wednesday; from 9:00 a.m. to 5:00 p.m. on

## Petition Table

At the request of the AMS Committee on Human Rights of Mathematicians, a table will be made available in the meeting registration area at which petitions on behalf of named individual mathematicians suffering from human rights violations may be displayed and signed by meeting participants acting in their individual capacities.

Signs of moderate size may be displayed at the table, but must not represent that the case of the individual in question is backed by the Committee on Human Rights unless it has, in fact, so voted. Volunteers may be present at the table to provide information on individual cases, but notice must be sent at least seven (7) days in advance of the meeting to the Meetings Department in Providence (telephone 401-272-9500). Since space is limited, it may also be necessary to limit the number of volunteers present at the table at any one time. The Committee on Human Rights may delegate a person to be present at the table at any or all times, taking precedence over other volunteers.

Any material which is not a petition (e.g., advertisements, résumés) will be removed by the staff. **When registration closes, any material on the table will be discarded, so individuals placing petitions on the table should be sure to remove them prior to the close of registration.**

Thursday and Friday; and from 9:00 a.m. to noon on Saturday. All participants are encouraged to visit the exhibits during the meeting. **Participants visiting the exhibits will be asked to display their meeting badge in order to enter the exhibit area.**

## MATHFILE

MATHFILE, the computerized version of *Mathematical Reviews*, will be demonstrated in the exhibit area during regular registration hours. Sample literature searches on material published in MR since 1973 will be performed on request, with printed results available in minutes.

MATHFILE is available through two U.S. on-line vendors, BRS and DIALOG. In addition, the European vendors SAMSOM Data Systemen and the European Space Agency (ESA) will offer MATHFILE, with access from the U.S. at comparable telecommunication rates.

## Rare Book Exhibit

The University of Louisville (Belknap Campus) will mount an exhibition of rare books from the William Marshall Bullitt Collection of Mathematics and Astronomy in the Department of Rare Books on the ground floor of the Ekstrom Library. The library is approximately 20 blocks south of the Commonwealth Convention Center, off Third Street. Directions for reaching the university campus can be obtained at the Local Information Section of the meetings registration

desk. Those interested are invited to view the exhibition between 9:00 a.m. and 6:00 p.m., Wednesday through Friday.

## ACCOMMODATIONS

### Hotels

Please read the page on **Housing** carefully for information on hotel deposits, which are now required.

The rates listed below are subject to a 5 percent sales tax and a 4.2 percent occupancy tax. The number after the name of the hotel is the number it carries on the map. The estimated walking distance from the hotel to the Commonwealth Convention Center is given in parentheses following the telephone number.

Reservations at these hotels cannot be made by calling the hotel directly until after **January 15, 1984**. Also, after that date, the rates below may not apply.

In all cases "single" refers to one person in one bed; "double" refers to two persons in one bed; "twin" refers to two persons in two single beds; and "twin double" refers to two persons in two double beds. A rollaway cot for an extra person can be added to double or twin rooms only; however, not all hotels are willing to do so.

Please make all changes to or cancellations of hotel reservations with the Mathematics Meetings Housing Bureau in Providence **before January 15, 1984**. The telephone number in Providence is 401-272-9500 (extension 239). After that date, changes or cancellations should be made with the Louisville Convention and Visitors Bureau by calling 502-584-2144.

#### **Best Western—Midtown (5)**

200 E. Liberty

Louisville, Kentucky 40202

Telephone: 502-589-6410 (11 minutes)

Singles	\$25
Twin Double	\$31
Triples	\$35
Quads	\$39

**Personal checks and major credit cards will be accepted for room deposits and payment of balance due; travelers' checks will also be accepted at time of check-out.**

#### **Galt House (2)**

On the River at Fourth

Louisville, Kentucky 40202

Telephone: 502-589-5200 (4 minutes)

Singles	\$40
Doubles	\$43
Twin Double	\$43
Triples	\$46
Quads	\$48
Parlor Suite	\$110

**Personal checks and major credit cards will be accepted for room deposits and payment of**

**balance due; however, if a personal check will be used at time of check-out, it must be cleared three days prior to departure.**

#### **Howard Johnson's (4)**

100 East Jefferson Street

Louisville, Kentucky 40202

Telephone: 502-582-2481 (8 minutes)

Singles	\$38
Doubles	\$44
Twin Doubles	\$44
Triples	\$50
Quads	\$56

**Personal checks, travelers' checks, and major credit cards will be accepted for room deposits and payment of balance due.**

#### **Hyatt Regency Louisville (7)**

320 West Jefferson Street

Louisville, Kentucky 40202

Telephone: 502-587-3434 (2 minutes)

Singles	\$50
Double	\$59
Twin/Twin Doubles	\$59
Triples	\$67
Quads	\$74

**Personal checks and major credit cards will be accepted for room deposits and payment of balance due; however, if a personal check is used, it must be accompanied by credit card identification.**

#### **The Louisville Inn (9)**

120 West Broadway

Louisville, Kentucky 40202

Telephone: 502-582-2241 (15 minutes)

Singles	\$38
Twin/Twin Double	\$46
Triples	\$52
Quads	\$58
Parlor/Bedroom	\$85

Transportation to the Commonwealth Convention Center will be available upon request at no charge.

**Personal checks and major credit cards will be accepted for room deposits and payment of balance due; however, if a personal check is used, it must be accompanied by credit card identification.**

#### **Rodeway Inn (3)**

101 East Jefferson Street

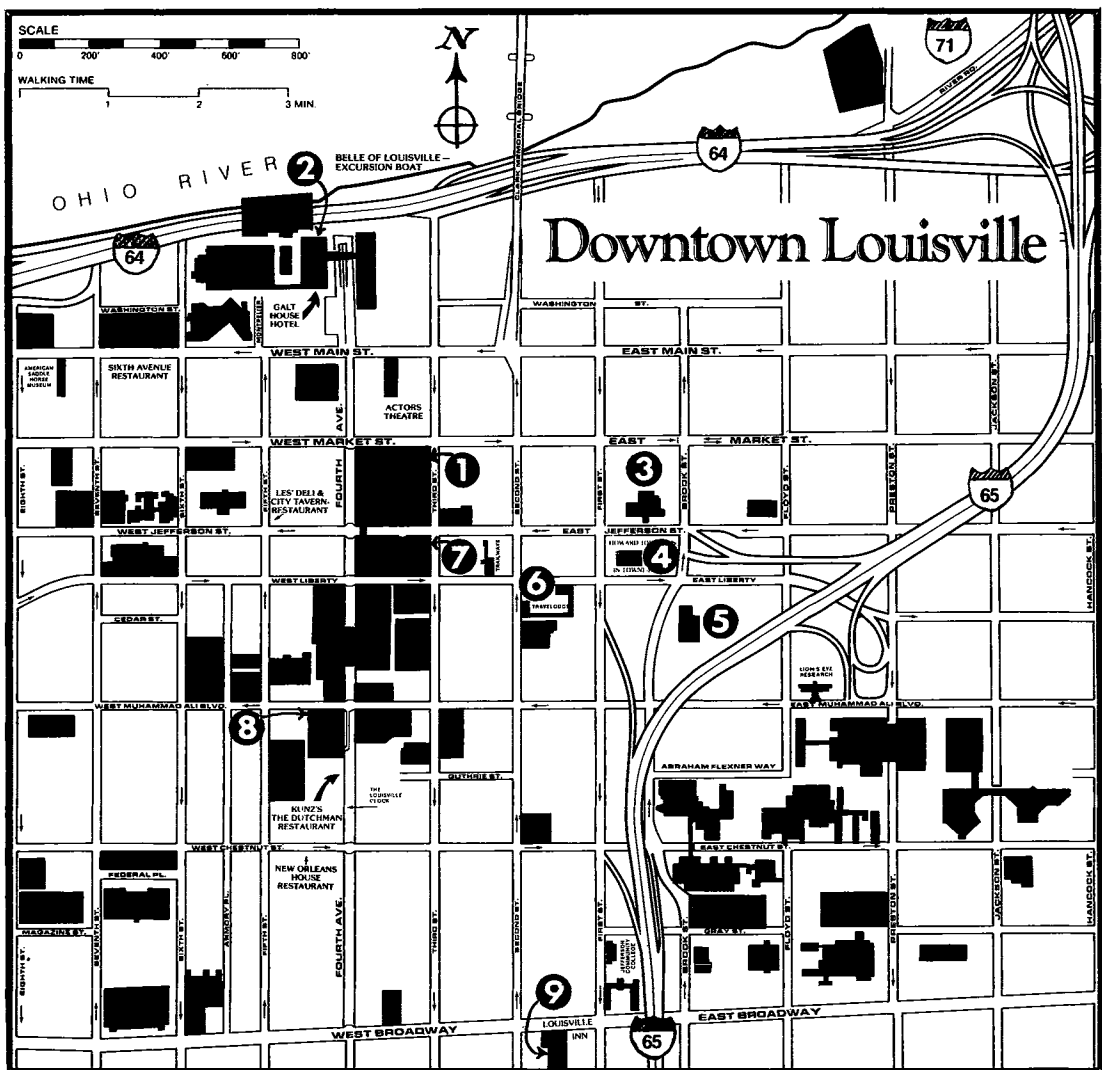
Louisville, Kentucky 40202

Telephone: 502-585-2200 (8 minutes)

Singles	\$43
Double	\$49
Twin Doubles	\$49
Triples	\$49
Quads	\$49

Transportation to the Commonwealth Convention Center will be available upon request at no charge.

**Personal checks and major credit cards will be accepted for room deposits and payment of**



1. Commonwealth Convention Center
2. Galt House
3. Rodeway Inn
4. Howard Johnson's
5. Best Western-Midtown

6. Louisville TraveLodge
7. Hyatt Regency Louisville
8. Seelbach Hotel
9. The Louisville Inn



# TIMETABLE

The purpose of this timetable is to provide assistance to registrants in the selection of arrival and departure dates. The program, as outlined below, is based on information available at press time.

AMERICAN MATHEMATICAL SOCIETY SHORT COURSE SERIES		
MONDAY, January 23	MATHEMATICS OF INFORMATION PROCESSING	
11:00 a.m. - 4:00 p.m.	REGISTRATION	
2:00 p.m. - 3:00 p.m.	Fundamental database issues Barry E. Jacobs	
3:30 p.m. - 4:30 p.m.	Theory of data dependencies Moshe Y. Vardi	
4:45 p.m. - 5:15 p.m.	General Discussion	
TUESDAY, January 24		
8:00 a.m. - 2:00 p.m.	REGISTRATION	
9:00 a.m. - 10:00 a.m.	The diameters of communication networks Fan R. K. Chung	
10:30 a.m. - 11:30 a.m.	Compression algorithms Victor S. Miller	
1:30 p.m. - 2:30 p.m.	Applications of category theory of structural sets to information systems Avgustin Tuzhilin	
3:00 p.m. - 4:00 p.m.	Transaction management Hector Garcia-Molina	
4:15 p.m. - 4:45 p.m.	General Discussion	
	JOINT MATHEMATICS MEETINGS	
TUESDAY, January 24	American Mathematical Society	Mathematical Association of America
2:00 p.m. - 10:00 p.m.	COUNCIL MEETING	
4:00 p.m. - 8:00 p.m.		REGISTRATION
4:00 p.m. - 8:00 p.m.	AMS BOOK SALE	MAA BOOK SALE
WEDNESDAY, January 25	AMS	Mathematical Association of America
8:00 a.m. - 5:00 p.m.	REGISTRATION	
8:00 a.m. - 5:00 p.m. morning	AMS BOOK SALE Special Sessions Sessions for Contributed Papers	MAA BOOK SALE
9:00 a.m. - 10:00 a.m.	INVITED ADDRESS The Yang-Mills equations as a non-linear Hodge theory Simon K. Donaldson	
10:15 a.m. - 11:15 a.m.	INVITED ADDRESS Design and analysis of self-adjusting data structures Robert E. Tarjan	
1:00 p.m. - 2:00 p.m.	COLLOQUIUM LECTURE I On the arithmetic of curves Barry Mazur	
1:00 p.m. - 5:00 p.m. afternoon		EXHIBITS
2:15 p.m. - 3:15 p.m.	Special Sessions Sessions for Contributed Papers INVITED ADDRESS Segal's Burnside ring conjecture Gunnar Carlsson	

balance due; however, if a personal check or travelers' check is used at time of check-out, it must be accompanied by credit card identification.

**Seelbach Hotel (8)**  
500 Fourth Avenue  
Louisville, Kentucky 40202  
Telephone: 502-585-3200 (4 minutes)

Singles	\$48
Doubles	\$54
Twin/Twin Doubles	\$54
Triples	\$60
Quads	\$66
One-bedroom suite	\$100
Two-bedroom suite	\$250

**Personal checks, American Express and VISA credit cards will be accepted in payment of room deposits; balance due is payable on check-out in cash, major credit cards or travelers' checks. Personal checks will be accepted at check-out subject to prior approval.**

**Louisville Travelodge (6)**  
401 South Second Street  
Louisville, Kentucky 40202  
Telephone: 502-583-2841 (10 minutes)

Singles	\$33
Doubles	\$38
Twin Doubles	\$43
Triples	\$48
Quads	\$53

**No personal checks will be accepted as payment for room deposit or balance of room charges; however, all major credit cards, money orders, and travelers' checks will be honored.**

The AMS-MAA Joint Meetings Committee always endeavors to obtain the lowest possible sleeping room rates for participants at annual meetings. The Committee is also responsible for maintaining a sound fiscal position for these meetings, and, until recently, has been able to keep the deficits at a reasonable level, while still providing the very best meeting facilities available to the participants.

As the meetings have grown in scope and complexity over the years, however, it has been necessary to find larger facilities with more and more session rooms. For this reason, the meetings in Louisville will take place in the Commonwealth Convention Center. Unfortunately, the cost of this excellent facility is higher than can be covered by the registration fees, and the Committee has arranged for most of the hotels in Louisville to collect an extra \$3 per room per night from participants, which will be used to offset the rental cost of the Center. (The rates above include this extra charge where applicable.) The Committee hopes that these extra funds will not be necessary at future annual meetings, and therefore chose this method over an increase in the registration fees.

## Registration at the Meetings

Meeting preregistration and registration fees only partially cover expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register, and should be prepared to show their meeting badge, if so requested. The fees for Joint Meetings registration at the meeting (listed below) are 30 percent more than the preregistration fees.

### Joint Mathematics Meetings

Member of AMS, MAA	\$61
Emeritus Member of AMS, MAA	\$15
Nonmember	\$93
Student/Unemployed	\$15

### Employment Register

Employer	\$75
Applicant	No charge

### AMS Short Course

Student/Unemployed	\$10
All Other Participants	\$30
One-day Fee (Second Day Only)	\$15

### MAA Minicourses #1 through #8

All Participants	\$20 each
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Registration fees may be paid at the meetings in cash, by personal or travelers' check, or by VISA or MASTERCARD credit card. Canadian checks must be marked for payment in U.S. funds.

There is no extra charge for members of the families of registered participants, except that all professional mathematicians who wish to attend sessions must register independently.

All full-time students currently working toward a degree or diploma qualify for the student registration fees, regardless of income.

The unemployed status refers to any person currently unemployed, actively seeking employment, and who is not a student. It is not intended to include any person who has voluntarily resigned or retired from his or her latest position.

Persons who qualify for emeritus membership in either the Society or the Association may register at the emeritus member rate. The emeritus status refers to any person who has been a member of the AMS or MAA for twenty years or more, and is retired on account of age from his or her latest position.

Nonmembers who register at the meetings and pay the \$93 nonmember registration fee are entitled to a discount of the difference between the member registration fee of \$61 and the nonmember registration fee of \$93 as a \$32 credit against dues in either the AMS or MAA or both, provided they apply for membership before February 29, 1984.

Nonmember students who register at the meetings and pay the \$15 registration fee are entitled to a discount of the difference between the student preregistration fee of \$12 and the registration fee of \$15 as a \$3 credit against dues

# TIMETABLE

WEDNESDAY, January 25	AMS	Mathematical Association of America
3:30 p.m. - 4:30 p.m.	INVITED ADDRESS Some recent results concerning minimal surfaces Leon Simon	
8:30 p.m. - 9:30 p.m.	JOSIAH WILLARD GIBBS LECTURE Computer programs that model the process of scientific and mathematical discovery Herbert A. Simon	
THURSDAY, January 26	AMS	Mathematical Association of America and Other Organizations
8:00 a.m. - 4:00 p.m.	REGISTRATION	
8:00 a.m. - 4:00 p.m. morning	AMS BOOK SALE Special Sessions Sessions for Contributed Papers	MAA BOOK SALE
8:30 a.m. - 10:30 a.m.		MAA - MINICOURSE #2 Discrete algorithmic mathematics Stephen B. Maurer
9:00 a.m. - 9:30 a.m.	EMPLOYMENT REGISTER ORIENTATION SESSION	
9:00 a.m. - 10:00 a.m.	INVITED ADDRESS Vorticity and fluid dynamics Andrew Majda	
9:00 a.m. - 4:00 p.m.		MAA - BOARD OF GOVERNORS' MEETING
9:00 a.m. - 5:00 p.m.	EXHIBITS	
9:30 a.m. - 4:00 p.m.	EMPLOYMENT REGISTER REGISTRATION	
10:15 a.m. - 11:15 a.m.		National Association of Mathematicians William W. S. Claytor Lecture Some notions and applications in probability theory—numerical methods A. T. Bharucha-Reid
11:15 a.m. - 12:30 p.m.		Association for Women in Mathematics Panel Discussion Lipman Bers, a mathematics mentor Jane P. Gilman Linda Keen (moderator) Irwin Kra Tilla Klotz Milnor Rubi E. Rodriguez Leslie Sidnor
12:30 p.m. - 12:55 p.m.		AWM - BUSINESS MEETING
1:00 p.m. - 2:00 p.m.	COLLOQUIUM LECTURE II On the arithmetic of curves Barry Mazur	
2:00 p.m. - 4:00 p.m.		Rocky Mountain Mathematics Consortium Board of Directors' Meeting
2:00 p.m. - 4:00 p.m.		MAA - MINICOURSE #1 Linear programming Charles E. Haff
2:15 p.m. - 3:15 p.m.	The Mathematical Sciences at the National Science Foundation Judith S. Sunley, NSF	
4:00 p.m. - 6:00 p.m.	BOCHER PRIZE SESSION AND BUSINESS MEETING	
6:05 p.m.	AWM - PARTY	
7:00 p.m. - 10:00 p.m.	Joint Concerns Committee for Mathematics A National Meeting of Department Chairman	

## Louisville Meetings SuperPhone Exclusive

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### FLY TO LOUISVILLE WITH DELTA OR USAIR AND SAVE

Delta and USAir, the two major carriers to Louisville, are making special round trip air fares available to the Joint Mathematics Meetings in Louisville, Kentucky, January 23–28, 1984.

Delta is offering a 30 percent discount on full round-trip coach fares. This special fare requires departure between January 23 and 27. Reservations and ticketing must be done at least seven days in advance and a maximum stay of 15 days will be permitted.

USAir is offering an unrestricted Super Saver fare to any participant purchasing tickets on its airline at least fourteen days in advance. Other fares will, of course, still be available after the fourteen-day limitation.

These special offers are available **ONLY** through the Louisville Meeting SuperPhone Exclusive.

**Call SuperPhone toll-free today –800-556-6882–and save!!**

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in either the AMS or MAA or both, provided they apply for membership before February 29, 1984.

Nonmembers and nonmember students who thus qualify may apply for membership at the meetings, or by mail afterward up to the deadline.

### Dates and Times

#### AMS Short Course

Prefunction Room, Regency Ballroom South  
Hyatt Regency Louisville

Monday, January 23 11:00 a.m. to 4:00 p.m.

Tuesday, January 24 8:00 a.m. to 2:00 p.m.

#### Joint Mathematics Meetings

[and MAA Minicourses (until filled)]

Main Lobby, Commonwealth Convention Center

Tuesday, January 24 4:00 p.m. to 8:00 p.m.

Wednesday, January 25 8:00 a.m. to 5:00 p.m.

Thursday, January 26,  
through 8:00 a.m. to 4:00 p.m.

Saturday, January 28

### Registration Desk Services

#### AMS/MAA Information

Information on the publications and activities of both organizations may be obtained at this section of the registration desk.

#### Assistance, Comments and Complaints

A log for registering participants' comments or complaints about the meeting is kept at the Transparencies section of the registration desk. All participants are encouraged to use this method of helping to improve future meetings. Comments on all

phases of the meeting are welcome. If a written reply is desired, participants should furnish their name and address.

Participants with problems of an immediate nature requiring action at the meeting should see the meeting manager, who will try to assist them.

#### Audio-Visual Assistance

A member of the AMS/MAA staff will be available to advise or consult with speakers on their audio-visual requirements.

Rooms where special sessions and contributed paper sessions will be held will be equipped with an overhead projector and screen. **Blackboards will not be available.**

#### Baggage and Coat Check

Information on this service will be available later.

#### Check Cashing

The meeting cashier will cash personal or travelers' checks up to \$50, upon presentation of the official meeting registration badge, provided there is enough cash on hand. Canadian checks must be marked for payment in U.S. funds.

#### Local Information

This section of the desk will be staffed by members of the Local Arrangements Committee and other volunteers from the Louisville mathematical community.

#### Lost and Found

See the meeting cashier.

#### Mail

All mail and telegrams for persons attending the meetings should be addressed to the participant,

# TIMETABLE

THURSDAY, January 26	AMS	Mathematical Association of America and Other Organizations
7:30 p.m. - 9:30 p.m.		MAA - MINICOURSE #2 Discrete algorithmic mathematics Stephen B. Maurer
FRIDAY, January 27	AMS	Mathematical Association of America and Other Organizations
8:00 a.m. - 10:00 a.m.		MAA - MINICOURSE #3 Teaching problem solving Alan H. Schoenfeld
8:00 a.m. - 10:00 a.m.		MAA - MINICOURSE #7 CONDUIT microcomputer software David A. Smith
8:00 a.m. - 4:00 p.m.		REGISTRATION
8:00 a.m. - 4:00 p.m.	AMS BOOK SALE	MAA BOOK SALE
9:00 a.m. - 5:00 p.m.		EXHIBITS
9:00 a.m.	EMPLOYMENT REGISTER DISTRIBUTION OF SCHEDULES	
9:00 a.m. - 9:50 a.m.		MAA - INVITED ADDRESS Some examples of combinatorial averaging Herbert S. Wilf
9:00 a.m. - 9:50 a.m.		MAA - INVITED ADDRESS The computer as a grader Melvin Maron
9:30 a.m. - 5:30 p.m.	EMPLOYMENT REGISTER INTERVIEWS	
10:00 a.m. - 10:50 a.m.		AWM- Emmy Noether Lecture Paracompactness Mary Ellen Rudin
10:00 a.m. - 10:50 a.m.		MAA - INVITED ADDRESS Mathematics in industry—How do problems arise? Henry O. Pollak
10:00 a.m. - noon		MAA - MINICOURSE #8 NonCONDUIT microcomputer software David A. Smith
11:00 a.m. - 11:50 a.m.		MAA - Panel Discussion Issues in remediation Joan Leltzel (moderator)
11:00 a.m. - 11:50 a.m.		MAA - INVITED ADDRESS Computational geometry: Paradigms and applications Frances Yao
11:15 a.m. - 12:30 p.m.		NAM - Panel Discussion Some approaches for providing computer literacy for students in small colleges and universities Melvis Atkinson Samuel H. Douglas (moderator) Henry L. Hardy John Harris Nelloise Watkins
noon - 12:50 p.m.		MAA - BUSINESS MEETING
1:00 p.m. - 2:00 p.m.	COLLOQUIUM LECTURE III On the arithmetic of curves Barry Mazur	
1:00 p.m. - 3:00 p.m.		MAA - MINICOURSE #5 Problems from industry Jeanne L. Agnew Marvin S. Keener

c/o Joint Mathematics Meetings, Commonwealth Convention Center, 221 Fourth Avenue, Louisville, Kentucky 40202. Mail and telegrams so addressed may be picked up at the mailbox in the registration area during the hours the registration desk is open. U.S. mail not picked up will be forwarded after the meeting to the mailing address given on the participant's registration record.

### **Personal Messages**

Participants wishing to exchange messages during the meeting should use the mailbox mentioned above. Message pads and pencils are provided. It is regretted that such messages left in the box cannot be forwarded to participants after the meeting is over.

### **Telephone Messages**

A telephone message center is located in the registration area to receive incoming calls for participants. The center is open from January 25 through 28 only, during the hours that the Joint Mathematics Meetings registration desk is open. Messages will be taken and the name of any individual for whom a message has been received will be posted until the message has been picked up at the message center. The telephone number of the message center will be announced later.

### **Transparencies**

Speakers wishing to prepare transparencies in advance of their talk will find the necessary materials and copying machines at this section of the registration desk. A member of the staff will assist and advise speakers on the best procedures and methods for preparation of their material. There is a modest charge for these materials.

### **Visual Index**

An alphabetical list of registered participants, including local addresses, arrival and departure dates, is maintained in the registration area.

## **MISCELLANEOUS INFORMATION**

### **Child Care**

We Sit Better, Inc., offers professional babysitting in hotel rooms. Day or evening service is available. Their present rate is minimum wage for a minimum of four hours, plus \$3 carfare. Please notify them as far in advance as possible. For more information call 502-583-9618. Many of the listed hotels will arrange for a babysitter if given enough prior notice.

### **Local Information**

Taxis presently cost \$1.90 for the first mile and \$1 for each additional mile. Each additional person is charged 30 cents extra, as long as they go from the same pickup point to the same destination. Fares from the airport to downtown hotels should average \$9. The Transit Authority of River City (TARC) operates buses throughout the area. The fee is 60 cents during peak hours (6:30–8:30 a.m. and 3:30–5:30 p.m.) and 35 cents for nonpeak hours.

A section of Fourth Avenue has been turned into a Galleria and pedestrian mall. Participants staying in

downtown hotels will want to take advantage of the many shops in this area.

Louisville's museums include the J. B. Speed Art Museum, the Museum of History and Science, the Howard Steamboat Museum and the Kentucky Derby Museum at Churchill Downs. The performing arts can be seen at Actors Theatre, Kentucky Center for the Arts, Macauley Theatre, and the Louisville Palace. Information on these and other points of visitor interest will be available at the Local Information section of the registration desk.

### **Parking**

Parking lots within a few blocks of the Commonwealth Convention Center charge from 35 cents to 75 cents for one hour (50 cents median); twenty-four hour parking ranges from \$1 to \$3.50 (\$3 median).

The Hyatt Regency has its own parking garage at Third Street and River City Mall at a daily charge of \$3. This garage is also available for patrons of the Commonwealth Convention Center.

The Galt House has a 600-car parking lot which guests can use at no charge, with in and out privileges.

### **Social Events**

The Local Arrangements Committee has arranged a no-host cocktail party for Friday, January 27, from 7:00 to 9:00 p.m., in the Regency Ballroom North at the Hyatt Regency Louisville.

### **Travel**

In January, Louisville is on Eastern Standard Time. There is regular airline service to Standiford Field by several major airlines.

The airport in Louisville is approximately four miles from downtown and the trip takes about ten minutes. The airport limousine stops at the major downtown hotels, and runs every forty-five minutes from 7:00 a.m. until 11:00 p.m. daily. Present cost is \$3.75 per person. A taxi from the airport to a downtown hotel costs about \$8.50, plus 30 cents for each additional passenger one way. There is bus service provided by Transit Authority of River City (TARC) on bus #2 from the airport to downtown, with the fare varying between 35 cents and 60 cents depending on the hour of the day. Most major car rental agencies maintain desks at the airport.

Louisville can be reached by car via I-65 from the North and South, I-64 from the East and West, and I-71 from the Northeast.

There is no passenger train service into Louisville; however, Greyhound and Trailways Bus Lines serve the Louisville area.

### **Weather**

Louisville is located on the south bank of the Ohio River. The climate, while continental in type, is of a variable nature because of its position in the midlatitudes. The winters are moderately cold with temperatures rarely below 0°F. The mean temperature in January is 34°F while the average high temperature in January is 42°F and the average low temperature is 26°F. On rare occasions the

# TIMETABLE

FRIDAY, January 27	AMS	Mathematical Association of America and Other Organizations
1:00 p.m. - 3:00 p.m.		MAA - MINICOURSE #6 Applications of computer graphics Joan Wyzkoski
1:30 p.m. - 2:30 p.m. afternoon	Special Sessions Sessions for Contributed Papers	NAM - Business Meeting
2:00 p.m. - 4:00 p.m.		MAA - MINICOURSE #1 Linear programming Charles E. Haff
2:00 p.m. - 4:00 p.m.		MAA - MINICOURSE #4 Applications of discrete mathematics Fred S. Roberts
2:15 p.m. - 3:15 p.m.	INVITED ADDRESS Card shuffling and group representations Persi Diaconis	
2:15 p.m. - 5:00 p.m.		RMMC - Symposium The mathematics of large scale simulation
3:30 p.m. - 4:30 p.m.	INVITED ADDRESS Group actions on rings and generalized inner automorphisms M. Susan Montgomery	
4:00 p.m. - 5:30 p.m.		MAA - Section Officers' Meeting
4:30 p.m. - 6:00 p.m.	Committee on Employment and Educational Policy Panel Discussion The supply of mathematical science researchers in the 1990's Lida K. Barrett (moderator)	
7:00 p.m. - 9:00 p.m.	NO-HOST COCKTAIL PARTY	
SATURDAY, January 28	AMS	Mathematical Association of America
8:00 a.m. - 2:00 p.m.	AMS BOOK SALE	MAA BOOK SALE
8:00 a.m. - 4:00 p.m.	REGISTRATION	
9:00 a.m. - 9:50 a.m.		MAA - RETIRING PRESIDENTIAL ADDRESS Reflections on the mystique of R. L. Moore Richard D. Anderson
9:00 a.m. - 11:00 a.m.		MAA - MINICOURSE #3 Teaching problem solving Alan H. Schoenfeld
9:00 a.m. - 11:00 a.m.		MAA - MINICOURSE #7 CONDUIT microcomputer software David A. Smith
9:00 a.m. - noon	EXHIBITS	
9:00 a.m.	EMPLOYMENT REGISTER DISTRIBUTION OF SCHEDULES	
9:30 a.m. - 5:30 p.m.	EMPLOYMENT REGISTER INTERVIEWS	
10:00 a.m. - 10:50 a.m.		MAA - INVITED ADDRESS Beta and gamma functions from Euler to Selberg and beyond Richard A. Askey
10:00 a.m. - 10:50 a.m.		MAA - Committee on Corporate Members SESSION on Mathematics publishing, copyright, and software Jerry Lyons (moderator) Carol Rischer Robert Sickles

# TIMETABLE

SATURDAY, January 28	AMS	Mathematical Association of America
11:00 a.m. - 11:50 a.m.		MAA - INVITED ADDRESS Nonexpansive maps Andrew M. Gleason
11:00 a.m. - 12:50 p.m.		MAA - Panel Discussion Beginning integration: Calculus and discrete mathematics in the first two years Martha Siegel (moderator)
11:00 a.m. - 1:00 p.m.		MAA - MINICOURSE #8 NonCONDUIT microcomputer software David A. Smith
noon - 12:50 p.m.		MAA - INVITED ADDRESS Turning good mathematics into good TV Donald Berman Ross L. Finney
1:00 p.m. - 2:00 p.m.	COLLOQUIUM LECTURE IV On the arithmetic of curves Barry Mazur	
afternoon	Special Sessions Sessions for Contributed Papers	
1:00 p.m. - 3:00 p.m.		MAA - MINICOURSE #5 Problems from Industry Jeanne L. Agnew Marvin S. Keener
1:00 p.m. - 3:00 p.m.		MAA - MINICOURSE #6 Applications of computer graphics Joan Wyzkoski
2:00 p.m. - 4:00 p.m.		MAA - MINICOURSE #4 Applications of discrete mathematics Fred S. Roberts
2:15 p.m. - 3:15 p.m.	INVITED ADDRESS Intersection homology and some applications Robert D. MacPherson	
3:30 p.m. - 5:30 p.m.		MAA Committee on Retraining for Computer Sciences - Panel Discussion Progress report on the Clarkson Institute for Retraining in Computer Sciences Conducted Under the Auspices of the Joint ACM/MAA Committee on Retraining for Computer Sciences Donald L. Kreider (moderator)

Continued from page 784

winters in Louisville are extreme both in temperature and snowfall.

Middletown, Connecticut

W. Wistar Comfort  
Associate Secretary

Important information on the Employment Register immediately follows.



# Mathematical Sciences Employment Register

## January Meeting in Louisville

The Mathematical Sciences Employment Register, held annually at the Joint Mathematics Meetings in January, provides opportunities for mathematical scientists seeking professional employment to meet employers who have positions to be filled. Job listings (or descriptions) and résumés prepared by employers and applicants are displayed for the participants so that members of each group may determine which members of the other group they would like to have an opportunity to interview. A computer program assigns the appointments, matching requests to the extent possible, using an algorithm which maximizes the number of interviews which can be scheduled subject to constraints determined by the number of time periods available, the numbers of applicants and employers, and the pattern of requests. The report below outlines the operation of the register, indicating some of the procedures involved for the benefit of those not familiar with its operation.

The Mathematical Sciences Employment Register is apparently unique among employment services offered by professional organizations in the sciences, engineering and the humanities. The computer programs used are constructed around a matching program, devised by Donald R. Morrison and based on an algorithm described in his paper "Matching Algorithms" in *Journal of Combinatorial Theory*, volume 6 (1969), pages 20 to 32; see also "Matching Algorithms" (abstract) *Notices*, August 1967, page 630. The number of interviews arranged by the program is significantly greater than the number possible at the employment registers of other organizations, in many cases greater by an order of magnitude.

### 1984 Employment Register in Louisville

The Employment Register at the Louisville meeting will take place in the Commonwealth Convention Center, Exhibit Space A, on Thursday, Friday, and Saturday, January 26, 27, and 28, 1984. A short (optional) orientation session will be conducted by the AMS-MAA-SIAM Committee on Employment Opportunities at 9:00 a.m. on Thursday, January 26. The purpose of the orientation session is to familiarize participants with the operation of the Register and with the various forms involved. Following orientation, participants of the Employment Register can pick up their interview request forms. Computer-scheduled interviews will be held on Friday and Saturday, January 27 and 28. No interviews will be held on Thursday.

Fifteen-minute intervals are allowed for interviews, including two or three minutes between successive interviews. The interviews are scheduled in half-day sessions: Friday morning and afternoon, and Saturday morning and afternoon, amounting to four half-day sessions for interviews. There are ten time periods (9:30–11:45 a.m.) in which interviews can be scheduled in the morning sessions and fourteen time periods (1:15–5:00 p.m.) in the afternoon sessions. It is possible that an applicant or employer may be scheduled for the maximum number of interviews in a session. The scheduling program gives priority to your first six requests. The remaining requests will be accommodated depending on the availability of participants. The scheduling program does not have a provision allowing participants to specify particular times for interviews beyond the choice of session (day, and morning or afternoon). Such requests cannot be accommodated.

Requests for interviews to take place during the two sessions on Friday must be submitted on Thursday between 9:30 a.m. and 4:00 p.m. Requests for interviews to take place during the

**Saturday sessions must be submitted on Friday before 4:00 p.m.**

On Friday and Saturday mornings at 9 a.m. all schedules for applicants and employers for the day (both the morning and afternoon sessions) will be available for distribution in the Commonwealth Convention Center, Exhibit Space A.

The Saturday afternoon session is the annual "employers' choice" session. For this session interviews will be scheduled on the basis of requests made by employers. Applicants do not submit specific interview requests for this session; but, in order to participate they must indicate their availability for the session by filing the Interview Request Form for Saturday, indicating that they will attend the afternoon session that day. **Request Forms for the "employers' choice" session must be submitted by 4:00 p.m. on Friday in order for the interviews to be scheduled for Saturday afternoon.**

Applicants should be aware of the fact that interviews arranged by the Employment Register represent only an initial contact with employers, and that hiring decisions are not ordinarily made during or immediately following such interviews. **Applicants are advised to bring a number of copies of their vitae or résumés so that they may leave them with prospective employers.**

All participants in the Employment Register are required to register for the Joint Mathematics Meetings. For applicants there is no additional fee for participation in the Employment Register.

**The preregistration deadline is December 5, 1983.**

For employers, additional fees for participation in the Employment Register are \$50, if paid before the December 5 deadline for Joint Meetings preregistration, or \$75 if paid at the meeting.

Employers who wish to participate in the Register and who have neither preregistered nor paid the Employment Register fee must go

## December Issue of Employment Information in the Mathematical Sciences

For several years the periodical *Employment Information in the Mathematical Sciences* (EIMS) has published six issues per year listing open positions in academic, governmental and industrial organizations, primarily in North America, along with a few listings from countries in other parts of the world. EIMS is a joint project of the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics. It is published by the Society.

The December issue of EIMS contains résumés of persons seeking professional positions in the mathematical sciences. Résumés of applicants taking part in the January 1984 Mathematical Sciences Employment Register at the Joint Mathematics Meetings in Louisville will be included in the December 1983 issue provided both that they are received before the December 5 deadline specified below and are in satisfactory condition. Other mathematical scientists who wish to be included may have their résumés printed if the same deadline is observed and if the copy supplied meets the same technical requirements, described below.

Copies of the December issue of EIMS will be distributed both to subscribers and to the employers who participate in the Mathematical Sciences Employment Register at the Joint Mathematics Meetings in Louisville in January 1984. Job applicants planning to participate in the Employment Register in Louisville are therefore strongly urged to preregister so that their résumés can appear in the December issue.

Applicants who will participate in the Employment Register in Louisville and wish to have their résumés included in the December issue of *Employment Information in the Mathematical Sciences* should complete both the special MSER Applicant Form and the Preregistration and Housing Form at the back of this issue of the *Notices*. Both Forms must be received in Providence by the December 5, 1983 deadline. Forms received after the December 5 deadline cannot be included in the printed booklet. For details on registration and preregistration for the Louisville Joint Mathematics Meetings, please refer to the information on these subjects which may be found elsewhere in this issue of the *Notices*.

Applicants for professional positions in the mathematical sciences, who do not plan to attend the meeting in Louisville and participate in the Employment Register there, may also submit résumés for publication in the December issue if they use the MSER Preregistration Form for Applicants at the back of this issue of the *Notices* and observe the same deadline (December 5) as that for applicants who will be attending the meeting. (It is, of course, not necessary to preregister for the meeting if one is not going to attend the meeting. Résumés will not be posted if the participant is not attending the meeting.)

### Preparation of Applicants' Résumés for the December issue of EIMS

The December issue of EIMS will be printed using photographic reproductions of Forms completed and submitted by applicants. For this reason, special care must be exercised by those who prepare the Forms in order to assure that the results are of good quality, and will be clear and legible after they have been photographed, reduced in size, and printed.

Because an employer's first impressions of an applicant are likely to be based on the appearance of the printed Form, applicants are strongly advised to study the suggestions given below very carefully before the forms are filled out, so that the original copy will be neither marred nor damaged.

The Forms **must** be carefully typed using a new black ribbon. The best results are obtained by using a modern typewriter with a carbon-coated polyethylene film ribbon, but satisfactory results may be obtained with a ribbon made of nylon or other woven fabric if suitable care is exercised. It is important that the keys be clean and make a sharp clear impression, which must be a uniform dark black; gray, blue, or other colors will not reproduce and should, therefore, not be used. Do not use an eraser, as it will cause smudges which reproduce when photographed. Use a correcting typewriter, or correction tape or fluid, if necessary.

Only an original copy of the Form should be submitted, a photocopy or xerographic reproduction will not reproduce as well and may not be accepted for publication. It is therefore important to exercise care in order to assure that the results are satisfactory. The timetable for production of the December issue will not permit poor copy received after the first week of December to be returned to applicants for correction or replacement.

Submission of copy of good quality is entirely the responsibility of the applicant. The Society (which will print this material) must be the final judge of what copy is capable of being reproduced adequately, and therefore of what is acceptable for inclusion in the printed booklet. The Society cannot undertake to correct or replace inadequate copy, and cannot entertain requests to prepare original copy. In the event the quality of a résumé, submitted by an applicant participating in the Employment Register, does not meet the necessary conditions for inclusion in the December issue, the résumé will nonetheless be posted at the Employment Register in Louisville, along with those of the other participants.

# Preregistration Information for Mathematical Sciences Employment Register

## MSER PREREGISTRATION – Employers

Employers who plan to participate in the Employment Register are urged to preregister for it. The MSER Preregistration Form for Employers (which appears at the back of this issue of the *Notices*) should be submitted along with the Housing and Preregistration Form for the Joint Meetings. **Deadline** for receipt of both forms is **December 5**. Preregistration for the Employment Register, in addition to permitting inclusion in the printed lists, has the advantage of reduced fees and the services of the Mathematics Meetings Housing Bureau, and has the further advantage of helping to reduce waiting times at the meeting in Louisville.

Employers are encouraged to provide more than one interviewer, when they are able to do so, in order to increase the number of interviews which may be scheduled. Please take care to indicate on the Form the number of interviewers for whom simultaneous interviews may be scheduled. (If all interviewers will be interviewing for the same position, or for the same set of positions, only one form should be submitted and only one employer code number will be assigned; therefore, each interviewer would then receive a separate computer schedule and separate table number.) More than one employer code will be required if some interviewers will not interview for all positions. Thus, if there are two disjoint sets of positions, two forms are required and two employer codes will be assigned.

A coded strip summarizes the information on each Form; it appears at the bottom of the Form. Employers' job listings will be posted at the meeting, so that applicants may study them when choosing which employers they wish to interview. All employers are required to complete the Summary Strip. The strip provides an abbreviated version of the information on the Form and is used to prepare a computer-printed list of preregistered employers for distribution to the applicants, called the Winter List of Employers.

Employers who have preregistered **must** pick up their MSER material in the Commonwealth Convention Center, Exhibit Space A, after 9:30 a.m. on Thursday, January 26, 1984, and **must** submit an interview request form by 4:00 p.m. in order to receive a computer printed schedule for the following day. This form is handed out at the meeting only. This is not the form that is submitted with preregistration.

In order for interviews to be scheduled on one day, the Employer's Interview Request Form must be submitted by the 4:00 p.m. deadline on the previous day; it will not be possible to assign any interviews to employers who do not submit the Request Forms in good time even if they choose not to identify particular applicants to be interviewed. Submission of the form is required in order to

indicate availability for the session in question, whether or not any specific interviews are to be requested.

## MSER PREREGISTRATION – Applicants

Applicants planning to participate in the Employment Register in Louisville are urged to preregister for it. The special Applicants Preregistration Form for the Employment Register (which appears at the back of this issue of the *Notices*) should be completed and submitted with the Housing and Preregistration Form for the Joint Mathematics Meetings prior to the deadline of December 5.

Applicants' résumés will be made available to employers in printed form, so that they may be studied carefully at leisure. The December issue of *Employment Information in the Mathematical Sciences* which will be printed a few weeks before the Louisville meeting will contain photographic reproductions of the résumés of applicants who have preregistered by **December 5**. Forms not received in time cannot be included in the issue. Applicants (as well as others planning to attend the Joint Meetings) should note that those who preregister well in advance of the final deadline have access to a wider selection of accommodations, including, in particular, those in the lower price range, which (being in limited supply) tend to be exhausted early in the preregistration process.

The **deadline** for receipt of applicant forms to be included in the December issue of EIMS is **December 5**. They must be accompanied by the Housing and Preregistration Form, since registration for the Joint Meetings is a prerequisite for registration for the Employment Register. The special forms for the Employment Register, as well as the Housing and Preregistration Form for the Joint Meetings, appear at the back of this issue of the *Notices*.

Applicants who preregister for the Employment Register may pick up their MSER material anytime after 9:30 a.m. on Thursday, January 26, 1984, in the Commonwealth Convention Center, Exhibit Space A. **Interview Request Forms must be submitted the day before interviews are to be scheduled; applicants who fail to submit the Form before the 4:00 p.m. deadline on the previous day, cannot be included in the pool of participants available for interviews on the day in question. The forms are given out the day before the interviews to be completed and returned. These are not the forms that are submitted with preregistration.**

to the Joint Mathematics Meetings registration desk in the Main Lobby of the Commonwealth Convention Center in order to complete their registration. Registration for the Joint Meetings is required to use the Employment Register facilities. (No provision will be made to handle cash transactions at the site of the Employment Register in the Commonwealth Convention Center, Exhibit Space A.)

Employers and applicants who have completed registration for the Employment Register, and employers and applicants who have preregistered, may pick up their MSER material after 9:30 a.m. on Thursday, January 26, in the Commonwealth Convention Center, Exhibit Space A, where the Employment Register will be held. All who wish to have interviews scheduled for Friday or Saturday, must submit their Interview Request Forms on the preceding day by 4:00 p.m. Those who fail to do so cannot be included in the pool of available participants when the matching program which schedules the interviews is run on the computer that night. This applies both to preregistered employers and applicants, and to those registering at the meeting.

These forms are given to participants at the meeting. These are not the forms that are completed with preregistration.

Employers who do not plan to attend the Employment Register, but wish to display literature, may do so (subject to approval) at no charge, provided all copies of the material to be displayed are received in the Providence Office (MSER, P. O. Box 6248, Providence, RI 02940) no later than December 5.

The MSER registration fee for employers covers the cost of a copy of the December Issue of *Employment Information in the Mathematical Sciences* (EIMS). This publication contains printed copies of the résumés of applicants who preregistered prior to the December 5 deadline; it also contains a copy of the summary Winter

List of Applicants. The résumés themselves will be posted at the site of the Register in addition to the résumés of those who register at the meeting. Additional copies of the December Issue of EIMS and both the summary Winter Lists (of Applicants and of Employers) will be available for sale at the AMS Book Sale at the meeting, as long as supplies last. Prices at the meeting are \$2 each for the summary lists and \$3 for the December issue. Any copies remaining after the meeting will be available from the Providence office of the Society for \$3 and \$6, respectively. (Attention is called to the fact that the December issue of EIMS will contain the Winter List of Applicants, but will not contain the Winter List of Employers.)

The Winter List of Employers consists of summaries of the position listings submitted by the employers who preregistered for the meeting; it will be distributed without charge to the applicants participating in the Register. Others may purchase the Winter List of Employers at the AMS Book Sale at the meeting or from the Providence office later, as long as the supply lasts. (See previous paragraph for prices.)

The Mathematical Sciences Employment Register is sponsored by the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics; it is operated by members of the AMS staff under the general supervision of the joint AMS-MAA-SIAM Committee on Employment Opportunities.

**Preregistration Information** may be found in an accompanying article in this issue of the *Notices*. Information on the December Issue of *Employment Information in the Mathematical Sciences*, including specific suggestions for the proper preparation of material to be submitted for publication in the December Issue, will also be found in a separate article in this issue of the *Notices*.

### Limiting Equations for Problems Involving Long Range Memory

Moshe Marcus and Victor Mizel

Asymptotic solution behavior and relevant limit equations are studied for a broad class of nonautonomous hereditary equations. These problems are presented on a function space consisting of locally integrable functions defined on semi-axes of the reals, and the operators occurring in the equations map this function space into the space of continuous functions—in a 'nonanticipative' manner. The basic topological dynamic framework which is developed is then employed in the detailed analysis of three

concrete classes of problems: nonlinear Volterra equations with autonomous kernel; a general family of nonlinear functional differential equations; and nonlinear Volterra equations with nonautonomous kernel.

1980 *Mathematics Subject Classifications*: 54H20, 45D05, 34K25, 45M05

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# Notre Dame, April 6–7, 1984, University of Notre Dame

## First Announcement of the 810th Meeting

The eight hundred and tenth meeting of the American Mathematical Society will be held at the University of Notre Dame, Notre Dame, Indiana, on Friday and Saturday, April 6 and 7, 1984. Sessions will be held in the Notre Dame Center for Continuing Education.

### Invited Addresses

By invitation of the 1983 Committee to Select Hour Speakers for Central Sectional Meetings there will be five invited one-hour addresses. The speakers, their titles, and the scheduled times of presentation are as follows:

GERD FALTINGS, Gesamthochschule Wuppertal, *Arithmetic algebraic geometry*, 9:30 a.m. Friday.

NIGEL J. KALTON, University of Missouri, Columbia, *Three space problems in functional analysis*, 1:45 p.m. Saturday.

PAUL G. NEVAI, The Ohio State University, *Orthogonal polynomials*, 11:00 a.m. Saturday.

KAREL L. PRIKRY, University of Minnesota, Minneapolis, *The role of measurable cardinals in set theory and analysis*, 1:45 p.m. Friday.

WILLIAM F. SCHELTER, University of Texas, Austin, *Finitely generated algebras satisfying a polynomial identity*, 11:00 a.m. Friday.

All five one-hour talks will be held in the auditorium of the Notre Dame Center for Continuing Education.

### Special Sessions

By invitation of the same committee there will be five sessions of selected twenty-minute papers. The topics of these special sessions and the names of the mathematicians arranging them are as follows:

*Orthogonal polynomials and their applications*, THEODORE S. CHIHARA, Purdue University, Calumet.

*Ring theory*, BARBARA CORTZEN, De Paul University.

*Model theory*, JULIA F. KNIGHT, University of Notre Dame.

*Metric linear function spaces*, N. TENNEY PECK, University of Illinois, Urbana-Champaign.

*Differential equations*, T. K. PUTTASWAMY, Ball State University.

Most of the papers to be presented at these special sessions will be by invitation. However, anyone submitting an abstract for the meeting who feels that his or her paper would be particularly appropriate for one of these special sessions should indicate this clearly on the abstract and submit it by **January 10**, three weeks before the deadline for contributed papers.

### Contributed Papers

There will also be sessions for contributed ten-minute papers as needed. Abstracts should be

prepared on the standard AMS form available from the AMS office in Providence, or in departments of mathematics. Abstracts should be sent to the American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940, so as to arrive prior to the abstract deadline of **February 1, 1984**. Members are reminded that a charge of \$12 is imposed for retyping abstracts that are not in camera-ready form.

### Council Meeting

The Council of the Society will meet at 7:00 p.m. on Thursday, April 5.

### Symposium

#### *Pseudodifferential Operators and Fourier Integral Operators with Applications to Partial Differential Equations*

With the anticipated support of the National Science Foundation, a symposium on *Pseudodifferential operator and Fourier integral operators with applications to partial differential equations* is scheduled to take place Monday through Thursday, April 2–5. This topic was selected by the 1982 Committee to Select Hour Speakers for Central Sectional Meetings, whose members were Richard A. Askey, M. Salah Baouendi (chairman), Paul T. Bateman, R. H. Bing, and J. Ian Richards.

The Organizing Committee for the symposium consists of Charles Fefferman, Princeton University; Victor W. Guillemin, Massachusetts Institute of Technology; Nancy K. Stanton, University of Notre Dame; Michael E. Taylor, SUNY, Center at Stony Brook; and François Trèves (chairman), Rutgers University.

Names of speakers in the symposium will be announced in the January issue of the *Notices*.

### Association for Symbolic Logic

There will be a meeting of the Association for Symbolic Logic on Saturday and Sunday, April 7 and 8. Further details may be obtained from Julia F. Knight, Department of Mathematics, University of Notre Dame, Notre Dame, Indiana 46556.

### Petition Table

A petition table will be set up in the registration area. Additional information can be found in a box in the Louisville meeting announcement in this issue.

### Book Exhibits and Sale

There will be an exhibit of assorted mathematics books offered by various publishers, and a sale at substantial discounts of recent books published by the American Mathematical Society. Further information will be available in a later issue of the *Notices*.

### Travel and Accommodations

Information on travel and accommodations will be given in the next issue of the *Notices*.

**Paul T. Bateman**  
Associate Secretary

Urbana, Illinois

# MATHFILE — Mathematical Reviews Online

**MATHFILE** is the online database of **Mathematical Reviews (MR)** produced by the American Mathematical Society. It provides essentially complete worldwide coverage of pure and applied mathematics as well as mathematical applications in other fields such as physics, engineering, computer science, biology and operations research.

**MATHFILE** provides excellent and quick access to the international mathematical research literature. Using Boolean logic, one can identify and intersect mathematical terms and concepts, authors, publishers, journals, and AMS classifications, to produce research information, bibliographies, statistics, etc., about mathematics.

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**MATHFILE** is available electronically through online vendors **DIALOG**, **BRS** and **SAMSOM**. Communicate with the vendors directly to establish accounts. Costs to use **MATHFILE** vary with the vendor. Connect time charge is approximately \$60/hour. Professional librarians access the online systems daily and can perform most searches within 5 to 10 minutes.

A **NEW**, simplified low-cost system has been designed for home computer use—**BRS/After Dark**. **MATHFILE** is accessible through **After Dark** at the greatly reduced rate of \$13/hour from 6 p.m. to 12 p.m. The system is menu-driven, eliminating the need for long manuals and training. Communicate with **BRS** for account and system information.

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The Netherlands  
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outside The Netherlands.

**MATHFILE User's Guide.** This 360-page loose-leaf Guide, which is updated as necessary, is designed to help the user access information more quickly and efficiently. \$55 list and \$41 for AMS members. See the AMS catalogue for more information.

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For each article requested, the first 10 pages or fewer will cost \$12. Additional pages beyond the first 10 will be \$2 for 10 pages or fewer. Copyright royalties will be added in compliance with Copyright Clearance Center regulations.

## For more information: MATHFILE and user aids

Taissa T. Kusma  
Database Specialist, American Mathematical Society  
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Librarian, Mathematical Reviews  
611 Church Street, P.O. Box 8604  
Ann Arbor, MI 48107  
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# Richmond, April 13–14, 1984, Virginia Commonwealth University

## First announcement of the 811th Meeting

The eight hundred and eleventh meeting of the American Mathematical Society scheduled jointly with the Maryland–District of Columbia–Virginia Section of the Mathematical Association of America will be held at Virginia Commonwealth University, Richmond, Virginia, on Friday and Saturday, April 13–14, 1984.

### Invited Addresses

By invitation of the 1983 Committee to Select Hour Speakers for Southeastern Sectional Meetings, there will be three AMS invited one-hour addresses. The speakers and their affiliations are as follows:

BÉLA BALLOBÁS, Louisiana State University.

THOMAS F. BANCHOFF, Brown University.

JOHN J. WALSH, University of Tennessee.

Professor Banchoff is jointly invited by the AMS and MAA to address a joint meeting at 7:00 p.m. on Friday night. Titles and scheduled times of presentations will appear in the next issue of the *Notices*.

### Special Sessions

By invitation of the same committee, there will be three special sessions of selected twenty-minute papers. The topics of these special sessions and the names of the organizers are:

*Field theory*, JAMES K. DEVENEY, Virginia Commonwealth University.

*Low dimensional topology*, WILBUR WHITTEN, University of Southwestern Louisiana.

*Applied mathematics*, organizer to be announced.

Most of the papers to be presented at these special sessions will be by invitation. However, anyone submitting an abstract for the meeting who feels that his or her paper would be particularly appropriate for one of these special sessions should indicate this

clearly on the abstract and submit it by **January 16**, three weeks before the deadline for contributed papers.

### Contributed Papers

There will also be sessions for contributed ten-minute papers. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence, or in departments of mathematics. Abstracts should be sent to the American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940, so as to arrive prior to the abstract deadline of **February 6, 1984**. Members are reminded that a charge of \$12 is imposed for retyping abstracts that are not in camera-ready form.

### Other Activities

In conjunction with the joint AMS-MAA sectional meetings, Virginia Commonwealth University will host a mini-symposium on *Analysis on Semigroups*, coordinated by J. F. Berglund, P. Milnes and H. D. Junghenn. The mini-symposium will be held on April 12 and 13. Persons interested in participating should contact J. F. Berglund, Mathematical Sciences Department, Virginia Commonwealth University, Richmond, Virginia 23284.

### Petition Table

A petition table will be set up in the registration area. Additional information can be found in a box in the Louisville meeting announcement in this issue.

### Accommodations and Travel

Information on accommodations and travel will appear in the next issue of the *Notices*.

**Frank T. Birtel**

New Orleans, Louisiana

Associate Secretary



### Structure of Factors and Automorphism Groups Masamichi Takesaki

CBMS REGIONAL CONFERENCE SERIES, NUMBER 51  
(Supported by the National Science Foundation)

This book describes the recent development in the structure theory of von Neumann algebras and their automorphism groups. It gives a quick survey of the Tomita-Takesaki theory needed for the latter use, then moves on to the duality theory for crossed products and automorphism groups, which is applied to the structure theory of factors of type III. The last part is devoted to Connes' theory of injective factors. The book can be viewed as a guided tour to the state of the art.

#### Contents

- I. Noncommutative Integration
- II. General Theory of Crossed Products and Duality
- III. Structure of Factors of Type III
- IV. Connes' Theory of Injective Factors and Automorphisms

1980 *Mathematics Subject Classification*: 46L10

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# 1984 SUMMER SEMINAR IN APPLIED MATHEMATICS

## Nonlinear Systems of PDE in Applied Mathematics

July 8–July 21, 1984  
College of Santa Fe  
Santa Fe, New Mexico

The sixteenth AMS-SIAM Summer Seminar in Applied Mathematics will be held July 8–July 21, 1984, and will take place at the College of Santa Fe, Santa Fe, New Mexico. The seminar will be sponsored jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics. It is anticipated that it will be supported by a grant from a federal agency. The topic *Nonlinear systems of PDE in Applied Mathematics* was selected by the AMS-SIAM Committee on Applied Mathematics whose members at the time were R. W. Brockett, John E. Dennis, Jr., Norman Lebovitz, Alan C. Newell, (chairman), George C. Papanicolaou, and R. S. Warming.

The seminar will address three major subtopics of nonlinear systems of partial differential equations in applied mathematics: hyperbolic systems, completely integrable systems, and evolutionary systems of nonlinear partial differential equations. Recent progress has been pushed by interrelated developments in dynamical systems theory, Hamiltonian structure, and soliton theory. The interplay of these developments with the theory of hyperbolic systems and evolutionary systems will be stressed.

Lecture topics and speakers will be selected by the Organizing Committee and Advisory Committee.

The members of the Organizing Committee are Darryl D. Holm, James M. Hyman, and Basil Nicolaenko (chairman), all of the Center for Nonlinear Studies, Los Alamos National Laboratory. Members of the Advisory Committee are: Peter D. Lax, Courant Institute, New York University; J. L. Lions, Collège de France, Paris; Jerrold Marsden, University of California, Berkeley; David McLaughlin, University of Arizona; Louis Nirenberg, Courant Institute of the Mathematical Sciences, New York University; and Isadore M. Singer, University of California, Berkeley.

In the early spring a brochure will be available from the AMS office which will include a description of the scientific program, as well as information on the residence and dining hall facilities, with firm room and board rates, local information, and a reservation form to be used to obtain accommodations on campus. Each participant will pay a social fee to cover the cost of refreshments served at breaks and for social events. There will also be a meeting registration fee of \$30 (\$10 for students and/or unemployed).

Individuals may apply for admission to the seminar. Application blanks for admission and/or financial assistance can be obtained from the Meetings Department, American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940. **The deadline for return of applications is March 2, 1984.** An applicant should have completed at least one year of graduate school and will be asked to indicate his or her scientific background and interest. A graduate student's application must be accompanied by a letter from his or her faculty advisor concerning the applicant's ability and promise. Those who wish to apply for a grant-in-aid should so indicate; however, funds available for the seminar are limited and individuals who can obtain support from other sources should do so.

## Hopf Bifurcation in the Two Locus Genetic Model

Ethan Akin

Hopf bifurcations occur in the class of simple genetic models for the combined effect of selection and recombination. The demonstration of cycling in such models is biologically unexpected. To study this phenomenon we describe the locus of positions at which Hopf bifurcation occurs in the two-locus-two-allele model. The description is given by an explicit, computable parametrization which can be used to generate all possible examples. Asymptotic estimates show that limit cycles can occur.

### I. Cycles in simple genetic systems

1. The space of selection matrices, 2. Eigenvalues, eigenvectors and linear differential equations, 3. Nonlinear equilibria and Hopf bifurcations, 4. The Hopf bifurcation locus, 5. Parametrization of  $\Sigma_H$ , 6. Symmetries, 7. Concluding remarks.

### II. Parametric description of the Hopf locus

1. Linear maps, bilinear forms and matrices, 2. Coordinates and the cylindrical frame, 3. Linearizations and Hessians, 4. The parametrization, 5. Symmetric cases, 6. MARMC, 7. Asymptotic estimates.

### III. Programs and examples

1. The general program, 2. The symmetric program 3. Sample computations

### Bibliography

1980 *Mathematics Subject Classifications*: 34C25, 92A10

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# Joint Summer Research Conferences in the Mathematical Sciences

*Bowdoin College, June 10 to August 18, 1984*

The 1984 Joint Summer Research Conferences in the Mathematical Sciences will be held at Bowdoin College, Brunswick, Maine, between June 10 and August 18, 1984. It is anticipated that the series of week-long conferences will be supported by a grant from the National Science Foundation.

There will be ten one-week conferences in ten different areas of mathematics. Each week participants will arrive on Sunday and leave the following Saturday. The topics and organizers for the ten conferences were selected by the AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences. The selections were based on suggestions made by the members of the committee, by members of the Council of the AMS and others. The committee considered it important that the conferences represent diverse areas of mathematical activity, with emphasis on areas currently especially active, and paid careful attention to subjects in which there is important interdisciplinary activity at present.

The conferences will be similar in structure to those held throughout the year at Oberwolfach. These conferences are intended to complement the Society's program of annual Summer Institutes and Summer Seminars, which have much larger attendance and are substantially broader in scope. The conferences are research conferences, and are not intended to provide an entree to a field in which a participant has not already worked.

It is expected that funding will be available for about thirty participants in each conference. Others, in addition to those funded, will be welcome, within the limitations of the facilities of the campus. Up to about seventy participants can be accommodated at each conference. Housing accommodations will be available on campus for those attending the conference, and daily meals will be served in a dining hall near the dormitories. A brochure describing the facilities available at Bowdoin College will be available from the AMS office in March 1984. The brochure will include information on firm room rates and the residence and dining hall facilities, as well as local information and a reservation form to be used for accommodations on campus. Each participant will pay a registration and social fee to cover the cost of refreshments served at breaks and for social events.

Those interested in attending one of the conferences should request an application form from Carole Kohanski, Summer Research Conference Coordinator, American Mathematical Society, Post Office Box 6248, Providence, RI 02940 (401-272-9500, extension 286), specifying which conference they wish to attend. Selection of the participants and approval of participant support will be made by the Organizing Committee for each conference. Women and members of minority groups are encouraged to apply and to participate in these conferences. The deadline for receipt of applications is **January 16, 1984**. Those who wish to apply for a grant-in-aid should so indicate on the application form; however, funds available for these conferences are limited and so individuals who can obtain support from other sources should do so.

The Joint Summer Research Conferences in the Mathematical Sciences is under the direction of the AMS-IMS-SIAM Committee on Summer Research Conferences in the Mathematical Sciences which includes: Benedict Gross, Malcolm R. Leadbetter, Angus J. Macintyre, Jerrold E. Marsden, James McKenna, Evelyn M. Nelson, Katsumi Nomizu, Julius Shaneson, R. O. Wells, Jr. (chairman), and Shmuel Winograd.

Descriptions of the subject matter of each of the 1984 Conferences appeared in the October *Notices*, pages 663 to 665; they were accompanied by lists of members of the respective organizing committees.

## June 10 to June 16

*New multivariate methods in statistics*

PETER HUBER (Harvard University), Chairman

## June 17 to June 23

*Random matrices and their applications*

JOEL COHEN (Rockefeller University), Chairman

## June 24 to June 30

*The mathematics of phase transitions*

RICHARD DURRETT (University of California, Los Angeles), Chairman

## July 1 to July 7

*Aspherical complexes*

KENNETH BROWN (Cornell University), Co-Chairman

F. T. FARRELL (University of Michigan, Ann Arbor), Co-Chairman

## July 8 to July 14

*Group actions on rings*

SUSAN MONTGOMERY (University of Southern California), Chairman

## July 15 to July 21

*Diophantine problems, including diophantine equations, diophantine approximation, and transcendence*

D. J. LEWIS (University of Michigan, Ann Arbor), Co-Chairman

W. M. SCHMIDT (University of Colorado, Boulder), Co-Chairman

## July 22 to July 28

*The Selberg trace formula and related topics*

AUDREY TERRAS (University of California, San Diego), Chairman

## July 29 to August 4

*Linear algebra and its role in systems theory*

BISWA NATH DATTA (Northern Illinois University), Chairman

## August 5 to August 11

*Integral geometry*

ROBERT L. BRYANT (Rice University), Chairman

## August 12 to August 18

*Complex differential geometry and non-linear differential equations*

Y. T. SIU (Harvard University), Chairman

# Invited Speakers and Special Sessions

## Invited Speakers at AMS Meetings

The individuals listed below have accepted invitations to address the Society at the times and places indicated. For some meetings, the list of speakers is incomplete.

### Louisville, January 1984

Gunnar Carlsson	M. Susan Montgomery
Persi Diaconis	Herbert A. Simon
Simon K. Donaldson	(Gibbs Lecturer)
Robert D. MacPherson	Leon Simon
Andrew Majda	Robert E. Tarjan
Barry Mazur	
(Colloquium Lecturer)	

### Notre Dame, April 1984

Gerd Faltings	Karel L. Prikry
Nigel J. Kalton	William F. Schelter
Paul G. Nevai	

### Richmond, April 1984

Béla Ballobás	John J. Walsh
Thomas F. Banchoff	

### Plymouth, June 1984

David Catlin	Amatai Regev
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### Minneapolis, November 1984

Jerry L. Bona	Naresh C. Jain
I. Martin Isaacs	Stephen C. Milne

## Organizers and Topics of Special Sessions

The list below contains all the information about Special Sessions at meetings of the Society available at the time this issue of the *Notices* went to the printer.

The section below entitled **Information for Organizers** describes the timetable for announcing the existence of Special Sessions.

### January 1984 Meeting in Louisville

Associate Secretary: W. Wistar Comfort

*Deadline for organizers: Expired*  
*Deadline for consideration: Expired*

Donald W. Anderson and Gunnar Carlsson, *Homotopy theory*  
J. Thomas Beale, *Incompressible fluid flow*  
John B. Conway, *Function theoretic operator theory*  
Persi Diaconis, *Random walks on finite groups*  
Andrew M. W. Glass, *Ordered algebraic structures*  
Henry Hermes and Hector Sussmann, *Vector field systems and control*  
Mark A. Kon, *Partial differential operators*  
Suzanne M. Lenhart, *Partial differential equations and optimal control problems*  
M. Susan Montgomery and Lance Small, *Ring theory*  
Ira J. Papick, *Commutative algebra*

William L. Perry, *Ill-posed problems*

W. Wiley Williams, *Semigroup theory*

### April 1984 Meeting in Notre Dame

Central Section

*Deadline for organizers: Expired*  
*Deadline for consideration: January 10, 1984*

Theodore S. Chihara, *Orthogonal polynomials and their applications*

Barbara Cortzen, *Ring theory*

Julia F. Knight, *Model theory*

N. Tenney Peck, *Metric linear function spaces*

T. K. Puttaswamy, *Differential equations*

### April 1984 Meeting in Richmond

Southeastern Section

*Deadline for organizers: Expired*  
*Deadline for consideration: January 16, 1984*

James K. Deveney, *Field theory*

Wilbur Whitten, *Low dimensional topology*

Organizer to be announced, *Applied mathematics*

### June/July 1984 Meeting in Plymouth

Eastern Section

*Deadline for organizers: Expired*  
*Deadline for consideration: April 2, 1984*

### August 1984 Meeting in Eugene

Associate Secretary: Frank T. Birtel

*Deadline for organizers: November 15, 1983*  
*Deadline for consideration: May 15 or June 8, 1984*

### November 1984 Meeting in Minneapolis

Central Section

*Deadline for organizers: January 15, 1984*  
*Deadline for consideration: To be announced*

Marian B. Pour-El, *Logic*

### November 1984 Meeting in San Diego

Far Western Section

*Deadline for organizers: January 15, 1984*  
*Deadline for consideration: To be announced*

S.-Y. A. Chang, *Classical harmonic analysis*

Carl Cunningham and David Lesley, *Complex analysis*

### Fall 1984 Meeting

Eastern Section

*Deadline for organizers: To be announced*  
*Deadline for consideration: To be announced*

### Fall 1984 Meeting

Southeastern Section

*Deadline for organizers: To be announced*  
*Deadline for consideration: To be announced*

### January 1985 Meeting in Anaheim

Associate Secretary: Hugo Rossi

*Deadline for organizers: April 15, 1984*  
*Deadline for consideration: To be announced*

### March 1985 Meeting in Chicago

Central Section

*Deadline for organizers: May 15, 1984*  
*Deadline for consideration: To be announced*

### Send Proposals for Special Sessions to the Associate Secretaries

The programs of sectional meetings are arranged by the Associate Secretary for the section in question:

#### Far Western Section (Pacific and Mountain)

Hugo Rossi, Associate Secretary  
Department of Mathematics  
Institute for Advanced Study  
Princeton, NJ 08540  
(Telephone 609-734-8157)

#### Central Section

Robert M. Fossum, Associate Secretary Presumptive  
Department of Mathematics  
University of Illinois  
1409 West Green Street  
Urbana, IL 61801  
(Telephone 217-333-3975)

#### Eastern Section

W. Wistar Comfort, Associate Secretary  
Department of Mathematics  
Wesleyan University  
Middletown, CT 06457  
(Telephone 203-347-9411)

#### Southeastern Section

Frank T. Birtel, Associate Secretary  
Department of Mathematics  
Tulane University  
New Orleans, LA 70118  
(Telephone 504-865-5646)

As a general rule, members who anticipate organizing Special Sessions at AMS meetings are advised to seek approval at least nine months prior to the scheduled date of the meeting. No Special Sessions can be approved too late to provide adequate advance notice to members who wish to participate.

### Information for Organizers

Special Sessions at Annual and Summer meetings are held under the general supervision of the Program Committee. They are administered by the Associate Secretary in charge of the meeting with staff assistance from the Society office in Providence.

Some Special Sessions arise from an invitation to a proposed organizer issued through the Associate Secretary. Others are spontaneously proposed by interested organizers or participants. Such proposals are welcomed by the Associate Secretaries.

The number of Special Sessions at a Summer or Annual Meeting is limited to twelve. Proposals, invited or offered, which are received at least nine months prior to the meeting are screened for suitability of the topic and of the proposed list of speakers, and for possible overlap or conflict with other proposals (specific deadlines for requesting approval for Special Sessions at national meetings are given above). If necessary, the numerical limitation is enforced.

Proposals for Special Sessions should be submitted directly to the Associate Secretary in charge of the meeting (at the address given in the accompanying box). If such proposals are sent to the Providence office, addressed to the *Notices*, or directed to anyone other than the Associate Secretary, they will have to be forwarded and may not be received before the quota is filled.

In accordance with an action of the Executive Committee of the Council, no Special Session may

be arranged so late that it may not be announced in the *Notices* early enough to allow any member of the Society, who wishes to do so, to submit an abstract for consideration for presentation in the Special Session before the deadline for such consideration.

Special Sessions are effective at sectional meetings and can usually be accommodated. They are arranged by the Associate Secretary under the supervision of the Committee to Select Hour Speakers for the section. The limitation on the number of sessions depends on the space and time available. The same restriction as for national meetings applies to the deadline for announcing Special Sessions at sectional meetings: no Special Session may be approved too late for its announcement to appear in time to allow a reasonable interval for members to prepare and submit their abstracts prior to the special early deadline set for consideration of papers for Special Sessions.

### Information for Speakers

A great many of the papers presented in Special Sessions at meetings of the Society are invited papers, but any member of the Society who wishes to do so may submit an abstract for consideration for presentation in a Special Session, provided it is received in Providence prior to the special early deadline announced above and in the announcements of the meeting at which the Special Session has been scheduled.

Abstracts of papers submitted for consideration for presentation at a Special Session must be received by the Providence office (Editorial Department, American Mathematical Society, Post Office Box 6248, Providence, RI 02940) by the special deadline for Special Sessions, which is usually three weeks earlier than the deadline for contributed papers for the same meeting. The Council has decreed that no paper, whether invited or contributed, may be listed in the program of a meeting of the Society unless an abstract of the paper has been received in Providence prior to the deadline.

### Call for Invitations

The undersigned Associate Secretary hereby solicits invitations from institutions interested in serving as host to a future meeting (Eastern Section) of the Society.

Among desirable characteristics for the site of a sectional meeting are:

- (a) Accessibility via public transportation;
- (b) Availability of inexpensive food and lodging on or near campus;
- (c) Minimal cost (normally nil) to the Society for the use of classrooms and other facilities; and
- (d) A couple of energetic local mathematicians willing to serve as an Arrangements Committee.

Planning for a sectional meeting begins approximately two years in advance of the meeting itself. At the moment we seek sites for meetings in the Spring and the Fall of 1985. Exact dates are flexible and negotiable.

Exploratory correspondence may be addressed to W. W. Comfort, Associate Secretary, AMS, Department of Mathematics, Wesleyan University, Middletown, Connecticut 06457.

## Special Meetings

THIS SECTION contains announcements of meetings of interest to some segment of the mathematical public, including *ad hoc*, local, or regional meetings, and meetings or symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. (Information on meetings of the Society, and on meetings sponsored by the Society, will be found inside the front cover.)

AN ANNOUNCEMENT will be published in the *Notices* if it contains a call for papers, and specifies the place, date, subject (when applicable), and the speakers; a second full announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in each issue until it has been held and a reference will be given in parentheses to the month, year and page of the issue in which the complete information appeared.

IN GENERAL, announcements of meetings held in North America carry only date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. All communications on special meetings should be sent to the Editor of the *Notices*, care of the American Mathematical Society in Providence.

DEADLINES for entries in this section are listed on the inside front cover of each issue. In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the *Notices* prior to the meeting in question. To achieve this, listings should be received in Providence SIX MONTHS prior to the scheduled date of the meeting.

Fall 1983. **Special Semester in Hodge Theory: Valley Geometry Seminar**, Amherst College, Amherst, Massachusetts; Mount Holyoke College, South Hadley, Massachusetts; Smith College, Northampton, Massachusetts; University of Massachusetts, Amherst, Massachusetts. (October 1983, p. 669)

1983–1984. **Academic Year Devoted to Problems on Iteration in Classical Real and Complex Analysis**, The Mittag-Leffler Institute, Djursholm, Sweden. (February 1983, p. 205)

1983. **Special Year in Commutative Algebra and Algebraic Geometry**, University of Illinois, Urbana, Illinois. (November 1982, p. 699)

October 2, 1983–September 29, 1984. **Mathematisches Forschungsinstitut Oberwolfach** (Weekly Conferences), Federal Republic of Germany. (October 1983, p. 669)

1984. **European Mechanics Colloquia**, Various locations.  
*Information:* Secretary of the European Mechanics Committee, H. H. Fernholz (Hermann-Föttinger-Institut für Thermo- und Fluidodynamik) Techn. Universität Berlin, Strasse des 17. Juni 135, D-1000 Berlin 12, Germany.

### NOVEMBER 1983

16–18. **Eighth Conference on Probability & Statistics in the Atmospheric Sciences**, Hot Springs, Arkansas. (June 1983, p. 438)

24–28. **First Asian-Pacific Conference on Science Education**, Taipei, Republic of China. (October 1983, p. 671)

28–December 2. **Eighth Australasian Fluid Mechanics Conference**, Newcastle, Australia. (October 1983, p. 671)

### DECEMBER 1983

1–2. **International Conference on Collective Phenomena** (A Moscow Refusenik Seminar-in-Exile), Stockholm, Sweden. (October 1983, p. 671)

2–3. **Midwest Conference on Representation Theory and Automorphic Forms**, Ohio State University, Columbus, Ohio.

*Program:* There will be five one-hour talks given by P. Gérardin, J. I. Igusa, P. Sally, N. Wallach and one additional speaker.

*Information:* S. Rallis or R. J. Stanton, Department of Mathematics, Ohio State University, Columbus, Ohio 43210.

5–7. **Everett Pitcher Lecture Series**, Lehigh University, Bethlehem, Pennsylvania. (August 1983, p. 542)

5–7. **Second Latin American Conference on Applied Mathematics**, Laboratorio de Computação Científica LCC/CNPq, Rio de Janeiro, Brazil. (April 1983, p. 364)

5–16. **Workshop on Pattern Recognition and Analysis of Seismicity**, Miramare-Trieste, Italy. (June 1983, p. 438)

6–9. **Congrès du Centenaire de la S.E.E., "Électricité, électronique et civilisation"**, Paris, France. (August 1983, p. 542)

### JANUARY 1984

1–December 14. **Symposium on Hyperbolic Geometry, Kleinian Groups and Three-Dimensional Manifolds**, University of Warwick, Coventry, England. (October 1983, p. 671)

6–10. **NSF-CBMS Regional Conference on Some Global Problems Concerning Curvature of Riemannian Manifolds**, Polytechnic Institute of New York, Brooklyn, New York. (August 1983, p. 542)

9–13. **NSF-CBMS Regional Conference on Minimax Methods in Critical Point Theory and Applications to Differential Equations**, University of Miami, Coral Gables, Florida. (October 1983, p. 672)

16–20. **Symposium International "Signatures Micro-ondes en Télédétection"**, Toulouse, France. (October 1983, p. 672)

27–29. **Mathematical Association of America Annual Meeting**, Louisville, Kentucky. (October 1983, p. 672)

### FEBRUARY 1984

6–9. **Second International Modal Analysis Conference**, Orlando, Florida. (October 1983, p. 672)

### MARCH 1984

12–16. **Seventeenth Annual Simulation Symposium**, Bay Harbor Inn, Old Tampa Bay, Florida. (October 1983, p. 672)

19–21. **International Conference on Numerical Analysis**, Technische Universität Munich, Munich, Federal Republic of Germany. (October 1983, p. 672)

2-4. **Third ACM SIGACT-SIGMOD Symposium on Principles of Database Systems**, Waterloo, Ontario, Canada. (October 1983, p. 672)

9-13. **British Mathematical Colloquium**, University of Bristol, Bristol, United Kingdom.

*Program:* The principal speakers will be J. P. Serre (Paris), M. O. Rabin (Harvard and Jerusalem), and H. Furstenberg (Jerusalem). There will also be fifteen additional speakers. The colloquium will include an educational forum on the use of computers in university mathematics teaching.

*Information:* H. E. Rose, Colloquium Secretary, School of Mathematics, University of Bristol, University Walk, Bristol BS8 1TW, United Kingdom.

11-13. **Symposium on Theoretical Aspects of Computer Science**, Paris, France. (October 1983, p. 672)

12-14. **Annual Lecture Series in the Mathematical Sciences: Estimation and Control of Distributed Systems**, Fayetteville, Arkansas. (October 1983, p. 672)

17-19. **Sixth Colloque International sur la Programmation**, Toulouse, France. (October 1983, p. 672)

19-20. **Fifteenth Annual Pittsburgh Conference on Modeling and Simulation**, University of Pittsburgh, Pittsburgh, Pennsylvania. (October 1983, p. 672)

23-27. **Conference Celebrating the Sixtieth Birthday of Professor Harish-Chandra**, Institute for Advanced Study, Princeton, New Jersey.

*Theme:* Harmonic analysis and the representation theory of reductive groups. The talks are intended to be of general interest, and will include surveys of recent work.

*Speakers (tentative):* J. Arthur, J. Bernstein, F. Bruhat, L. Clozel, T. Enright, S. Helgason, R. Howe, H. Jacquet, D. Kazhdan, R. Langlands, G. Lusztig, W. Schmid, V. Varadarajan, D. Vogan.

*Information:* V. S. Varadarajan, Department of Mathematics, University of California, Los Angeles, California 90024.

# MAY 1984

1-4. **Conference on the Mathematics of Finite Elements and Applications**, Uxbridge, Great Britain.

*Information:* The Secretary, The Institute of Computational Mathematics, Brunel University, Uxbridge, Middlesex UB8 3PH, Great Britain.

2-4. **Optimisation Days 1984**, Concordia University, Montreal, Quebec, Canada.

*Organizers:* École Polytechnique, McGill University, Concordia University, Université de Montréal, École des Hautes Études Commerciales, Université du Québec à Montréal.

*Program:* Sessions will consist of invited and contributed talks. Topics may include: mathematical programming; optimal control theory; numerical methods of optimization; systems theory, including large scale systems; statistical methods; estimation and identification, as well as applications to engineering, management sciences, transportation, economics, urban and environmental problems, resource management, biology, and so on.

*Deadline for Abstracts:* A 200- to 700-word abstract in English or French should be sent to the address below by January 31, 1984.

*Information and Abstracts:* G. Pederzoli or C. L. Sandblom, Department of Quantitative Methods, Concordia University, 7141 Sherbrooke Street West, Montreal, Quebec H4B 1R6, Canada.

4-6. **Midwest Algebraic Geometry Conference**, Purdue University, West Lafayette, Indiana. (October 1983, p. 672)

7-11. **ACM-IEEE Computer Society Tutorials for Professional Development**, Chicago, Illinois. (October 1983, p. 672)

13-17. **Computer Graphics '84**, Anaheim Convention Center, Anaheim, California. (October 1983, p. 672)

17-18. **IMACS International Symposium on Modelling and Simulation of Electrical Machines and Converters**, Liege, Belgium. (October 1983, p. 672)

28-June 1. **Sixteenth Yugoslav Congress of Theoretical and Applied Mechanics**, Bečići, Yugoslavia.

*Program:* There will be general lectures and contributed papers in the areas of general mechanics; fluid mechanics; and mechanics of deformable bodies.

*Information:* J. Jaric, Yugoslav Society of Mechanics (16th Congress 1984), Kneza Milosa 9/i, 11000 Belgrade, Yugoslavia.

# JUNE 1984

4-8. **Fifth International Conference on the Theory and Applications of Graphs, With Special Emphasis on Computer Science Applications**, Western Michigan University, Kalamazoo, Michigan. (June 1983, p. 438)

6-8. **1984 American Control Conference**, San Diego, California. (October 1983, p. 673)

10-14. **Conference on Global Differential Geometry-Global Analysis**, Technical University Berlin, Berlin, Federal Republic of Germany.

*Organizing Committee:* Ferus, Gardner, Helgason, Kühnel, Simon, Wegner.

*Information:* (United States and Canada) Robert B. Gardner, Department of Mathematics, University of North Carolina, Chapel Hill, North Carolina, 27514. (Other countries) Dirk Ferus, Fachbereich 3-Mathematik, Technische Universität Berlin, Strasse des 17 Juni 135, 1000 Berlin 12, Federal Republic of Germany.

12-14. **Tenth International Symposium on Machine Processing of Remotely Sensed Data**, Purdue University, West Lafayette, Indiana. (October 1983, p. 673)

18-20. **Twenty-sixth International Meeting of the Institute of Management Sciences**, Copenhagen, Denmark.

*Information:* Julie Eldridge, TIMS, 146 Westminster Street, Providence, Rhode Island 02903, 401-274-2525.

19-21. **Fifth IMACS International Symposium on Computer Methods for Partial Differential Equations**, Lehigh University, Bethlehem, Pennsylvania. (October 1983, p. 673)

20-22. **Fourteenth International Conference on Fault-Tolerant Computing**, Hyatt Orlando Hotel, Kissimmee, Florida.

*Topics:* Papers and panel session proposals in the following areas are invited: fault-tolerant computer system/network/switching/distribution systems; hardware fault-tolerant design and methodology; dependable software development and recovery techniques; topics in testing and testability; modeling, evaluation, simulation, verification and measurements; new concepts and merging disciplines.

*Deadline for Submissions:* All papers and panel proposals must be submitted by November 18, 1983, to the Program Committee Chairman, Ben M. Y. Hsiao, IBM Corporation, P. O. Box 390, Dept. D18, Bldg. 707, Poughkeepsie, New York, 12602, 914-463-8007.

*Information for Authors:* Submit five copies, double-spaced, of a 1000-5000-word paper. The first page must include title and subject index and an abstract of not more than 150 words; all of the authors' names, addresses, affiliations and telephone numbers; and indication that the paper has been cleared through the authors' affiliations. For panel proposals, a 1000-word summary of each proposed panelist's subject is needed.

*Information:* Richard M. Sedmak, General Chairman, FTCS 14, Sperry Corporation, P. O. Box 500, M.S. C1-SW12, Blue Bell, Pennsylvania, 19424, 215-542-3638.

**20–22. Third International Conference on Boundary and Interior Layers (BAIL III)**, Dublin, Ireland. (October 1983, p. 673)

**25–29. International Workshop on Applied Optimization Techniques in Energy Problems**, Linz, Austria.

*Topics:* Optimal scheduling of power systems; forecasting techniques for the electrical power demand; network flow problems; optimization of electrical power plants; real time river flow forecasting techniques.

*Information:* Hj. Wacker, Math. Institut, Johannes-Kepler-Universität Linz, Altenbergerstrasse, A-4040 Linz, Austria.

#### JULY 1984

**2–11. Canadian Mathematical Society Summer Seminar on Algebraic Geometry**, University of British Columbia, Vancouver, Canada. (October 1983, p. 673)

**8–14. Gatlinburg IX: Householder-Gatlinburg Meeting on Numerical Algebra**, Waterloo, Ontario, Canada.

*Deadline for Applications:* November 30, 1983. Attendance limited to 100.

*Information:* Alan George, Department of Computer Science, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1.

**9–12. Twelfth Annual National Computer Conference**, Las Vegas, Nevada.

*Program:* The theme of the conference is "Enhancing Creativity." The conference will consider the increasing personalization of computer systems, and the attendant focus on individual productivity and innovation.

*Information:* Dennis J. Frailey, Program Chairman, Texas Instruments, 8642-A Spicewood Springs Road, Suite 1984, P. O. Box 10998, Austin, Texas 78766-1998, 512-250-6663.

**11–14. Conference on Universal Algebra and Lattice Theory**, The Citadel, Charleston, South Carolina. (October 1983, p. 673)

**23–27. Conference on Complex Analysis and Approximation Theory**, State University of Campinas, Campinas, São Paulo, Brazil.

*Information:* Jorge Mujica, Instituto de Matemática, Universidade Estadual de Campinas, Caixa Postal 6155, 13100 Campinas SP, Brazil.

**23–August 8. NATO-ASI Conference on Computational Mathematical Programming**, Bad Windsheim, Federal Republic of Germany.

*Information:* K. Schittkowski, Institut für Informatik, Azenbergstrasse 12, D-7000 Stuttgart 1, Federal Republic of Germany.

**24–27. International Congress on Computational and Applied Mathematics**, University of Leuven, Belgium. (February 1983, p. 210)

**25–August 4. Edinburgh Mathematical Colloquium**, University of St. Andrews, Scotland. (October 1983, p. 673)

#### AUGUST 1984

**1–3. Fifth ASCE-EMD Specialty Conference: Engineering Mechanics in Civil Engineering**, University of Wyoming, Laramie, Wyoming.

*Deadline for Abstracts:* December 1, 1983.

*Information:* Ken P. Chong, Department of Civil Engineering, University of Wyoming, University Station Box 3295, Laramie, Wyoming 82071.

**19–25. Sixteenth International Congress of Theoretical and Applied Mechanics**, Lyngby, Denmark. (October 1983, p. 673)

**24–30. Fifth International Congress on Mathematics Education**, University of Adelaide, Australia. (June 1982, pp. 331, 376)

*Information and Registration:* ICMI 5, Wattle Park Teachers' Centre, 424 Kensington Road, Wattle Park, South Australia 5066, Australia.

**27–31. COMPSTAT 1984: Sixth Symposium on Computational Statistics**, Prague, Czechoslovakia.

*Program:* The symposium will cover computational statistics, including numerical and algorithmic aspects of statistical methods and their applications and relevant techniques in computer science.

*Information:* M. Novak, General Computer Center, Czechoslovak Academy of Sciences, 182 07–Prague, P. O. Box 5, Czechoslovakia.

#### OCTOBER 1984

**15–17. Society of Engineering Science Annual Meeting**, Blacksburg, Virginia.

*Information:* Daniel Frederick, Department of Engineering Science and Mechanics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061.

**15–18. International Symposium on Orthogonal Polynomials and their Applications**, Bar-le-Duc, France. (October 1983, p. 673)

**25–28. American Mathematical Association of Two-Year Colleges' Annual Convention**, New York, New York.

*Call for Papers:* Those wishing to speak at the convention should contact Larry Gilligan, Mattatuck Community College, Waterbury, Connecticut 06708. Those wishing to preside over sessions should contact Larry Rubin, Nashville State Technical Institute, Nashville, Tennessee 37209.

*Program Deadline:* March 1, 1984.

*Information:* Allen Angel, 1984 AMATYC Convention Chairperson, Monroe Community College, Rochester, New York 14623.

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### AMS SHORT COURSE LECTURE NOTES

Introductory Survey Lectures

(Proceedings of Symposia in Applied Mathematics)  
(ISSN 0160-7634)

#### **Applied Cryptology, Cryptographic Protocols, and Computer Security Models**

**Richard A. DeMillo, George I. Davida,**

**David P. Dobkin, Michael A. Harrison, and**

**Richard J. Lipton**

On January 5–6, 1981, the authors delivered a series of lectures entitled *Cryptology in Revolution: Mathematics and Models* to a meeting of the American Mathematical Society. This survey of cryptology and computer security is an edited and expanded version of the notes which the Society published for the original lecture series.

The presentation is organized as follows. A survey of cryptographic theory which emphasizes the two major developments of contemporary cryptography (the federal data encryption standard and public-key cryptography) is presented in Chapter 2. Chapter 3 presents a survey of the security problems which arise in the use of time-shared and networked digital computers. Finally, a number of protocols which are used to achieve levels of security in computer systems and the emerging theory surrounding cryptographic protocols are presented in Chapter 4. As this survey is being compiled, some friction exists between certain U.S. Government agencies, academic researchers, and professional societies. A brief account of the issues which have led to this controversy is given in Chapter 1.

This work was supported in part by the National Science Foundation and the Office of Naval Research.

1980 *Mathematics Subject Classifications*: 68-02, 68B99, 68C99

Proceedings of Symposia in Applied Mathematics  
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### CONTEMPORARY MATHEMATICS

(ISSN 0271-4132)

#### **Central Extensions, Galois Groups, and Ideal Class Groups of Number Fields** **A. Fröhlich**

Preface

"These notes deal with a set of interrelated problems and results in algebraic number theory, in which there has been renewed activity in recent years. The underlying tool is the theory of the central extensions and, in vaguest and most general terms, the underlying aim is to use class field theoretic methods to reach beyond Abelian extensions. The literature in this area is now quite extensive, with often differing but overlapping approaches. One purpose of this write-up is to give an introductory survey, assuming the basic theorems of class field theory, as mostly recalled in §1. No originality is claimed as regards the general theory, although our approach seems to have some novel features, in particular in the central role that the Tate cohomology groups  $\hat{H}^{-1}$  play.

"Our principal aim is, however, to use the general theory, as developed here, together with the special features of class field theory over  $\mathbb{Q}$ , to derive some rather strong theorems of a very concrete nature, with  $\mathbb{Q}$  as basefield. This is where the main emphasis of these notes lies. The specialization of the theory of central extensions to the base field  $\mathbb{Q}$  will be shown to derive from an underlying principle of wide applicability. We shall describe certain non-Abelian Galois groups over the rational field, and their inertia subgroups and use this description to gain information on ideal class groups of absolutely Abelian fields, and this in entirely rational terms. Here indeed we shall obtain precise and explicit arithmetic results, which go far beyond anything available in the general theory. Much of this really goes back to the author's thesis, but has so far not been genuinely accessible in terms of modern class field theory, and indeed our proofs are entirely new. As we shall show, some of the results on class groups have also an interpretation in terms of the group of norms modulo total norm residues, the so-called number knot.

"The theory of the genus field, which is needed as background, but of course is of independent interest, is presented in §2. Then we develop the theory of

central extension in §3. The special features over **Q** are pointed out throughout, also in §1. Next, §4 deals with Galois groups, and in §5 come the applications to class groups. Finally §6 contains some remarks on the history and literature, but no completeness is attempted."

1980 *Mathematics Subject Classifications*: 12Axx, 12Bxx

Contemporary Mathematics  
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## MEMOIRS OF THE AMS

(ISSN 0065-9266)

### ***R*-linear Endomorphisms of $(R)_n$ preserving invariants**

**Bernard R. McDonald**

This Memoir examines and classifies the *R*-endomorphisms of  $(R)_n$  which preserve rank one matrices, where *R* denotes a commutative ring with identity and  $(R)_n$  the matrix ring of size *n* over *R*. This extends the standard work of Marcus and Moyls over an algebraically closed field. These rank one preserving maps are invertible and their groups are discussed and related to the Picard group  $\text{Pic}(R)$ . Applications of the above results include a classification of those *R*-endomorphisms of  $(R)_n$  which preserve the determinant. This latter result dates to Frobenius in 1897 where the solution was given over the complex field. This Memoir additionally contains a study of the invertible *R*-submodules of  $(R)_n$ , a description of the rank one matrices, and a theory of generalized equivalence transformations.

1980 *Mathematics Subject Classifications*: 15A33, 15A72, 13C10

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### **A Simple Definition of the Feynman Integral, with Applications**

**R. H. Cameron and D. A. Storvick**

This Memoir presents a simple sequential definition of the Feynman integral which is applicable to a rather large class of functionals. The existence theorem shows that this sequential Feynman integral exists and equals the analytic Feynman for all elements of a Banach algebra of functionals expressible

as Fourier transforms of measures of finite variation on  $L^1_2$ . This integral has good translation and rotation properties and permutes with other integrals and sums in a reasonable way. Applications to the Schrodinger equation are given and the relationship to other sequential definitions is discussed.

1980 *Mathematics Subject Classification*: 28C20

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(ISSN 0065-9282)

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**I. A. Aizenberg and A. P. Yuzhakov**

Abstract

This book deals with integral representations of holomorphic functions of several complex variables, the multidimensional logarithmic residue, and the theory of multidimensional residues. Applications are given to implicit function theory, systems of nonlinear equations, computation of the multiplicity of a zero of a mapping, and computation of combinatorial sums in closed form. Certain applications in multidimensional complex analysis are considered.

The monograph is intended for specialists in theoretical and applied mathematics and theoretical physics, and for post graduate and graduate students interested in multidimensional complex analysis or its applications.

Contents

- I. Integral representations and the logarithmic residue
- II. Integral representations of special form for holomorphic functions
- III. The theory of residues
- IV. Applications to implicit functions, systems of nonlinear equations, computation of the multiplicity of a zero, and combinatorics
- V. Some applications in multidimensional complex analysis

1980 *Mathematics Subject Classifications*: 32-02, 32A25, 32A27

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## PROCEEDINGS OF THE

## STEKLOV INSTITUTE

(ISSN 0081-5438)

### Theory and Applications of Differentiable Functions of Several Variables. VIII

**S. M. Nikol'skii, Editor**

#### Abstract

In the papers of this collection, properties of differentiable functions of real variables are investigated, inequalities between integral norms of partial derivatives are established, boundary and approximation properties of functions are studied, generalized Riesz potentials and hypersingular integrals are investigated, and difference methods for approximate solution of Laplace's equation and approximate computation of integrals are proposed.

#### Contents

- G. G. Akopyan, *Sequences of cubature formulas for differentiable functions on domains with degenerate corners*
- O. V. Besov, *Weighted estimates of mixed derivatives in a domain*
- V. I. Burenkov, *On exact constants in inequalities for the norms of intermediate derivatives on a finite interval*
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- B. V. Tandit, *On boundary properties of functions in the space  $W_{p,0}^{r,1}$*
- V. N. Temlyakov, *Approximation of periodic functions of several variables with bounded mixed derivative*

1980 *Mathematics Subject Classifications*: 26, 35, 41, 42, 45 and others

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### Personal Items

**Myron B. Allen** of Princeton University has been appointed to a visiting assistant professorship at the University of Wyoming.

**A. T. Bharucha-Reid** of the Georgia Institute of Technology has been appointed Distinguished Professor of Mathematics, Department of Mathematics and Computer Science, Atlanta University.

**Scott W. Brown** of the University of Hawaii, Manoa, will be on faculty exchange for the spring semester of 1984. He will be exchanging teaching duties with Donald Hadwin of the University of New Hampshire.

**George L. E. Csordas** of the University of Hawaii, Manoa, has been appointed to a professorship at that university.

**Richard E. Ewing** of Mobil Research and Development Corporation has been appointed to a professorship of mathematics and petroleum engineering at the University of Wyoming.

**Peter Hilton** of the State University of New York, Binghamton, has been appointed Distinguished Professor of Mathematics at that university.

**E. Lee Lady** of the University of Hawaii, Manoa, has been appointed to a professorship at that university. He will be on sabbatical leave at the University of California, Berkeley, during the academic year 1983-1984.

**Ralph N. McKenzie** of the University of California, Berkeley, has been appointed to a visiting professorship at the University of Hawaii, Manoa, for the Fall 1983 semester.

**Tom S. Pitcher** of the University of Hawaii, Manoa, will be on sabbatical leave at the University of Southern California during the spring 1984 semester.

**Doraiswamy Ramachandran** of the University of Georgia has been appointed to an associate professorship at California State University, Sacramento.

**Wayne S. Smith** of the University of California, Berkeley, has been appointed to an assistant professorship at the University of Hawaii, Manoa.

**Steven T. Tschantz** of the University of California, Berkeley, has been appointed to a visiting assistant professorship at the University of Hawaii, Manoa, for the academic year 1983-1984.

### Deaths

**Karen C. Beck** of the University of Utah died on June 25, 1983 at the age of 31. She was a member of the Society for 9 years.

**William W. Boone** of the University of Illinois, Urbana-Champaign, died on September 14, 1983 at the age of 63. He was a member of the Society for 37 years.

**Gustave Efroymson** of the University of New Mexico died on August 13, 1983 at the age of 46. He was a member of the Society for 23 years.

### Visiting Mathematicians (Supplementary List)

Mathematicians visiting other institutions during the 1983-1984 academic year have been listed in recent issues of the *Notices*: June 1983, pages 450-452; August 1983, pages 550-552; and October 1983, pages 685-686. The list below gives the name and home country, the host institution, period of visit, and field of special interest of additional visiting mathematicians.

**Rafal Ablamowicz** (Poland), Southern Illinois University, Carbondale, August 1983 to May 1984, degenerate Clifford algebras, twistors and their applications, Yang-Mills Theory.

**Georg W. Desch** (Austria), Southern Illinois University, Carbondale, August 1983 to May 1984, semigroups, integral and integrodifferential equations.

**Rohan Hemasinha** (Sri Lanka), Southern Illinois University, Carbondale, August 1983 to May 1985, probability theory on linear spaces.

**Aleksander Janicki** (Poland), Southern Illinois University, Carbondale, August 1983 to May 1985, partial differential equations, numerical methods, optimization.

**András Kroó** (Hungary), Central Michigan University, September 1983 to June 1984, approximation theory.

**Toshio Nomura** (Japan), Southern Illinois University, Carbondale, August 1983 to May 1984, control theory, systems theory.

# Application Deadlines for Grants and Assistantships

Many fellowship programs have deadlines for receipt of applications. These deadlines are noted in news items and in the Stipends Section of the December *Notices*. They are listed below for your convenience, and as a reminder since many of these deadlines occur before the publication date of the special December issue on *Assistantships and Fellowships*. Dates taken from the 1982 special issue have been updated with information received in preparation for the December 1983 issue. For information about the various programs, the reader is referred to the appropriate part of the Stipends Section of the December 1982 *Notices* as follows: [GS] = Graduate Support Section; [PS] = Postdoctoral Support Section; [TSA] = Travel and Study Abroad Section; [SFN] = Study in the U.S. for Foreign Nationals.

- \* Information from the December 1982 issue not yet confirmed for this year.

## November

NSF Graduate Fellowships [GS]  
NSF Minority Graduate Fellowships [GS]

## November 1

- American-Scandinavian Foundation [TSA]  
\* Fannie and John Hertz Foundation Fellowships [GS]

## November 7

National Academy of Sciences (Exchange Programs with China) [TSA]

## November 15

- NSF Mathematical Sciences Postdoctoral Research [PS]  
Weizmann Institute of Sciences (Feinberg Graduate School Postdoctoral Fellowships) [TSA]  
\* Woodrow Wilson Women's Studies Research Grants [GS]

## November 30

North Atlantic Treaty Organization [TSA]

## December 1

- American Philosophical Society [PS]  
Lady Davis Fellowship Trust [TSA]  
Lady Davis Visiting Professorships [TSA]  
\* Royal Norwegian Council for Scientific and Industrial Research (Postdoctorate Fellowships) [TSA]  
\* Sigma Delta Epsilon, Graduate Women in Science (Eloise Gerry Fellowship) [GS]

## December 15

- \* Los Alamos National Laboratory (J. Robert Oppenheimer Research Fellowship) [PS]
- \* State University of New York, Buffalo (George William Hill and Emmy Noether Research Instructorships) [PS]

## December 31

Institute for Advanced Study Memberships [PS]  
Massachusetts Institute of Technology (C. L. E. Moore Instructorships in Mathematics) [PS]  
University of Wisconsin, Madison (Van Vleck Assistant Professorships in Mathematics) [PS]

## January 1

- Brown University (Jacob David Tamarkin Assistant Professorships) [PS]  
Courant Institute (Instructorships in Mathematics) [PS]  
Courant Institute (Postdoctoral Visiting Memberships) [PS]  
Indiana University, Bloomington (Václav Hlavatý Research Assistant Professorships) [PS]  
Mathematical Sciences Research Institute [PS]  
\* University of California, San Diego (S. E. Warschawski Assistant Professorship) [PS]

## January 2

Harvard University (Benjamin Peirce Lectureships) [PS]  
University of Michigan, Ann Arbor (Theophil Henry Hildebrandt Research Assistant Professorships) [PS]

## January 15

- Committee on Institutional Cooperation (Minorities Fellowships in the Sciences, Mathematics and Engineering) [GS]  
Dartmouth College (John Wesley Young Research Instructorships) [PS]  
Institute for Mathematics and its Applications [PS]  
\* Kosciuszko Foundation [GS] [SFN]  
\* Kosciuszko Foundation (Graduate and Postgraduate Exchange with Poland) [TSA]  
\* National Research Council (Research Associateship Program) [PS]  
Natural Sciences and Engineering Research Council of Canada (Visiting Fellowships) [TSA]  
Rice University (Griffith Conrad Evans Instructorships) [PS]  
Smithsonian Institution (Predoctoral Fellowships) [GS]  
Smithsonian Institution (Postdoctoral Fellowships) [PS]  
University of California, Los Angeles (Earle Raymond Hedrick Assistant Professorships in Mathematics) [PS]  
University of Chicago (Leonard Eugene Dickson Instructorships in Mathematics) [PS]  
\* University of Pittsburgh (Andrew Mellon Postdoctoral Fellowships) [PS]

## January 16

California Institute of Technology (Harry Bateman Research Instructorships) [PS]

National Research Council (Postdoctoral Fellowships for Minorities) [PS]

**January 27**

- \* National Center for Atmospheric Research (Advanced Study Program) [PS]

**January 30**

Centro de Investigacion del IPN (Solomon Lefschetz Research Instructorships) [TSA]

IBM Thomas J. Watson Research Center (Mathematical Sciences Department Postdoctoral and Junior Faculty Research Fellowships) [PS]

**January 31**

- \* Yale University (Josiah Willard Gibbs Instructorships) [PS]

**February 1**

- \* AAAS Summer Fellowship [GS]  
American Philosophical Society [PS]  
American Society for Engineering Education (NASA-ASEE Summer Faculty Fellowships) [PS]  
American Society for Engineering Education (Navy- and DOE-ASEE Summer Faculty Research Programs) [PS]  
Carnegie-Mellon University (Zeev Nehari Instructorship in Mathematics) [PS]  
Kenneth O. May Fellowship in the History of Mathematics [GS]
- \* Minna-James-Heinemann-Stiftung (Research Abroad) [TSA]
- \* Sigma Delta Epsilon, Graduate Women in Science (Grants-in-Aid) [GS]
- \* University of Cincinnati (Charles Phelps Taft Postdoctoral Fellowships) [PS]

**February 9**

- \* California State Graduate Fellowships [GS]

**February 15**

American Society for Engineering Education (ONR Graduate Fellowship Program) [GS]

AMS-MAA-SIAM Congressional Science Fellowship [PS]

- \* University of California, Irvine (Visiting Irvine Lectureship) [PS]

**February 18**

- \* AAAS Science, Engineering and Diplomacy Fellowships [PS]

**February 22**

- \* Hubert H. Humphrey Doctoral Fellowships [GS]

**February 28**

Australian Institute of Nuclear Science and Engineering (Research Fellowships) [PS]

**March 1**

American Philosophical Society [PS]

**March 14**

NSF United States-India Exchange [TSA]

**March 31**

Hubert H. Humphrey Doctoral Fellowships [GS]  
North Atlantic Treaty Organization [TSA]

**April 1**

American Philosophical Society [PS]

**April 30**

- \* Organization of American States [SFN]

**May 1**

Air Force Office of Scientific Research (Research Contracts and Grants) [PS]

**July 1**

Indo-American Fellowship Program [TSA]

**August 1**

American Philosophical Society [PS]

**August 15**

North Atlantic Treaty Organization [TSA]

**August 31**

Australian Institute of Nuclear Science and Engineering (Research Fellowships) [PS]

- \* Organization of American States [SFN]

**September 14**

NSF United States-India Exchange [TSA]

## **Hodge Theory and the Local Torelli Problem**

**Loring W. Tu**

This monograph consists of two parts. The first part is an exposition of some developments in Hodge theory dating from the sixties and due largely to Phillip Griffiths and his coworkers. The topics include the period map, Hodge bundles, monodromy and variation of Hodge structure, mixed Hodge structures and the numerical invariants of a degeneration. This machinery is applied in the second part to the local Torelli problem in algebraic geometry. Several

new proofs are given for the case of curves. In higher dimensions an affirmative answer is given for a smooth family of varieties of dimension at most four having a large number of holomorphic 1-forms. Throughout the book the presentation has been kept as down-to-earth and as elementary as possible.

1980 *Mathematics Subject Classifications*: 14C30, 14H15, 14J15

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## Recent Appointment

Committee members' terms of office on standing committees expire on December 31 of the year given in parentheses following their names, unless otherwise specified.

David W. Ballew, Felix E. Browder, Paul W. Davis, Bernard L. Madison, Robert E. O'Malley, Jr., and William T. Trotter, Jr., have been appointed by Presidents Julia B. Robinson (AMS), Ivan Niven (MAA) and Hirsh G. Cohen (SIAM) to the *Organizing Committee for a Meeting of Department Chairmen*. This is a committee of the AMS-MAA-SIAM *Joint Concerns Committee in Mathematics*. Professor Madison will serve as chairman.

## Reports of Past Meetings

### The Summer Meeting in Albany

The 87th summer meeting of the American Mathematical Society was held from August 8 to August 11, 1983, at the State University of New York, Center at Albany. It was held jointly with the 63rd summer meeting of the Mathematical Association of America, and the 1983 annual meeting of Pi Mu Epsilon. The meeting was preceded by the AMS Short Course, *Population Biology*. There were 901 participants, including 612 members of the Society.

**Colloquium Lectures.** BERTRAM KOSTANT of the Massachusetts Institute of Technology presented a series of four Colloquium Lectures entitled *On the Coxeter element and the structure of the exceptional Lie groups*. The presiding officers were Julia B. Robinson, Louis Auslander, and I. Satake.

**Steele Prizes.** Three 1983 Leroy P. Steele Prizes were awarded at a prize session on Wednesday, August 10. The 1983 recipients were PAUL R. HALMOS of Indiana University, Bloomington; STEPHEN C. KLEENE Professor Emeritus of the University of Wisconsin, Madison; and SHING-SHEN CHERN of the University of California, Berkeley (see pages 574 to 579 of the October 1983 *Notices*).

**Invited Addresses.** By invitation of the AMS Program Committee, there were eight invited one-hour addresses as follows:

SELMAN AKBULUT, Michigan State University, *The topology of real algebraic sets*. The presiding officer was Paul Baum.

JAMES EELLS, University of Warwick, England, *Harmonic maps of Riemann surfaces*. The presiding officer was Hugo Rossi.

ROBERT C. GUNNING, Princeton University, *Riemann surfaces and their associated Wirtinger varieties*. The presiding officer was Joseph J. Kohn.

LEO A. HARRINGTON, University of California, Berkeley, did not present his scheduled address.

IRA W. HERBST, University of Virginia, *The Schrödinger equation*.

HERVÉ JACQUET, Columbia University, *On the residual spectrum of the linear group*. The presiding officer was Charles W. Curtis.

J. H. B. KEMPERMAN, University of Rochester, *Functional equations over a group, and the mean value property*. The presiding officer was Kenneth A. Ross.

WEN-CH'ING WINNIE LI, Pennsylvania State University, University Park, *Fourier transforms and representations of general linear groups*. The presiding officer was A. H. Atkin.

**Special Sessions.** By invitation of the same committee, there were eleven special sessions of selected twenty-minute papers as follows:

*The calculus of variations in the large and its applications*, MEL S. BERGER and ALEXANDER EYDELAND, University of Massachusetts, Amherst. The speakers were F. Almgren, Charles J. Amick, Mel S. Berger, Kung-chin Chang, Alexander Eydeland, L. E. Fraenkel, George H. Knightly, Wei-Ming Ni, Martin Schechter, Jean E. Taylor, and Michael I. Weinstein.

*Dynamical systems*, LOUIS BLOCK, University of Florida. The speakers were Steve Batterson, Chris Bernhardt, Philip Boyland, Sue Goodman, Glen R. Hall, David Hart, Chung-wu Ho, Mike Hurley, Tien-Yien Li, Michael Maller, R. McGehee, Kenneth Meyer, John Milnor, Dennis Pixton, Clark Robinson, Stephen Schecter, James Selgrade, Russell B. Walker, R. F. Williams, and Helena S. Wisniewski.

*Ergodic theory concerning point transformations with finite invariant measure*, NATHANIEL A. FRIEDMAN, State University of New York, Center at Albany. The speakers were Alexandra Bellow, Jane M. Hawkins, Roger L. Jones, Nelson G. Markley, N. F. G. Martin, Kyewon Park, Karl Petersen, V. S. Prasad, William L. Reddy, Robert Sine, and Sherman Wong.

*Tensor products and  $p$ -summing operators in harmonic analysis*, COLIN C. GRAHAM, Northwestern University, and BERTRAM SCHREIBER, Wayne State University. The speakers were John J. F. Fournier, Colin C. Graham, D. Hajela, Michael B. Marcus, Cora Sadosky, Bertram M. Schreiber, Brent Smith, and Martin Walter.

*Applications of algebraic topology*, TIMOTHY L. LANCE, State University of New York, Center at Albany. The speakers were Douglas R. Anderson, Paul Baum, Michael Chisholm, David Handel, Norman Levitt, Jack Morava, and Mark Steinberger.

*Automorphic functions and automorphic representations*, WEN-CH'ING WINNIE LI, Pennsylvania State University, University Park. The speakers were

A. O. L. Atkin, Solomon Friedberg, Paul Gerardin, Guy Henniart (presented in absentia by Paul Gerardin), Martin L. Karel, Wen-Ch'ing Winnie Li, Carlos Julio Moreno, I. Piateckii-Shapiro, Arnold K. Pizer, Steve Rallis, and Stephen V. Ullom.

*Several complex variables*, R. MICHAEL RANGE, State University of New York, Center at Albany. The speakers were H. Alexander, Frank Beatrous, Steve Bell, Daniel M. Burns, Jr., Joseph Cima, John P. D'Angelo, Frank Farris, B. L. Fridman, Daryl Geller, C. Robin Graham, J. J. Kohn, John M. Lee, Ngaiming Mok, Hugo Rossi, Walter Rudin, Jerzy Ryczaj, Bernard Schiffman, Yum-Tong Siu, David S. Tartakoff, Boguslaw Tomaszewski, Sidney M. Webster, John Wermer, Paul Yang, and William R. Zame.

*Summability methods*, BILLY E. RHOADES, Indiana University, Bloomington. The speakers were Wolfgang Beekmann, Shao-Chien Chang, David Borwein, Martin G. Buntinas, J. DeFranza, Allen R. Freedman, Billy E. Rhoades, William H. Ruckle, J. J. Sember, Bruce L. R. Shawyer, A. K. Snyder, and Albert Wilansky.

*Solutions of operator equations and fixed points*, V. M. SEHGAL, University of Wyoming, and S. P. SINGH, Memorial University, Newfoundland. The speakers were M. Altman, David G. Bourgin, Patrick M. Fitzpatrick, Gilles Fournier, W. A. Kirk, Anthony To-Ming Lau, Teck-Cheong Lim, Mario Martelli, M. Zuhair Nashed, W. V. Petryshyn, L. B. Rall, Simeon Reich, V. M. Sehgal, K. L. Singh, S. P. Singh, and S. Thomeier.

*Differential analysis in infinite dimensional spaces*, SRINIVASA SWAMINATHAN, Dalhousie University. The speakers were Mel S. Berger, Sean Dineen, E. P. Hamilton, M. P. Heble, Boris Mityagin, Louis D. Nel, C. C. A. Sastri, T. N. Subramanian, K. Sundaresan, and Kok-Keong Tan.

*Topological methods in combinatorial group theory*, EDWARD C. TURNER, State University of New York, Center at Albany. The speakers were A. M. W. Glass, Guenther Huck, R. Kramer, Alexander Lubotzky, Darryl McCullough, Allan J. Sieradski, Craig Squier, John R. Stallings, Marvin Tretkoff, and Thomas W. Tucker.

**Contributed Papers.** There were nine sessions for contributed ten-minute papers. The presiding officers for these sessions were Saber N. Elaydi, Michael J. Hoffman, James F. Hurley, L. F. McAuley, Diane Meuser, Howard Osborn, K. I. Rosenthal, Alan H. Stein, and Donald R. Wilken.

**Council and Business Meetings.** The reports of the Council and Business Meetings held during the summer meeting were given on pages 689 and 690 of the October 1983 issue of the *Notices*.

**Hugo Rossi**  
Associate Secretary

Salt Lake City, Utah



## Sixteen Papers on Differential Equations

Lev Leifman, Editor

### Table of Contents

- D. M. Galin, *Versal deformations of linear Hamiltonian systems*
- O. A. Oleĭnik and E. V. Radkevič, *On the analyticity of solutions of linear second order partial differential equations*
- V. M. Petkov, *Necessary conditions for the Cauchy problem for nonsymmetrizable hyperbolic systems to be well-posed*
- P. R. Popivanov, *On the local solvability of a class of pseudodifferential equations with double characteristics*
- A. N. Šoštaišvili, *On bifurcation of topological type of singular points of vector fields depending on parameters*
- D. A. Silaev, *Construction of the solutions of a system of boundary-layer equations by the method of lines with respect to time*
- A. I. Suslov, *On Prandtl's system of equations for the boundary layer with a surface of discontinuity*
- M. I. Višik and A. I. Komeč, *On the solvability of the Cauchy problem for the Hopf equation corresponding to a nonlinear hyperbolic equation*
- Ju. V. Egorov and C. V. Rangelov, *On a class of pseudodifferential equations with multiple characteristics*
- Ju. S. Il'jašenko, *The multiplicity of limit cycles arising from perturbations of the form  $w' = P_2/Q_1$  of a Hamiltonian equation in the real and complex domain*
- T. F. Kalugina, *A priori estimates for equations of parabolic type*
- V. Ju. Kiselev, *Almost periodic Fourier integral operators and some of their applications*
- A. A. Lokšin, *Fundamental solutions of quasilinear hyperbolic equations and polynomials of several variables*
- O. A. Oleĭnik and N. O. Maksimova, *On the behavior of solutions of inhomogeneous elliptic systems in unbounded domains*
- A. V. Fursikov, *First integrals and integrability of systems of quasilinear equations*
- M. A. Subin, *The density of states of selfadjoint elliptic operators with almost periodic coefficients*

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# BYLAWS of the American Mathematical Society

## ARTICLE I

### *Officers*

**Section 1.** There shall be a president, a president-elect (during the even-numbered years only), an ex-president (during the odd-numbered years only), three vice-presidents, a secretary, four associate secretaries, a treasurer, and an associate treasurer.

**Section 2.** It shall be a duty of the president to deliver an address before the Society at the close of his term of office or within one year thereafter.

## ARTICLE II

### *Board of Trustees*

**Section 1.** There shall be a Board of Trustees consisting of eight trustees, five trustees elected by the Society in accordance with Article VII, together with the president, the treasurer, and the associate treasurer of the Society *ex officio*. The Board of Trustees shall designate its own presiding officer and secretary.

**Section 2.** The function of the Board of Trustees shall be to receive and administer the funds of the Society, to have full legal control of its investments and properties, to make contracts, and, in general, to conduct all business affairs of the Society.

**Section 3.** The Board of Trustees shall have the power to appoint such assistants and agents as may be necessary or convenient to facilitate the conduct of the affairs of the Society, and to fix the terms and conditions of their employment. The Board may delegate to the officers of the Society duties and powers normally inhering in their respective corporate offices, subject to supervision by the Board. The Board of Trustees may appoint committees to facilitate the conduct of the financial business of the Society and delegate to such committees such powers as may be necessary or convenient for the proper exercise of those powers. Agents appointed, or members of committees designated, by the Board of Trustees need not be members of the Board.

Nothing herein contained shall be construed to empower the Board of Trustees to divest itself of responsibility for, or legal control of, the investments, properties, and contracts of the Society.

## ARTICLE III

### *Publications and Communications Committees*

**Section 1.** There shall be eight publications committees, which shall be the eight editorial committees specified in Section 2 of this Article.

**Section 2.** There shall be eight editorial committees as follows: committees for the *Bulletin*, for the *Proceedings*, for the *Colloquium Publications*, for *Mathematical Surveys*, for *Mathematical Reviews*; a joint committee for the *Transactions*

and the *Memoirs*; a committee consisting of the representatives of the Society on the Board of Editors of the *American Journal of Mathematics*; and a committee for *Mathematics of Computation*.

**Section 3.** There shall be a communications committee called the Committee to Monitor Problems in Communication.

**Section 4.** The size of each publications committee and communications committee shall be determined by the Council.

## ARTICLE IV

### *Council*

**Section 1.** The Council shall consist of fifteen members-at-large and the following *ex officio* members: the officers of the Society specified in Article I, the members of the publications committees and the chairman of the communications committee specified in Article III, any former secretary for a period of two years following his terms of office, and members of the Executive Committee (Article V) who remain on the Council by the operation of Article VII, Section 4.

**Section 2.** The Council shall formulate and administer the scientific policies of the Society and shall act in an advisory capacity to the Board of Trustees.

**Section 3.** In the absence of the secretary from any meeting of the Council, one of the associate secretaries present may be designated as acting secretary for the meeting, either by written authorization of the secretary, or, failing that, by majority agreement among the associate secretaries present.

**Section 4.** All members of the Council shall be voting members. The method for settling matters before the Council at any meeting shall be by majority vote of the members present. If the result of a vote is challenged, it shall be the duty of the presiding officer to determine the true vote by a roll call. In a roll call vote, each Council member shall vote only once (although he may be a member of the Council in several capacities), and he shall state before the vote in which capacity he votes. The group consisting of the four associate secretaries shall have one vote, and it shall be divided equally among those who vote as associate secretaries. Each of the eight publications committees shall have one vote, and it shall be divided equally among those who vote as members of the respective publications committees. All other members of the Council shall have one vote each. Fractional votes shall be counted.

**Section 5.** Any group of members of the Council who have a total of five votes as defined in Section 4 of this Article for a vote by roll call shall constitute a quorum for the transaction of business at any meeting of the Council.

**Section 6.** Between meetings of the Council, business may be transacted by a mail vote. Votes shall be counted as in the case of a roll call as specified in Section 4 of this Article, "members present" being replaced by "members voting." An affirmative vote by mail on any proposal shall be declared if, and only if, (a) more than half of the total number of possible votes is received by the time announced for the closing of the polls, and (b) at least three-quarters of the votes received by then are affirmative. If members who have a total of five or more votes request postponement at the time of voting, action on the matter at issue shall be postponed until the next meeting of the Council, unless either (1) at the discretion of the secretary, the question is made the subject of a second vote by mail, in connection with which brief statements of reason, for and against, are circulated; or (2) the Council places the matter at issue before the Executive Committee for action.

**Section 7.** The Council may delegate to the Executive Committee certain of its duties and powers. Between meetings of the Council, the Executive Committee shall act for the Council on such matters and in such ways as the Council may specify. Nothing herein contained shall be construed as empowering the Council to divest itself of responsibility for formulating and administering the scientific policies of the Society.

**Section 8.** The Council shall also have power to speak in the name of the Society with respect to matters affecting the status of mathematics or mathematicians, such as proposed or enacted federal or state legislation; conditions of employment in universities, colleges, or business, research or industrial organizations; regulations, policies, or acts of governmental agencies or instrumentalities; and other items which tend to affect the dignity and effective position of mathematics.

With the exception noted in the next paragraph, a favorable vote of two-thirds of the entire membership of the Council, taken in accordance with the provisions of a vote by roll call as specified in Section 4 of this Article, shall be necessary to authorize any statement in the name of the Society with respect to such matters. With the exception noted in the next paragraph, such a vote may be taken only if written notice shall have been given to the secretary by the proposer of any such resolution not later than one month prior to the Council meeting at which the matter is to be presented; and the vote shall be taken not earlier than one month after the resolution has been discussed by the Council.

If, at a meeting of the Council, there are present members having a total of twelve votes, as specified for a vote by roll call in Section 4 of this Article, then the prior notification to the secretary may be waived by unanimous consent. In such a case, a unanimous favorable vote by those present shall empower the Council to speak in the name of the Society.

The Council may also refer the matter to a referendum by mail of the entire membership of the Society, and shall make such reference if a referendum

is requested, prior to final action by the Council, by two hundred or more members. The taking of a referendum shall act as a stay upon Council action until the votes have been canvassed, and thereafter no action may be taken by the Council except in accordance with a plurality of the votes cast in the referendum.

## ARTICLE V

### *Executive Committee*

**Section 1.** There shall be an Executive Committee of the Council, consisting of four elected members and the following *ex officio* members: the president, the secretary, the president-elect (during even-numbered years), and the ex-president (during odd-numbered years).

**Section 2.** The Executive Committee of the Council shall be empowered to act for the Council on matters which have been delegated to the Executive Committee by the Council. If three members of the Executive Committee request that any matter be referred to the Council, the matter shall be so referred. The Executive Committee shall be responsible to the Council and shall report its actions to the Council. It may consider the agenda for meetings of the Council and may make recommendations to the Council.

**Section 3.** Each member of the Executive Committee shall have one vote. An affirmative vote on any proposal before the Executive Committee shall be declared if, and only if, at least four affirmative votes are cast for the proposal. A vote on any proposal may be determined at a meeting of the Executive Committee, but it shall not be necessary to hold a meeting to determine a vote.

## ARTICLE VI

### *Executive Director*

**Section 1.** There shall be an Executive Director who shall be a paid employee of the Society. He shall have charge of the central office of the Society, and he shall be responsible for the general administration of the affairs of the Society in accordance with the policies that are set by the Board of Trustees and by the Council.

**Section 2.** The Executive Director shall be appointed by the Board of Trustees with the consent of the Council. The terms and conditions of his employment shall be fixed by the Board of Trustees.

**Section 3.** The Executive Director shall work under the immediate direction of a committee consisting of the president, the secretary, and the treasurer, of which the president shall be chairman *ex officio*. The Executive Director shall attend meetings of the Board of Trustees, the Council, and the Executive Committee, but he shall not be a member of any of these bodies. He shall be a voting member of the Committee to Monitor Problems in Communication but shall not be its chairman.

## ARTICLE VII

### *Election of Officers and Terms of Office*

**Section 1.** The term of office shall be one year in the case of the president-elect and the ex-president;



five years in the case of the trustees; two years in the case of the president, the vice-presidents, the secretary, the associate secretaries, the treasurer, and the associate treasurer. The term of office in the case of members of the publications committees and elected members of the communications committees shall be four years for the *Proceedings* and the *Transactions* and *Memoirs* committees and three years for the remaining committees, except that when the size of a publications or communications committee is changed, the Council may authorize the election of a member for a shorter term. The term of office for members-at-large of the Council shall be three years, five of the members-at-large retiring annually. The term of office for elected members of the Executive Committee shall be two years, two of the elected members retiring annually. All terms of office shall begin on January 1 and terminate on December 31 with the exception that the officials specified in Articles I, II, III, IV, and V (excepting the president-elect and ex-president) shall continue to serve until their successors have been duly elected and qualified. The members of a communications committee with terms ending on December 31 are designated as past members through February 10 of the following year.

**Section 2.** The president-elect, the vice-presidents, the secretary, the associate secretaries, the treasurer, the associate treasurer, the trustees, the members of the publications and communications committees, and the members-at-large of the Council shall be elected by written ballot. An official ballot shall be sent to each member of the Society by the secretary on or before October 10, and such ballots, if returned to the secretary in envelopes bearing the name of the voter and received within thirty days, shall be counted. Each ballot shall contain one or more names proposed by the Council for each office to be filled, with blank spaces in which the voter may substitute other names. A plurality of all votes cast shall be necessary for election. In case of failure to secure a plurality for any office, the Council shall choose by written ballot among the members having the highest number of votes. Each communications committee elects one of its members as chairman in a manner and for a term designated by the Council. Past members, as designated in Section 1, may be authorized to vote in this election.

**Section 3.** At the end of his term of office, the president-elect shall become the president. At the end of his term of office, the president shall become the ex-president.

**Section 4.** On or before January 15, the secretary shall send to all members of the Council for a mail vote a ballot containing two names for each place to be filled on the Executive Committee. The nominees shall be chosen by a committee appointed by the president. Members of the Council may vote for persons not nominated. Any member of the Council who is not an *ex officio* member of the Executive Committee (see Article V, Section 1) shall be eligible for election to the Executive Committee. In case a

member is elected to the Executive Committee for a term extending beyond his regular term on the Council, he shall automatically continue as a member of the Council during his term on the Executive Committee.

**Section 5.** The president and vice-presidents shall not be eligible for immediate re-election to their respective offices. A member-at-large or an *ex officio* member of the Council shall not be eligible for immediate election (or re-election) as a member-at-large of the Council.

**Section 6.** If the president of the Society should die or resign while a president-elect is in office, the president-elect shall serve as president for the remainder of the year and thereafter shall serve his regular two-year term. If the president of the Society should die or resign when no president-elect is in office, the Council, with the approval of the Board of Trustees, shall designate one of the vice-presidents to serve as president for the balance of the regular presidential term. If the president-elect of the Society should die or resign before becoming president, his office shall remain vacant until the next regular election of a president-elect, and the Society shall, at the next annual meeting, elect a president for a two-year term. If the ex-president should die or resign before expiration of his term of office, the Council, with the approval of the Board of Trustees, shall designate a former president of the Society to serve as ex-president during the remainder of the regular term of the ex-presidency. Such vacancies as may occur at any time in the group consisting of the vice-presidents, the secretary, the associate secretaries, the treasurer, the associate treasurer, and the members of the publications and communications committees shall be filled by the Council with the approval of the Board of Trustees. If a member of a publications or communications committee should take temporary leave from his duties, that committee shall nominate a substitute for consideration by the Council. The Council shall then elect a substitute. The Council shall fill from its own membership any vacancy in the elected membership of the Executive Committee.

**Section 7.** If any elected trustee should die or resign during his tenure of office, the vacancy thus created shall be filled for his unexpired term by the Board of Trustees.

**Section 8.** If any member-at-large of the Council should die or resign more than one year before the expiration of his term, the vacancy for the unexpired term shall be filled by the Society at the next annual meeting.

**Section 9.** In case any officer should die or decline to serve between the time of election and the time at which he was to assume office, the vacancy shall be filled in the same manner as if he had served one day of his term.

## ARTICLE VIII

### *Members and Their Election*

**Section 1.** Election of members shall be by vote of the Council or of its Executive Committee.

**Section 2.** There shall be four classes of members, namely ordinary, contributing, corporate, and institutional.

**Section 3.** Application for admission to ordinary membership shall be made by the applicant on a blank provided by the secretary. Such applications shall not be acted upon until at least thirty days after their presentation to the Council (at a meeting or by mail), except in the case of members of other societies entering under special action of the Council approved by the Board of Trustees.

**Section 4.** An ordinary member may become a contributing member by paying the dues for such membership. (See Article IX, Section 3.)

**Section 5.** A university or college, or a firm, corporation, or association interested in the support of mathematics may be elected a corporate or an institutional member.

## ARTICLE IX

### *Dues and Privileges of Members*

**Section 1.** Any applicant shall be admitted to ordinary membership immediately upon election by the Council (Article VIII) and the discharge within sixty days of election of his first annual dues. Dues may be discharged by payment or by remission when the provision of Section 7 of this Article is applicable. The first annual dues shall apply to the year of election, except that if any applicant is elected after August 15 of any year, he may elect to have his first annual dues apply to the following year.

**Section 2.** The annual dues of an ordinary member of the Society shall be established by the Council with the approval of the Trustees. The Council, with the approval of the Trustees, may establish special rates in exceptional cases and for members of an organization with which the Society has a reciprocity agreement.

**Section 3.** The minimum dues for a contributing member shall be three-halves of the dues of an ordinary member per year. Members may, upon their own initiative, pay larger dues.

**Section 4.** The minimum dues of an institutional member shall depend on the amount of published material credited to that member in certain journals during a specific period. The formula for computing these dues shall be established from time to time by the Council, subject to approval by the Board of Trustees. Institutions may pay larger dues than the computed minimum.

**Section 5.** The minimum annual dues of a corporate member shall be one thousand dollars.

**Section 6.** The privileges of a corporate or an institutional member shall depend on its dues in a manner to be determined by the Council, subject to approval by the Board of Trustees. These privileges shall be in terms of Society publications to be received by the institution and of the number of persons it may nominate for ordinary membership in the Society.

**Section 7.** The dues of an ordinary member of the Society shall be remitted for any years during which he is the nominee of an institutional member.

**Section 8.** After retirement from active service on account of age, any ordinary or contributing member who is not in arrears of dues and with membership extending over at least twenty years may, by giving proper notification to the secretary, have his dues remitted, on the understanding that he will thereafter receive the *Notices* but not the *Bulletin*.

**Section 9.** An ordinary or contributing member shall receive the *Notices* and *Bulletin* as privileges of membership during each year for which his dues have been discharged.

**Section 10.** The annual dues of ordinary, contributing, and corporate members shall be due by January 1 of the year to which they apply. The Society shall submit bills for dues. If the annual dues of any member remain undischarged beyond what the Board of Trustees deems to be a reasonable time, his name shall be removed from the list of members after due notice. If a member wishes to discontinue his membership at any time, he shall submit his resignation in writing to the Society.

**Section 11.** Any member who became a life member before October 25, 1941, by the payment of a sum determined in accordance with actuarial principles, shall have for life the status and privileges of an ordinary member without further payment of dues. No additional applications for life memberships will be accepted.

## ARTICLE X

### *Meetings*

**Section 1.** The annual meeting of the Society shall be held between the fifteenth of December and the tenth of February next following. Notice of the time and place of this meeting shall be mailed by the secretary or an associate secretary to the last known post office address of each member of the Society. The times and places of the annual and other meetings of the Society shall be designated by the Council. There shall be a business meeting of the Society at the annual meeting and at the summer meeting. A business meeting of the Society shall take final action only on business accepted by unanimous consent, or business notified to the full membership of the Society in the call for the meeting, except that the business meetings held at either the annual meeting or the summer meeting may take final action on business which has been recommended for consideration by the Council and has been accepted by the vote of four-fifths of the Society present and voting at such a meeting. Such notification shall be made only when so directed by a previous business meeting of the Society or by the Council.

**Section 2.** Meetings of the Executive Committee may be called by the president; he shall call a meeting at any time upon the written request of two of its members.

**Section 3.** The Council shall meet at the annual meeting of the Society. Special meetings of the Council may be called by the president; he shall call a special meeting at any time upon the written request of five of its members. No special meeting of the

Council shall be held unless written notice of it shall have been sent to all members of the Council at least ten days before the day set for the meeting.

**Section 4.** The Board of Trustees shall hold at least one meeting in each calendar year. Meetings of the Board of Trustees may be called by the president, the treasurer, or the secretary of the Society upon three-days' notice of such meetings mailed to the last known post office address of each trustee. The secretary of the Society shall call a meeting upon the receipt of a written request of two of the trustees. Meetings may also be held by common consent of all the trustees.

**Section 5.** Papers intended for presentation at any meeting of the Society shall be passed upon in advance by a program committee appointed by or under the authority of the Council; and only such papers shall be presented as shall have been approved by such committee. Papers in form unsuitable for publication, if accepted for presentation, shall be referred to on the program as preliminary communications or reports.

## ARTICLE XI

### *Publications*

**Section 1.** The Society shall publish an official organ called the *Bulletin of the American Mathematical Society*. It shall publish three journals, known as the *Transactions of the American Mathematical Society*, the *Proceedings of the American Mathematical Society*, and *Mathematics of Computation*. It shall publish a series of mathematical papers known as the *Memoirs of the American Mathematical Society*. The object of the *Transactions*, *Proceedings*, *Memoirs*, and *Mathematics of Computation* is to make known important mathematical researches. It shall publish a periodical called *Mathematical Reviews*, containing abstracts or reviews of current mathematical literature. It shall publish a series of volumes called *Colloquium*

*Publications* which shall embody in book form new mathematical developments. It shall publish a series of monographs called *Mathematical Surveys* which shall furnish expositions of the principal methods and results of particular fields of mathematical research. It shall also cooperate in the conduct of the *American Journal of Mathematics*. It shall publish a news periodical known as the *Notices of the American Mathematical Society*, containing programs of meetings, items of news of particular interest to mathematicians, and such other materials as the Council may direct.

**Section 2.** The editorial management of the publications of the Society listed in Section 1 of this article, with the exception of the *Notices*, and the participation of the Society in the editorial management of the *American Journal of Mathematics* shall be in the charge of the respective editorial committees as provided in Article III, Section 2. The editorial management of the *Notices* shall be in the hands of a committee chosen in a manner established by the Council.

## ARTICLE XII

### *Communications*

The Committee to Monitor Problems in Communication shall perform such tasks in the field of communication of mathematics as are assigned to it by the Council.

## ARTICLE XIII

### *Amendments*

These bylaws may be amended or suspended at any meeting of the Society on recommendation of the Council and by a two-thirds vote of the members present, provided notice of such proposed action and of its general nature shall have been given in the call for such meeting.

### Presidents

J. H. Van Amringe, 1889, 1890  
J. E. McClintock, 1891–1894  
G. W. Hill, 1895, 1896  
Simon Newcomb, 1897, 1898  
R. S. Woodward, 1899, 1900  
E. H. Moore, 1901, 1902  
T. S. Fiske, 1903, 1904  
W. F. Osgood, 1905, 1906  
H. S. White, 1907, 1908  
Maxime Bôcher, 1909, 1910  
H. B. Fine, 1911, 1912  
E. B. Van Vleck, 1913, 1914  
E. W. Brown, 1915, 1916  
L. E. Dickson, 1917, 1918  
Frank Morley, 1919, 1920  
G. A. Bliss, 1921, 1922  
Oswald Veblen, 1923, 1924  
G. D. Birkhoff, 1925, 1926  
Virgil Snyder, 1927, 1928  
E. R. Hedrick, 1929, 1930  
L. P. Eisenhart, 1931, 1932  
A. B. Coble, 1933, 1934  
Solomon Lefschetz, 1935, 1936

R. L. Moore, 1937, 1938  
G. C. Evans, 1939, 1940  
Marston Morse, 1941, 1942  
M. H. Stone, 1943, 1944  
T. H. Hildebrandt, 1945, 1946  
Einar Hille, 1947, 1948  
J. L. Walsh, 1949, 1950  
John von Neumann, 1951, 1952  
G. T. Whyburn, 1953, 1954  
R. L. Wilder, 1955, 1956  
Richard Brauer, 1957, 1958  
E. J. McShane, 1959, 1960  
Deane Montgomery, 1961, 1962  
J. L. Doob, 1963, 1964  
A. A. Albert, 1965, 1966  
C. B. Morrey, Jr., 1967, 1968  
Oscar Zariski, 1969, 1970  
Nathan Jacobson, 1971, 1972  
Saunders Mac Lane, 1973, 1974  
Lipman Bers, 1975, 1976  
R. H. Bing, 1977, 1978  
Peter D. Lax, 1979, 1980  
Andrew M. Gleason, 1981, 1982  
Julia B. Robinson, 1983, 1984

### Secretaries

T. S. Fiske, 1888–1895  
F. N. Cole, 1896–1920  
R. G. D. Richardson, 1921–1940  
J. R. Kline, 1941–1950  
E. G. Begle, 1951–1956  
J. W. Green, 1957–1966  
Everett Pitcher, 1967–

### Treasurers

T. S. Fiske, 1890, 1891  
Harold Jacoby, 1892–1894  
R. S. Woodward, 1895, 1896  
Harold Jacoby, 1897–1899  
W. S. Dennett, 1900–1907  
J. H. Tanner, 1908–1920  
W. B. Fite, 1921–1929  
G. W. Mullins, 1930–1936  
P. A. Smith, 1937  
B. P. Gill, 1938–1948  
A. E. Meder, Jr., 1949–1964  
W. T. Martin, 1965–1973  
F. P. Peterson, 1973–

# FUNDS

## Endowment Fund

In 1923 an Endowment Fund was collected to meet the greater demands on the publication program of the Society, these demands caused by the ever-increasing number of important mathematical memoirs. Of this fund, which amounted to approximately \$94,000 in 1960, a considerable proportion was contributed by members of the Society. In 1961, upon the death of the last legatees under the will of the late Robert Henderson—for many years a Trustee of the Society—the entire principal of the estate was received by the Society, thereby bringing the total of the Endowment Fund to approximately \$648,000.

## Prize Funds

### The Bôcher Memorial Prize

This prize was founded in memory of Professor Maxime Bôcher with an original endowment of \$1,450. It is awarded every five years for a notable research memoir in analysis which has appeared during the past five years. Either the recipient is a member of the Society or the Memoir is published in a recognized North American journal; this provision, introduced in 1971, is a liberalization of the terms of the award.

**First (preliminary) award, 1923:** To G. D. Birkhoff for his memoir, *Dynamical systems with two degrees of freedom*, Transactions of the American Mathematical Society, volume 18 (1917), pp. 199-300.

**Second award, 1924:** To E. T. Bell for his memoir, *Arithmetical paraphrases*, I, II, Transactions of the American Mathematical Society, volume 22 (1921), pp. 1-30, 198-219; and to Solomon Lefschetz for his memoir, *On certain numerical invariants with applications to Abelian varieties*, Transactions of the American Mathematical Society, volume 22 (1921), pp. 407-482.

**Third award, 1928:** To J. W. Alexander for his memoir, *Combinatorial analysis situs*, Transactions of the American Mathematical Society, volume 28 (1926), pp. 301-329.

**Fourth award, 1933:** To Marston Morse for his memoir, *The foundations of a theory of the calculus of variations in the large in  $m$ -space*, Transactions of the American Mathematical Society, volume 31 (1929), pp. 379-404; and to Norbert Wiener for his memoir, *Tauberian theorems*, Annals of Mathematics, Series 2, volume 33 (1932), pp. 1-100.

**Fifth award, 1938:** To John von Neumann for his memoir, *Almost periodic functions and groups*, I, II, Transactions of the American Mathematical

Society, volume 36 (1934), pp. 445-492, and volume 37 (1935), pp. 21-50.

**Sixth award, 1943:** To Jesse Douglas for his memoirs, *Green's function and the problem of Plateau*, American Journal of Mathematics, volume 61 (1939), pp. 545-589; *The most general form of the problem of Plateau*, American Journal of Mathematics, volume 61 (1939), pp. 590-608; and *Solution of the inverse problem of the calculus of variations*, Proceedings of the National Academy of Sciences, volume 25 (1939), pp. 631-637.

**Seventh award, 1948:** To A. C. Schaeffer and D. C. Spencer for their memoir, *Coefficients of schlicht functions*, I, II, III, IV, Duke Mathematical Journal, volume 10 (1943), pp. 611-635, volume 12 (1945), pp. 107-125, and the Proceedings of the National Academy of Sciences, volume 32 (1946), pp. 111-116, volume 35 (1949), pp. 143-150.

**Eighth award, 1953:** To Norman Levinson for his contributions to the theory of linear, nonlinear, ordinary, and partial differential equations contained in his papers of recent years.

**Ninth award, 1959:** To Louis Nirenberg for his work in partial differential equations.

**Tenth award, 1964:** To Paul J. Cohen for his paper, *On a conjecture of Littlewood and idempotent measures*, American Journal of Mathematics, volume 82 (1960), pp. 191-212.

**Eleventh award, 1969:** To I. M. Singer in recognition of his work on the index problem, especially his share in two joint papers with Michael F. Atiyah, *The index of elliptic operators*, I, III, Annals of Mathematics, Series 2, volume 87 (1968), pp. 484-530, 546-604.

**Twelfth award, 1974:** To Donald S. Ornstein in recognition of his paper, *Bernoulli shifts with the same entropy are isomorphic*, Advances in Mathematics, volume 4 (1970), pp. 337-352.

**Thirteenth award, 1979:** To Alberto P. Calderón in recognition of his fundamental work on the theory of singular integrals and partial differential equations, and in particular for his paper *Cauchy integrals on Lipschitz curves and related operators*, Proceedings of the National Academy of Sciences, USA, volume 74 (1977), pp. 1324-1327.

### The Frank Nelson Cole Prize in Algebra

### The Frank Nelson Cole Prize in Number Theory

These prizes were founded in honor of Professor Frank Nelson Cole on the occasion of his retirement as secretary of the American Mathematical Society after twenty-five years of service as editor-in-chief of the *Bulletin*. The original fund was donated by Professor Cole from moneys presented to him on his retirement, was augmented by contributions from members of the Society, and was later doubled by his son, Charles A. Cole. The present endowment is \$2,250. The prizes are awarded at five-year

intervals for contributions to algebra and the theory of numbers, respectively, under restrictions similar to those for the Bôcher Prize.

**First award, 1928:** To L. E. Dickson for his book *Algebren und ihre Zahlentheorie*, Orell Füssli, Zürich and Leipzig, 1927.

**Second award, 1931:** To H. S. Vandiver for his several papers on Fermat's last theorem published in the Transactions of the American Mathematical Society and in the Annals of Mathematics during the preceding five years, with special reference to a paper entitled *On Fermat's last theorem*, Transactions of the American Mathematical Society, volume 31 (1929), pp. 613-642.

**Third award, 1939:** To A. Adrian Albert for his papers on the construction of Riemann matrices published in the Annals of Mathematics, Series 2, volume 35 (1934) and volume 36 (1935).

**Fourth award, 1941:** To Claude Chevalley for his paper, *La théorie du corps de classes*, Annals of Mathematics, Series 2, volume 41 (1940), pp. 394-418.

**Fifth award, 1944:** To Oscar Zariski for four papers on algebraic varieties published in the American Journal of Mathematics, volumes 61 (1939) and 62 (1940), and in the Annals of Mathematics, Series 2, volumes 40 (1939) and 41 (1940).

**Sixth award, 1946:** To H. B. Mann for his paper, *A proof of the fundamental theorem on the density of sums of sets of positive integers*, Annals of Mathematics, Series 2, volume 43 (1942), pp. 523-527.

**Seventh award, 1949:** To Richard Brauer for his paper, *On Artin's L-series with general group*

*characters*, Annals of Mathematics, Series 2, volume 48 (1947), pp. 502-514.

**Eighth award, 1951:** To Paul Erdős for his many papers in the theory of numbers, and in particular for his paper, *On a new method in elementary number theory which leads to an elementary proof of the prime number theorem*, Proceedings of the National Academy of Sciences, volume 35 (1949), pp. 374-385.

**Ninth award, 1954:** To Harish-Chandra for his papers on representations of semisimple Lie algebras and groups, and particularly for his paper, *On some applications of the universal enveloping algebra of a semisimple Lie algebra*, Transactions of the American Mathematical Society, volume 70 (1951), pp. 28-96.

**Tenth award, 1956:** To John T. Tate for his paper, *The higher dimensional cohomology groups of class field theory*, Annals of Mathematics, Series 2, volume 56 (1952), pp. 294-297.

**Eleventh award, 1960:** To Serge Lang for his paper, *Unramified class field theory over function fields in several variables*, Annals of Mathematics, Series 2, volume 64 (1956), pp. 285-325; and to Maxwell A. Rosenlicht for his papers, *Generalized Jacobian varieties*, Annals of Mathematics, Series 2, volume 59 (1954), pp. 505-530, and *A universal mapping property of generalized Jacobians*, Annals of Mathematics, Series 2, volume 66 (1957), pp. 80-88.

**Twelfth award, 1962:** To Kenkichi Iwasawa for his paper, *Gamma extensions of number fields*, Bulletin of the American Mathematical Society, volume 65

### Colloquium Lecturers

James Pierpont, 1896  
Maxime Bôcher, 1896  
W. F. Osgood, 1898  
A. G. Webster, 1898  
Oskar Bolza, 1901  
E. W. Brown, 1901  
H. S. White, 1903  
F. S. Woods, 1903  
E. B. Van Vleck, 1903  
E. H. Moore, 1906  
E. J. Wilczynski, 1906  
Max Mason, 1906  
G. A. Bliss, 1909  
Edward Kasner, 1909  
L. E. Dickson, 1913  
W. F. Osgood, 1913  
G. C. Evans, 1916  
Oswald Veblen, 1916  
G. D. Birkhoff, 1920  
F. R. Moulton, 1920  
L. P. Eisenhart, 1925  
Dunham Jackson, 1925  
E. T. Bell, 1927  
Anna Pell-Wheeler, 1927  
A. B. Coble, 1928  
R. L. Moore, 1929  
Solomon Lefschetz, 1930  
Marston Morse, 1931  
J. F. Ritt, 1932  
R. E. A. C. Paley, 1934  
Norbert Wiener, 1934

H. S. Vandiver, 1935  
E. W. Chittenden, 1936  
John von Neumann, 1937  
A. A. Albert, 1939  
M. H. Stone, 1939  
G. T. Whyburn, 1940  
Oystein Ore, 1941  
R. L. Wilder, 1942  
E. J. McShane, 1943  
Einar Hille, 1944  
Tibor Radó, 1945  
Hassler Whitney, 1946  
Oscar Zariski, 1947  
Richard Brauer, 1948  
G. A. Hedlund, 1949  
Deane Montgomery, 1951  
Alfred Tarski, 1952  
Antoni Zygmund, 1953  
Nathan Jacobson, 1955  
Salomon Bochner, 1956  
N. E. Steenrod, 1957  
J. L. Doob, 1959  
S. S. Chern, 1960  
G. W. Mackey, 1961  
Saunders Mac Lane, 1963  
C. B. Morrey, Jr., 1964  
A. P. Calderón, 1965  
Samuel Eilenberg, 1967  
D. C. Spencer, 1968  
J. W. Milnor, 1968

Raoul H. Bott, 1969  
Harish-Chandra, 1969  
R. H. Bing, 1970  
Lipman Bers, 1971  
Armand Borel, 1971  
Stephen Smale, 1972  
John T. Tate, 1972  
M. F. Atiyah, 1973  
E. A. Bishop, 1973  
F. E. Browder, 1973  
Louis Nirenberg, 1974  
John G. Thompson, 1974  
H. Jerome Keisler, 1975  
Ellis R. Kolchin, 1975  
Elias M. Stein, 1975  
I. M. Singer, 1976  
Jürgen K. Moser, 1976  
William Browder, 1977  
Herbert Federer, 1977  
Hyman Bass, 1978  
Philip A. Griffiths, 1979  
George D. Mostow, 1979  
Julia B. Robinson, 1980  
Wolfgang M. Schmidt, 1980  
Mark Kac, 1981  
Serge Lang, 1981  
Dennis Sullivan, 1982  
Morris W. Hirsch, 1982  
Charles L. Fefferman, 1983  
Bertram Kostant, 1983

(1959), pp. 183-226; and to Bernard M. Dwork for his paper, *On the rationality of the zeta function of an algebraic variety*, American Journal of Mathematics, volume 82 (1960), pp. 631-648.

**Thirteenth award, 1965:** To Walter Feit and John G. Thompson for their joint paper, *Solvability of groups of odd order*, Pacific Journal of Mathematics, volume 13 (1963), pp. 775-1029.

**Fourteenth award, 1967:** To James B. Ax and Simon B. Kochen for a series of three joint papers, *Diophantine problems over local fields. I, II, III*, American Journal of Mathematics, volume 87 (1965), pp. 605-630, 631-648, and Annals of Mathematics, Series 2, volume 83 (1966), pp. 437-456.

**Fifteenth award, 1970:** To John R. Stallings for his paper, *On torsion-free groups with infinitely many ends*, Annals of Mathematics, Series 2, volume 88 (1968), pp. 312-334; and to Richard G. Swan for his paper, *Groups of cohomological dimension one*, Journal of Algebra, volume 12 (1969), pp. 585-610.

**Sixteenth award, 1972:** To Wolfgang M. Schmidt for the following papers: *On simultaneous approximation of two algebraic numbers by rationals*, Acta Mathematica (Uppsala), volume 119 (1967), pp. 27-50; *T-numbers do exist*, Symposia Mathematica, volume IV, Academic Press, 1970, pp. 1-26; *Simultaneous approximation to algebraic numbers by rationals*, Acta Mathematica (Uppsala), volume 125 (1970), pp. 189-201; *On Mahler's T-numbers*, Proceedings of Symposia in Pure Mathematics, volume 20, American Mathematical Society, 1971, pp. 275-286.

**Seventeenth award, 1975:** To Hyman Bass for his paper, *Unitary algebraic K-theory*, Springer Lecture Notes in Mathematics, volume 343, 1973; and to Daniel G. Quillen for his paper, *Higher algebraic K-theories*, Springer Lecture Notes in Mathematics, volume 341, 1973.

**Eighteenth award, 1977:** To Goro Shimura for his two papers, *Class fields over real quadratic fields and Hecke operators*, Annals of Mathematics, Series 2, volume 95 (1972), pp. 130-190; and *On*

*modular forms of half integral weight*, Annals of Mathematics, Series 2, volume 97 (1973), pp. 440-481.

**Nineteenth award, 1980:** To Michael Aschbacher for his paper, *A characterization of Chevalley groups over fields of odd order*, Annals of Mathematics, Series 2, volume 106 (1977), pp. 353-398; and to Melvin Hochster for his paper *Topics in the homological theory of commutative rings*, CBMS Regional Conference Series in Mathematics, Number 24, American Mathematical Society, 1975.

**Twentieth award, 1982:** To Robert P. Langlands for pioneering work on automorphic forms, Eisenstein series and product formulas, particularly for his paper *Base change for GL(2)*, Annals of Mathematics Studies, volume 96, Princeton University Press, 1980; and to Barry Mazur for outstanding work on elliptic curves and Abelian varieties, especially on rational points of finite order, and his paper *Modular curves and the Eisenstein ideal*, Publications Mathématiques de l'Institut des Hautes Études Scientifiques, volume 47 (1977), pp. 33-186.

### The Oswald Veblen Prize in Geometry

This prize was established in 1961 in memory of Professor Oswald Veblen through a fund contributed by former students and colleagues. The fund was later doubled by the widow of Professor Veblen, bringing the fund to \$2,000. The first two awards of the prize were made in 1964 and the next in 1966; thereafter, an award will ordinarily be made every five years for research in geometry or topology under conditions similar to those for the Bôcher Prize.

**First award, 1964:** To C. D. Papakyriakopoulos for his papers, *On solid tori*, Annals of Mathematics, Series 2, volume 66 (1957), pp. 1-26, and *On Dehn's lemma and the asphericity of knots*, Proceedings of the National Academy of Sciences, volume 43 (1957), pp. 169-172.

**Second award, 1964:** To Raoul Bott for his papers, *The space of loops on a Lie group*, Michigan Mathematical Journal, volume 5 (1958), pp. 35-61, and *The stable homotopy of the classical groups*,

### Gibbs Lecturers

M. I. Pupin, 1923  
Robert Henderson, 1924  
James Pierpont, 1925  
H. B. Williams, 1926  
E. W. Brown, 1927  
G. H. Hardy, 1928  
Irving Fisher, 1929  
E. B. Wilson, 1930  
P. W. Bridgman, 1931  
R. C. Tolman, 1932  
Albert Einstein, 1934  
Vannevar Bush, 1935  
H. N. Russell, 1936  
C. A. Kraus, 1937  
Theodore von Kármán, 1939  
Sewall Wright, 1941  
Harry Bateman, 1943  
John von Neumann, 1944  
J. C. Slater, 1945

S. Chandrasekhar, 1946  
P. M. Morse, 1947  
Hermann Weyl, 1948  
Norbert Wiener, 1949  
G. E. Uhlenbeck, 1950  
Kurt Gödel, 1951  
Marston Morse, 1952  
Wassily Leontief, 1953  
K. O. Friedrichs, 1954  
J. E. Mayer, 1955  
M. H. Stone, 1956  
H. J. Muller, 1958  
J. M. Burgers, 1959  
Julian Schwinger, 1960  
J. J. Stoker, 1961  
C. N. Yang, 1962  
C. E. Shannon, 1963  
Lars Onsager, 1964

D. H. Lehmer, 1965  
Martin Schwarzschild, 1966  
Mark Kac, 1967  
E. P. Wigner, 1968  
R. L. Wilder, 1969  
W. H. Munk, 1970  
E. F. F. Hopf, 1971  
F. J. Dyson, 1972  
J. K. Moser, 1973  
Paul A. Samuelson, 1974  
Fritz John, 1975  
Arthur S. Wightman, 1976  
Joseph B. Keller, 1977  
Donald E. Knuth, 1978  
Martin D. Kruskal, 1979  
Kenneth G. Wilson, 1980  
Cathleen S. Morawetz, 1981  
Elliott W. Montroll, 1982  
Samuel Karlin, 1983

Annals of Mathematics, Series 2, volume 70 (1959), pp. 313-337.

**Third award, 1966:** To Stephen Smale for his contributions to various aspects of differential topology.

**Fourth award, 1966:** To Morton Brown and Barry Mazur for their work on the generalized Schoenflies theorem.

**Fifth award, 1971:** To Robion C. Kirby for his paper, *Stable homeomorphisms and the annulus conjecture*, Annals of Mathematics, Series 2, volume 89 (1969), pp. 575-582.

**Sixth award, 1971:** To Dennis P. Sullivan for his work on the Hauptvermutung summarized in the paper, *On the Hauptvermutung for manifolds*, Bulletin of the American Mathematical Society, volume 73 (1967), pp. 598-600.

**Seventh award, 1976:** To William P. Thurston for his work on foliations.

**Eighth award, 1976:** To James Simons for his work on minimal varieties and characteristic forms.

**Ninth award, 1981:** To Mikhael Gromov for his work relating topological and geometric properties of Riemannian manifolds.

**Tenth award, 1981:** To Shing-Tung Yau for his work in nonlinear partial differential equations, his contributions to the topology of differentiable manifolds, and for his work on the complex Monge-Ampère equation on compact complex manifolds.

#### **The George David Birkhoff Prize in Applied Mathematics**

This prize was established in 1967 in honor of Professor George David Birkhoff. The initial endowment of \$2,066 was contributed by the Birkhoff family. It is normally awarded every five years, beginning in 1968, for an outstanding contribution to "applied mathematics in the highest and broadest sense." The award is made jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics. The recipient must be a member of one of these societies and a resident of the United States, Canada, or Mexico.

**First award, 1968:** To Jürgen K. Moser for his contributions to the theory of Hamiltonian dynamical systems, especially his proof of the stability of periodic solutions of Hamiltonian systems having two degrees of freedom and his specific applications of the ideas in connection with this work.

**Second award, 1973:** To Fritz John for his outstanding work in partial differential equations, in numerical analysis, and, particularly, in nonlinear elasticity theory; the latter work has led to his study of quasi-isometric mappings as well as functions of bounded mean oscillation, which have had impact in other areas of analysis.

**Third award, 1973:** To James B. Serrin for his fundamental contributions to the theory of nonlinear

partial differential equations, especially his work on existence and regularity theory for nonlinear elliptic equations, and applications of his work to the theory of minimal surfaces in higher dimensions.

**Fourth award, 1978:** To Garrett Birkhoff for bringing the methods of algebra and the highest standards of mathematics to scientific applications.

**Fifth award, 1978:** To Mark Kac for his important contributions to statistical mechanics and to probability theory and its applications.

**Sixth award, 1978:** To Clifford A. Truesdell for his outstanding contributions to our understanding of the subjects of rational mechanics and nonlinear materials, for his efforts to give precise mathematical formulation to these classical subjects, for his many contributions to applied mathematics in the fields of acoustic theory, kinetic theory, and nonlinear elastic theory, and the thermodynamics of mixtures, and for his major work in the history of mechanics.

**Seventh award, 1983:** To Paul R. Garabedian for his important contributions to partial differential equations, to the mathematical analysis of problems of transonic flow and airfoil design by the method of complexification, and to the development and application of scientific computing to problems of fluid dynamics and plasma physics.

#### **The Norbert Wiener Prize in Applied Mathematics**

This prize was established in 1967 in honor of Professor Norbert Wiener and was endowed by a fund amounting to \$2,000 from the Department of Mathematics of the Massachusetts Institute of Technology. The prize is normally awarded every five years, beginning in 1970, for an outstanding contribution to "applied mathematics in the highest and broadest sense." The award is made jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics. The recipient must be a member of one of these societies and a resident of the United States, Canada, or Mexico.

**First award, 1970:** To Richard E. Bellman for his pioneering work in the area of dynamic programming, and for his related work on control, stability, and differential-delay equations.

**Second award, 1975:** To Peter D. Lax for his broad contributions to applied mathematics, in particular, for his work on numerical and theoretical aspects of partial differential equations and on scattering theory.

**Third award, 1980:** To Tosio Kato for his distinguished work in the perturbation theory of quantum mechanics.

**Fourth award, 1980:** To Gerald B. Whitham for his broad contributions to the understanding of fluid dynamical phenomena and his innovative

contributions to the methodology through which that understanding can be constructed.

### The Leroy P. Steele Prizes

These prizes were established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein, and are endowed under the terms of a bequest amounting to \$145,000 from Leroy P. Steele. From 1970 to 1976 one or more prizes were awarded each year for outstanding published mathematical research; most favorable consideration was given to papers distinguished for their exposition and covering broad areas of mathematics. In 1977 the Council of the AMS modified the terms under which the prizes are awarded. Since then, up to three prizes have been awarded each year in the following categories: (1) for the cumulative influence of the total mathematical work of the recipient, high level of research over a period of time, particular influence on the development of a field, and influence on mathematics through Ph.D. students; (2) for a book or substantial survey or expository-research paper; (3) for a paper, whether recent or not, which has proved to be of fundamental or lasting importance in its field, or a model of important research.

**August 1970:** To Solomon Lefschetz for his paper, *A page of mathematical autobiography*, Bulletin of the American Mathematical Society, volume 74 (1968), pp. 854-879.

**August 1971:** To James B. Carrell for his paper, written jointly with Jean A. Dieudonné, *Invariant theory, old and new*, Advances in Mathematics, volume 4 (1970), pp. 1-80.

**August 1971:** To Jean A. Dieudonné for his paper, *Algebraic geometry*, Advances in Mathematics, volume 3 (1969), pp. 223-321, and for his paper, written jointly with James B. Carrell, *Invariant theory, old and new*, Advances in Mathematics, volume 4 (1970), pp. 1-80.

**August 1971:** To Phillip A. Griffiths for his paper, *Periods of integrals on algebraic manifolds*, Bulletin of the American Mathematical Society, volume 76 (1970), pp. 228-296.

**August 1972:** To Edward B. Curtis for his paper, *Simplicial homotopy theory*, Advances in Mathematics, volume 6 (1971), pp. 107-209.

**August 1972:** To William J. Ellison for his paper, *Waring's problem*, American Mathematical Monthly, volume 78 (1971), pp. 10-36.

**August 1972:** To Lawrence F. Payne for his paper, *Isoperimetric inequalities and their applications*, SIAM Review, volume 9 (1967), pp. 453-488.

**August 1972:** To Dana S. Scott for his paper, *A proof of the independence of the continuum hypothesis*, Mathematical Systems Theory, volume 1 (1967), pp. 89-111.

**January 1975:** To Lipman Bers for his paper, *Uniformization, moduli, and Kleinian groups*,

Bulletin of the London Mathematical Society, volume 4 (1972), pp. 257-300.

**January 1975:** To Martin D. Davis for his paper, *Hilbert's tenth problem is unsolvable*, American Mathematical Monthly, volume 80 (1973), pp. 233-269.

**January 1975:** To Joseph L. Taylor for his paper, *Measure algebras*, CBMS Regional Conference Series in Mathematics, Number 16, American Mathematical Society, 1972.

**August 1975:** To George W. Mackey for his paper, *Ergodic theory and its significance for statistical mechanics and probability theory*, Advances in Mathematics, volume 12 (1974), pp. 178-286.

**August 1975:** To H. Blaine Lawson for his paper, *Foliations*, Bulletin of the American Mathematical Society, volume 80 (1974), pp. 369-418.

**1976, 1977, 1978:** No awards were made.

**January 1979:** To Salomon Bochner for his cumulative influence on the fields of probability theory, Fourier analysis, several complex variables, and differential geometry.

**January 1979:** To Hans Levy for three fundamental papers: *On the local character of the solutions of an atypical linear differential equation in three variables and a related theorem for regular functions of two complex variables*, Annals of Mathematics, Series 2, volume 64 (1956), pp. 514-522; *An example of a smooth linear partial differential equation without solution*, Annals of Mathematics, Series 2, volume 66 (1957), pp. 155-158; *On hulls of holomorphy*, Communications in Pure and Applied Mathematics, volume 13 (1960), pp. 587-591.

**August 1979:** To Antoni Zygmund for his cumulative influence on the theory of Fourier series, real variables, and related areas of analysis.

**August 1979:** To Robin Hartshorne for his expository research article *Equivalence relations on algebraic cycles and subvarieties of small codimension*, Proceedings of Symposia in Pure Mathematics, volume 29, American Mathematical Society, 1975, pp. 129-164; and his book *Algebraic geometry*, Springer-Verlag, Berlin and New York, 1977.

**August 1979:** To Joseph J. Kohn for his fundamental paper: *Harmonic integrals on strongly convex domains*. I, II, Annals of Mathematics, Series 2, volume 78 (1963), pp. 112-248 and volume 79 (1964), pp. 450-472.

**August 1980:** To André Weil for the total effect of his work on the general course of twentieth century mathematics, especially in the many areas in which he has made fundamental contributions.

**August 1980:** To Harold M. Edwards for mathematical exposition in his books *Riemann's zeta function*, Pure and Applied Mathematics, number 58, Academic Press, New York and London, 1974;



and *Fermat's last theorem*, Graduate Texts in Mathematics, number 50, Springer-Verlag, New York and Berlin, 1977.

**August 1980:** To Gerhard P. Hochschild for his significant work in homological algebra and its applications.

**August 1981:** To Oscar Zariski for his work in algebraic geometry, especially his fundamental contributions to the algebraic foundations of this subject.

**August 1981:** To Eberhard Hopf for three papers of fundamental and lasting importance: *Abzweigung einer periodischen Lösung von einer stationären Lösung eines Differential systems*, Berichte über die Verhandlungen der Sächsischen Akademie der Wissenschaften zu Leipzig. Mathematisch-Naturwissenschaftliche Klasse, volume 95 (1943), pp. 3-22; *A mathematical example displaying features of turbulence*, Communications on Applied Mathematics, volume 1 (1948), pp. 303-322; and *The partial differential equation  $u_t + uu_x = \mu u_{xx}$* , Communications on Pure and Applied Mathematics, volume 3 (1950), pp. 201-230.

**August 1981:** To Nelson Dunford and Jacob T. Schwartz for their expository book, *Linear operators*, Part I, *General theory*, 1958; Part II, *Spectral theory*, 1963; Part III, *Spectral operators*, 1971, Interscience Publishers, New York.

**August 1982:** To Lars V. Ahlfors for his expository work in *Complex analysis* (McGraw-Hill Book Company, New York, 1953), and in *Lectures on quasiconformal mappings* (D. Van Nostrand Co., Inc., New York, 1966) and *Conformal invariants* (McGraw-Hill Book Company, New York, 1973).

**August 1982:** To Tsit-Yuen Lam for his expository work in his book *Algebraic theory of quadratic forms* (1973), and four of his papers:  $K_0$  and  $K_1$ —*an introduction to algebraic K-theory* (1975), *Ten lectures on quadratic forms over fields* (1977), *Serre's conjecture* (1978), and *The theory of ordered fields* (1980).

**August 1982:** To John W. Milnor for a paper of fundamental and lasting importance, *On manifolds homeomorphic to the 7-sphere*, *Annals of Mathematics* (2) 64 (1956), pp. 399-405.

**August 1982:** To Fritz John for the cumulative influence of his total mathematical work, high level of research over a period of time, particular influence on the development of a field, and influence on mathematics through Ph.D. students.

**August 1983:** To Paul R. Halmos for his many graduate texts in mathematics and for his articles on how to write, talk and publish mathematics.

**August 1983:** To Steven C. Kleene for three important papers which formed the basis for later developments in generalized recursion theory and descriptive set theory: *Arithmetical predicates and*

*function quantifiers*, *Transactions of the American Mathematical Society* 79 (1955), pp. 312-340; *On the forms of the predicates in the theory of constructive ordinals (second paper)*, *American Journal of Mathematics* 77 (1955), pp. 405-428; and *Hierarchies of number-theoretic predicates*, *Bulletin of the American Mathematical Society* 61 (1955), pp. 193-213.

**August 1983:** To Shiing-Shen Chern for the cumulative influence of his total mathematical work, high level of research over a period of time, particular influence on the development of the field of differential geometry, and influence on mathematics through Ph.D. students.

## Special Funds

### AMS Research Fellowship Fund

This fund was established by the Society in 1973 and provides one-year Research Fellowships awarded each year in March. The number of fellowships granted each year depends on the contributions the Society receives, matched by a contribution from the Society of between \$9,000 and \$20,000.

**First Award, 1974-1975:** Fred G. Abramson and James Li-Ming Wang.

**Second award, 1975-1976:** Terence J. Gaffney, Paul Nèvai, and George M. Reed.

**Third award, 1976-1977:** Fredric D. Ancel and Joseph A. Sgro.

**Fourth award, 1977-1978:** Steven Kalikow, Charles Patton, Duong-Hong Phong, and David Vogan.

**Fifth award, 1978-1979:** Alan Dankner, David Harbater, Howard Hiller, Steven P. Kerckhoff, and Robert C. McOwen.

**Sixth award, 1979-1980:** Scott W. Brown, Jeffrey E. Hoffstein, Jeffry N. Kahn, James E. McClure, Rick L. Smith, and Mark Steinberger.

**Seventh award, 1980-1981:** Robert K. Lazarsfeld, Thomas H. Parker, and Robert Sachs.

**Eighth award, 1981-1982:** Lawrence Man-Hou Ein and Mark Williams.

**Ninth award, 1982-1983:** Nicholas J. Kuhn.

**Tenth award, 1983-1984:** Russell David Lyons.

### The Ernest William Brown Fund

From the estate of Professor Ernest William Brown, a fund of \$1,000 is available. The Board of Trustees stipulated that the interest from this fund should be used for the furtherance of such mathematical interests as (a) the publication of important mathematical books, memoirs, and

periodicals, and (b) for lectures to be delivered on special occasions by invited guests of the Society.

#### **The Levi L. Conant Fund**

Levi L. Conant bequeathed a sum of \$9,500 which the Trustees incorporated with the permanent endowments for prize funds.

#### **The Delbert Ray Fulkerson Fund**

Gifts of friends of the late Professor Fulkerson have provided a fund in excess of \$7,000. Part or all of the proceeds is to be used jointly by the Mathematical Programming Society and the American Mathematical Society for the award of one or more prizes in discrete mathematics at regular intervals.

**First award, 1979:** To Richard M. Karp, for *On the computational complexity of combinatorial problems*, Networks, volume 5 (1975), pp. 45-68; to Kenneth Appel and Wolfgang Haken, for *Every planar map is four colorable*, Part I: *Discharging*, Illinois Journal of Mathematics, volume 21 (1977), pp. 429-490; and to Paul D. Seymour, for *The matroids with the max-flow min-cut property*, Journal of Combinatorial Theory, Series B, volume 23 (1977), pp. 189-222.

**Second award, 1982:** To D. B. Judin and A. S. Nemirovskii, for *Informational complexity and effective methods of solution for convex extremal problems*, Ekonomika i Matematicheskie Metody 12 (1976), 357-369, and to L. G. Khachiyan for *A polynomial algorithm in linear programming*, Akademiia Nauk SSSR. Doklady 244 (1979), 1093-1096; to G. P. Egorychev, for *The solution of van der Waerden's problem for permanents*, Akademiia Nauk SSSR. Doklady 258 (1981), 1041-1044, and D. I. Falikman, for *A proof of the van der Waerden conjecture on the permanent of a doubly stochastic matrix*, Matematicheskie Zametki 29 (1981), 931-938; and to M. Grötschel, L. Lovász and A. Schrijver, for *The ellipsoid method and its consequences in combinatorial optimization*, Combinatorica 1 (1981), 169-197.

#### **The Geneva B. Hutchinson Fund**

From the estate of Geneva B. Hutchinson, a fund of \$1,000 is available to be used at the discretion of the Council and the Board of Trustees.

#### **The Solomon A. Joffe Fund**

A gift of \$3,000 was presented to the Society by Solomon A. Joffe, and the Board of Trustees set this aside in a fund bearing his name.

#### **The Helen A. Merrill Fund**

From the estate of Professor Helen A. Merrill, a fund of \$650 is available for use of the Society at the discretion of the governing bodies.

#### **The Eliakim Hastings Moore Fund**

This fund was donated in 1922 in honor of Professor Eliakim Hastings Moore on the occasion of the twenty-fifth anniversary of the Chicago (Western) section of the Society. The income from this fund, which is \$2,575, is to be used at the discretion of the Council for the publication of important mathematical books and memoirs and for the award of prizes.

#### **The Marion Reilly Fund**

Dean Marion Reilly willed to the American Mathematical Society a portion of her estate to be used for the advancement of research in pure mathematics. The principal of this fund is \$23,600.

#### **The Joseph Fels Ritt Memorial Fund**

From the estate of Estelle F. Ritt, the income from a fund of \$22,500 is available for the publication of works in the field of mathematics as shall be determined by the governing bodies of the Society.

#### **The James K. Whittemore Fund**

From the estate of James K. Whittemore, a fund of \$1,000 is available for use by the Society.

#### **Library Proceeds Fund**

A fund of \$66,000 was established by the Board of Trustees in 1951 from the proceeds of the sale of the library of the Society.

#### **Friends of Mathematics Fund**

An anonymous gift of \$2,700 was received by the Society in 1970. A special fund called the Friends of Mathematics Fund was created; further donations have been included in this fund, the proceeds of which are a part of the invested assets of the Society. The principal of this fund is now \$29,584.

## Classified Advertisements

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**SUGGESTED USES** for classified advertising are books or lecture notes for sale, books being sought, positions available, exchange or rental of houses, and typing services.

**THE RATE IS** \$.55 per word with a minimum of \$5.00. The same ad in 7 consecutive issues is \$3.50 per word. Type will be set solid unless centering and spacing are requested. A centered line of any length or the equivalent in white space is \$5.00. A word is defined as a group of characters with space at each end. Prepayment is required of individuals but not of institutions. For an additional \$10.00 charge, announcements can be placed anonymously. Correspondence will be forwarded.

**DEADLINES** are listed on the inside front cover.

**U. S. LAWS PROHIBIT** discrimination in employment on the basis of color, age, sex, race, religion or national origin. "Positions Available" advertisements from institutions outside the U. S. cannot be published unless they are accompanied by a statement that the institution does not discriminate on these grounds, whether or not it is subject to U. S. laws. Details and specific wording may be found on page 98 of the January 1983 issue of the *Notices*.

**SITUATION WANTED** advertisements are accepted under terms spelled out on page A-355 of the April 1979 *Notices*. (Deadlines are the same as for other classified advertisements.)

**SEND AD AND CHECK TO:** Advertising Department, AMS, P.O. Box 6248, Providence, Rhode Island 02940. Individuals are requested to pay in advance, institutions are not required to do so.

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### POSITIONS AVAILABLE

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#### UNIVERSITY OF CALIFORNIA, SANTA BARBARA DEPARTMENT OF MATHEMATICS

Applications are invited for assistant professor positions in the general areas of nonlinear differential equations and global analysis. Successful candidates must have outstanding research potential and have demonstrated excellence in teaching. Exceptionally well-qualified persons, whose background and experience warrant a tenure-level appointment are also encouraged to apply. We especially encourage applicants in the following areas: dynamical systems, global or qualitative theory of nonlinear partial differential equations, or modern mathematical physics. Résumés and letters of recommendation should be sent no later than December 15, 1983 to: James B. Robertson, Chairperson, Department of Mathematics, University of California, Santa Barbara, CA 93106

The University of California, Santa Barbara, is an equal opportunity affirmative action employer.

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#### UNIVERSITY OF CALIFORNIA DEPARTMENT OF MATHEMATICS, IRVINE, CA 92717

Position for an Assistant Professor in the Department of Mathematics. Duties involve undergraduate and graduate teaching. Research area: Algebra or Analysis in the broad sense (including Mathematical Physics and Probability). Applicants must possess a Ph.D. Send applications, curriculum vitae (work in print or preparation), a brief description of research plans, and three letters of recommendation. Appointment begins on July 1, 1984. U. C. Irvine is an Affirmative Action/Equal Opportunity Employer.

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#### Department of Mathematics University of Kansas

Applications and nominations are invited for two or more tenure-track positions at the Assistant and Associate Professor level beginning August 16, 1984, or as negotiated. Field is unrestricted, but for one position preference will be given to algebra. Otherwise, candidates whose interests mesh well with the department's needs are preferred. Requires Ph.D. or doctoral dissertation accepted with only formalities to be completed.

Send detailed résumé with description of past and present research, and arrange for three letters of recommendation to be sent to C. J. Himmelberg, Chairman, Department of Mathematics, University of Kansas, Lawrence, KS 66045. Deadline: December 15, 1983, for first consideration, then February 1, 1984, then monthly until the search is ended. Complete job description will be sent on request.

The University of Kansas is an EO/AA employer.

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#### DEPARTMENT OF MATHEMATICS UNIVERSITY OF CALIFORNIA, SANTA BARBARA

Applications are invited for a tenure-track assistant professor position in statistics. Candidates must have outstanding research potential and have demonstrated excellence in teaching. Qualified candidates from minority groups and qualified women are encouraged to apply. Exceptionally well-qualified persons, whose background and experience warrant a tenure-level appointment are also encouraged to apply. Résumés and three letters of recommendation should be sent prior to December 15, 1983 to James B. Robertson, Department of Mathematics, University of California, Santa Barbara, CA 93106.

The University of California, Santa Barbara is an equal opportunity/affirmative action employer.

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#### Mathematics Virginia Polytechnic Institute & State University

Applications and nominations are invited for anticipated tenure-track positions at the Assistant Professor level beginning September 1984. Candidates should have demonstrated strong research potential in an area of computational mathematics. These persons should have expertise in areas such as numerical analysis, numerical solutions of differential equations, software, hardware, and applications. Applications accepted until positions are filled.

Applicants should send a résumé and three letters of recommendation to Bruce E. Reed, Assistant Chairman, Department of Mathematics, Virginia Polytechnic Institute & State University, Blacksburg, Virginia 24061-4097.

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#### Mathematics Virginia Polytechnic Institute & State University

Applications and nominations are invited for anticipated senior level position beginning September 1984. Candidates should have a demonstrated record of outstanding research ability in an area of computational mathematics. This person should have expertise in areas such as numerical analysis, numerical solutions of differential equations, software, hardware, and applications. The person chosen to fill this position will have an unusual opportunity to aid in the development of a program in computational sciences. Applications accepted until position is filled.

Applicants should send a résumé and three letters of recommendation to Bruce E. Reed, Assistant Chairman, Department of Mathematics, Virginia Polytechnic Institute & State University, Blacksburg, Virginia 24061-4097.

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## POSITIONS AVAILABLE

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### SYRACUSE UNIVERSITY Department of Mathematics

Applications are invited for several tenure-track renewable positions effective 1 September 1984. Strong research potential is of primary importance, teaching ability is essential, and the Ph.D. is required. Preferred research areas include statistics, numerical analysis, and any of the specialties within the broad area of analysis; other areas compatible with the research activity in the department will be considered. Candidates should send a detailed vita, and arrange to have three letters of reference and a transcript sent to Professor L. J. Lardy, Chairman, Department of Mathematics, Syracuse University, Syracuse, New York 13210. Syracuse University is an affirmative action equal opportunity employer.

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### UNIVERSITY OF SOUTH CAROLINA

Applications are invited for faculty positions in mathematics, applied mathematics, and statistics, starting Fall 1984. Ph.D. degree with strong research potential and dedication to teaching at undergraduate and graduate level required. Candidates should send vita and arrange for four letters of recommendation to be sent to Dr. William T. Trotter, Jr., Chairman, Department of Mathematics and Statistics, University of South Carolina, Columbia, SC 29208. AA/EOE.

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### DEPARTMENT OF MATHEMATICS KANSAS STATE UNIVERSITY

Tenure-track position at the Assistant Professor level for the academic year 1984-1985. Salary commensurate with ability. Candidates must have demonstrated research ability in global analysis and the use of differential geometry and topology for the study of problems in analysis or theoretical physics. Commitment to excellence in teaching is expected. A Ph.D. in mathematics or equivalent required. Starting date: August 13, 1984; Closing date: January 31, 1984. Contact: Department Head, Department of Mathematics, Kansas State University, Manhattan, KS 66506; (913) 532-6750. KSU is an AA/EOE.

Tenure-track position at the Assistant Professor level for the academic year 1984-1985. Salary commensurate with ability. Candidates must have demonstrated research ability in number theory. Some areas of particular interest are the application of dynamical systems to number theory and sequences of integers. A broad background in algebraic number theory is also desirable. Commitment to excellence in teaching is expected. A Ph.D. in mathematics or equivalent required. Starting date: August 13, 1984; Closing date: January 31, 1984. Contact: Department Head, Department of Mathematics, Kansas State University, Manhattan, KS 66506; (913) 532-6750. KSU is an AA/EOE.

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### MATHEMATICS/COMPUTER SCIENCE ASSISTANT PROFESSOR

CONNECTICUT COLLEGE is a very selective, coeducational, private, liberal arts institution (1600 students) located on Long Island Sound midway between New York City and Boston. We invite applications for this regular position from Ph.D.'s committed to scholarship and teaching (3 courses per semester). The teaching comprises courses in introductory and advanced computer science and mathematics. Our computer resources include a PRIME 55011, a PDP11/44(UNIX), and several micros. A starting date of either 1/84 or 9/84 is acceptable. Send résumé and 3 letters of recommendation to: S. Wertheimer, Chairman, Mathematics Department, Box 1614, Connecticut College, New London, CT 06320.

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### Faculty of Science Opening 1983/1984

An independent Arab University in the Israeli-occupied West Bank of Jordan has the following faculty openings for the academic year 1983/1984 in the field of: Mathematics, preferred areas of specialization: Topology, Applied or pure Mathematics, Algebra and Analysis, and Computer Science.

English is the basic language of instruction and candidates should have a Ph.D. or a Master's Degree. Starting annual salary for Ph.D. 4414 JDs., approximately \$12,433, and for Masters Degree 2680 JDs., approximately \$7,550. Higher salaries are offered depending on experience. Fringe benefits include air ticket and relocation allowance for new faculty members, accident and health insurance, cost of living coverage.

All applications should include résumé and be addressed to:

Dean of the Faculty of Science  
Birzeit University  
P.O. Box 14  
Birzeit  
West Bank  
Via Israel

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### LOUISIANA STATE UNIVERSITY CHAIRPERSON DEPARTMENT OF MATHEMATICS

Applications and nominations are invited for the position of chairperson of the Department of Mathematics. The Chairperson is the chief administrative officer of the Department and has responsibility for all aspects of the departmental work. Candidates should have a strong record of research, a commitment to excellence in teaching, and should be able to effectively administer a large department within a state university.

The position will commence in August 1984. Applications should include a curriculum vitae and names and addresses of at least three references. Applications will be accepted until the position is filled, but to insure consideration, applications should be submitted by December 1, 1983. Applications and nominations should be submitted to: Chairperson Search Committee, Department of Mathematics, Louisiana State University, Baton Rouge, LA 70803.

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### UNIVERSITY OF FLORIDA ANNOUNCEMENT OF VACANCY DEPARTMENT OF MATHEMATICS

Applications are invited for a full professorship/senior associate professorship available August 1984. This position requires a record of substantial research accomplishment and teaching experience. Outstanding candidates in all areas of mathematics will be given serious consideration. Departmental preferred research specialties include: partial differential equations, numerical analysis, theoretical computer science, combinatorics, and related areas. The academic year salary for this position is highly competitive.

Applicants should provide a résumé, a list of publications, selected papers, and should arrange for five letters of reference to be sent to:

Chairman, Senior Search and Screen Committee  
Department of Mathematics  
University of Florida  
Gainesville, Florida 32611

Application deadline is January 10, 1984. The committee urges early application.

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## POSITIONS AVAILABLE

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### SOUTHWEST TEXAS STATE UNIVERSITY

One or more non-tenure-track instructorships expected for fall 1984. Master's degree in mathematics or computer science and potential for excellence in teaching required. Contact Dr. John Spellmann, Chairman, Department of Mathematics/Computer Science, Southwest Texas State University, San Marcos, TX 78666. Application deadline 2/1/84. Late applications considered if openings exist. SWTSU is an EO/AA employer.

One or more assistant or associate professorships expected for fall 1984. Possibility of tenure-track appointment. Ph.D. (or equivalent) and potential for excellence in research and teaching required. Prefer those in applied math, computer science, differential equations (o.d.e. or p.d.e.), math education, number theory (analytic or algebraic) and topology (geometric). Applications also invited in operations research, quadratic forms and topological dynamics. Contact Dr. John Spellmann, Chairman, Southwest Texas State University, San Marcos, TX 78666. Application deadline 2/1/84. Late applications considered if openings exist. SWTSU is an EO/AA employer.

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### STATE UNIVERSITY OF NEW YORK AT BINGHAMTON

The Department of Mathematical Sciences expects to have tenure-track-junior positions open in fall 1984. A senior appointment is also a possibility. Applications are invited from candidates having excellent research records or potential. All areas of pure and applied mathematics, including computer science, will be considered. The department has considerable computer science responsibilities, so applicants with CS experience, at whatever level, are asked to describe it. Send vita and letters of recommendation to:

David L. Hanson, Chairman  
Department of Mathematical Sciences  
State University of New York at Binghamton  
Binghamton, NY 13901

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### Mathematics UNIVERSITY OF IOWA

Applications are encouraged for anticipated tenure-track, tenured positions, and visiting positions at all levels. Application, vita, and three letters of recommendation should be sent to Robert H. Oehmke, Department of Mathematics, University of Iowa, Iowa City, Iowa 52242. Selections will be based on evidence of the applicants' effective teaching and research achievements and potential, instructional needs of the Department, and the potential for interaction with the faculty at the research level. Special attention will be given to applicants in numerical analysis or partial differential equations. The selection process will begin on January 25, 1984. The University of Iowa is an Affirmative Action and Equal Opportunity Employer and specifically encourages applications from women and minorities.

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### NORTHEASTERN UNIVERSITY Department of Mathematics

Applications are invited for several tenure-track appointments (Associate or Assistant Professor, depending on qualifications). A Ph.D. is required, and priority will be given to candidates with strong records of scholarship and excellence in teaching. Particular needs of the department are in applied analysis, applied algebra and statistics. Pending budgetary considerations, non-tenure track Assistant Professorships and/or Postdoctoral lectureships may be available. All positions start fall 1984. Please send résumé and three letters of reference to Hiring Committee Chairman, Department of Mathematics, Northeastern Univ., Boston, MA 02115, by Feb. 1, 1984. Northeastern University is an Equal Opportunity/Affirmative Action Employer.

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### EMORY UNIVERSITY

#### DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

Tenure-track assistant or (junior) associate professor in analysis, numerical analysis or computer science, beginning August 1984. Strong research commitment is required.

EMORY UNIVERSITY, located in suburban Atlanta, is enlarging the faculty of the Department of Mathematics and Computer Science in response to the growth of both the graduate and undergraduate programs. The teaching environment (small classes, able students, no remedial programs) is unusually good. All applications should include a vita, a publication list, and at least three letters of reference. These should be submitted to:

Paul Waltman, Chairman  
Department of Mathematics and Computer Science  
Emory University  
Atlanta, GA 30322

Applications will be reviewed beginning February 1, 1984.

EMORY UNIVERSITY is an affirmative action/equal opportunity employer. Applications from members of minority groups and women are particularly encouraged.

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### EMORY UNIVERSITY

#### DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

Senior position in analysis, professor or associate professor, beginning August 1984. Established research record, proven ability to work with graduate students and a willingness to play a major role in the development of a quality graduate program are required. Preferred areas are differential equations, numerical analysis or applied mathematics. All applications should include a vita, a publication list, and the names of at least three references. Submit to:

Paul Waltman, Chairman  
Department of Mathematics and Computer Science  
Emory University  
Atlanta, GA 30322

Applications will be reviewed beginning January 1, 1984.

EMORY UNIVERSITY is an affirmative action/equal opportunity employer. Applications from members of minority groups and women are particularly encouraged.

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**MICHIGAN TECHNOLOGICAL UNIVERSITY** — Several tenure-track positions in *applicable mathematics* (e.g., probability, fluid mechanics, ODE, PDE, etc.) *statistics, operations research, numerical analysis, and computer science* as well as visiting positions in all areas are available. Assistant or associate professors preferred. Excellent research and teaching required. MTU is a strong engineering school with good students and consulting possibilities. Some 3-year instructorships are also open. Houghton has temperatures moderated by Lake Superior with a great deal of snow and recreational activities. To apply, write to R. Millman, Mathematical and Computer Sciences, Michigan Technological University, Houghton, Michigan 49931. MTU is an equal opportunity educational institution/equal opportunity employer.

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### University of Central Florida

Applications are invited for two tenure-track positions at the Assistant or Associate professor level, beginning August 1984. Ph.D. degree with strong research potential or experience and dedication to teaching at undergraduate level required. Preferred research areas include analysis, applied mathematics in the broad sense. Candidates should send a detailed résumé, and arrange to have at least three letters of recommendation and a transcript sent to:

Lokenath Debnath, Chairman, Department of Mathematics, University of Central Florida, Orlando, FL 32816, not later than February 1, 1984. The University is an equal opportunity/affirmative action employer.

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## POSITIONS AVAILABLE

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### MELLON FELLOWSHIP PROGRAM 1984

The Program in Science, Technology, and Society at MIT invites applications from scientists, engineers, and physicians for several one-year study fellowships on the relationships of science, technology, or medicine with society. Ph.D. or equivalent in science or engineering is desirable. Partial or full stipend available. Deadline: February 1, 1984. For more information, write: Leon Trilling, Chairman, Mellon Fellowship Committee, E51-128, MIT, Cambridge, MA 02139. MIT is an equal opportunity/affirmative action employer.

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### UNIVERSITY OF CALIFORNIA, SANTA BARBARA DEPARTMENT OF MATHEMATICS

The University of California at Santa Barbara Mathematics Department anticipates making several temporary, part- or full-time, teaching appointments during the 1984-1985 academic year. We anticipate both part-time visiting faculty positions and full-time visiting lectureships at a junior level (with possibility of renewal up to a maximum of 2 years). Applicants should be active research mathematicians or statisticians with certifiably good teaching skills. We encourage applicants in all research areas. Please send vita, publications list, letters of recommendation on teaching and research, and financial requirements by February 15, 1984 to:

Professor James B. Robertson, Chair  
Mathematics Department  
University of California  
Santa Barbara, CA 93106

An Affirmative Action/Equal Opportunity Employer.

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### DEPARTMENT OF MATHEMATICAL SCIENCES

#### WORCESTER POLYTECHNIC INSTITUTE

Tenure-track assistant professorships requiring a strong commitment to scholarship, excellent classroom teaching and project advising. Preference will be given to applicants whose research interests parallel current work in the department, which includes discrete modeling, computer mathematics, applied analysis, differential equations, mathematical physics, operations research, statistics, and applied probability.

Worcester Polytechnic Institute is an Equal Employment Opportunity/Affirmative Action Employer.

Send applications to Bruce C. McQuarrie, Mathematical Sciences Department, Worcester Polytechnic Institute, Worcester, Massachusetts 01609.

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### DEPARTMENT OF MATHEMATICS LEHIGH UNIVERSITY

Applications are invited for three tenure-track positions of assistant professor, beginning in August 1984. One of the appointments may be made at the rank of associate professor for an individual with outstanding credentials. Candidates must possess a Ph.D. in mathematics, statistics or operations research. Preferred areas of specialization are classical analysis, geometry, mathematical statistics, numerical methods, operations research, partial differential equations, and probability. A strong commitment to excellence in teaching and research is essential. Salary and benefits are highly competitive. Anticipated teaching load is approximately six hours per week every semester.

Send résumé, transcripts, and three letters of recommendation to Professor Gregory McAllister, Chairman of Search Committee, Department of Mathematics, Lehigh University, Bethlehem, PA 18015. Applications will be accepted until February 1, 1984, or until the positions are filled.

Lehigh University is an EO/AA employer.

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MIAMI UNIVERSITY anticipates at least two tenure-track assistant professorships in the Mathematics and Statistics Department beginning August 1984. Candidates should have a Ph.D. in mathematics, statistics or operations research and a genuine interest in teaching and scholarship. Duties include teaching an average of 8 to 9 classroom hours per week, continuing research, and departmental service. For one position, preference will be given to applicants in operations research. The second position will be unrestricted. Candidates should send vitas, graduate transcripts and three letters of recommendation to Professor Fred Gass, Mathematics and Statistics Department, Miami University, Oxford, Ohio 45056 by February 1. (Late applications may be considered.) AA/EOE

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### IHPST, University of Toronto

The Institute for the History and Philosophy of Science and Technology of the University of Toronto invites applications for a tenure-track assistant professorship in the history of mathematics, for which the salary, depending on qualifications, is \$25,400 to \$43,000; the position begins on July 1, 1984. The rank of beginning associate professor, with salary starting at \$31,200, is also a possibility. Candidates must have a Ph.D. or its equivalent and a strong record of scholarly publications. The Institute seeks as its first choice someone whose work concentrates on aspects of eighteenth or nineteenth century mathematics which are closely related to the history of physics. We will also consider applicants concentrating in the scientific revolution or in ancient mathematics. We require a person able to provide leadership to a program of graduate teaching. Applications, including curriculum vitae and names of at least two references, should be sent by January 15, 1984, to Professor J. Z. Buchwald, IHPST, Victoria College, 73 Queen's Park Crescent East, Toronto, Ontario M5S 1K7. In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and permanent residents.

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### The Citadel

Applications are invited for tenure-track position(s) at the Assistant or Associate level. Teaching responsibilities at all undergraduate levels of Computer Science and Mathematics.

Qualifications include master's degree in Computer Science or Ph.D. in Mathematical Science with a strong background in Computing, capacity for research, and a dedication to undergraduate teaching. Salary negotiable. Liberal benefits include possible resources for assistants to pursue advanced Computer Science degrees. The Citadel is a state-supported, liberal arts, military college offering undergraduate degrees in the arts, sciences, engineering, education, and business administration.

Please send résumé which includes the names of three references to:

Charles E. Cleaver, Head, Department of Mathematics and Computer Science, The Citadel, Charleston, SC 29409. Applications should be received by February 1, 1984 to ensure consideration. The Citadel is an AA/EOE.

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EMPORIA STATE UNIVERSITY invites applications for an Assistant or Associate tenure-track appointment. Ph.D. in Computer Science preferred. Ph.D. in Mathematics, Statistics, or related areas with strong background in Computer Science will be considered. Excellence in teaching and commitment to scholarly activities is expected. Send résumé and three letters of reference to Dr. John Carlson, Search Committee Chair, Division of Mathematical and Physical Sciences, Emporia State University, Emporia, Kansas 66801. Deadline for applications: February 15, 1984 or until position filled. Appointment date: August 15, 1984. Equal Opportunity Employer.

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## POSITIONS AVAILABLE

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The Department of Mathematics and Statistics at Mississippi State University anticipates two or more tenure-track positions at the Assistant Professor level for the 1984-1985 academic year. A Ph.D. is preferred. Responsibilities include teaching and research. Candidates should submit a vita and three letters of recommendation by February 1, 1984, to J. L. Solomon, Head, Department of Mathematics and Statistics, Mississippi State, MS 39762. Mississippi State University is an equal opportunity/affirmative action employer.

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### NORTHWESTERN UNIVERSITY

The Mathematics Department invites applications for one or more possible positions at the Full, Associate, or Assistant Professor level. Outstanding candidates with excellent research credentials and a demonstrated commitment to teaching are sought in all fields of mathematics. Please send applications including vita and names of at least three references to:

Professor Eric M. Friedlander  
Department of Mathematics  
Northwestern University  
Evanston, IL 60201

Northwestern University is an Equal Opportunity/Affirmative Action employer.

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### NORTHWESTERN UNIVERSITY

Two 2-year positions at the assistant professor level and/or shorter term positions for higher level visitors are anticipated. Preference will be given to mathematicians who will profit from and contribute to our emphasis year in Group Cohomology and its applications to Algebraic Topology and Algebraic K-theory. Send applications including vita and three letters of reference to:

Professor Eric M. Friedlander  
Department of Mathematics  
Northwestern University  
Evanston, IL 60201

Northwestern University is an Equal Opportunity/Affirmative Action employer.

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### PURDUE UNIVERSITY CALUMET

Hammond, Indiana

DEAN

School of Science and Nursing

Applications and nominations are invited for the position of dean in this school which includes departments of Biology, Chemistry and Physics, Mathematical Sciences, and Nursing.

The School of Science and Nursing is one of three degree-granting schools of Purdue Calumet, a commuter campus of approximately 7800 students, located in the northwest Indiana-Chicago metropolitan area. Undergraduate and master's level programs offered.

Candidates must have an earned doctorate in an appropriate discipline from a recognized institution, effective college or university teaching experience, a record of research or creative activity, administrative experience, and must qualify for full professor. This position will be available July 1, 1984. Salary is competitive. Deadline for applications is January 9, 1984. Nominations or applications, including vita and names of three references, should be sent to:

Professor Samuel D. Paravonian, Chairman  
Dean Selection Advisory Committee  
Purdue University Calumet  
Hammond, Indiana 46323

An Equal Access/Equal Opportunity University

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### TEXAS A&M UNIVERSITY DEPARTMENT OF MATHEMATICS

Applications are invited for several tenure-track openings. All areas and ranks are considered. The Department has active research groups in Algebra, Approximation Theory, Functional Analysis, Geometry and Non-Linear Analysis, Number Theory and Partial Differential Equations and Combinatorics, Applied Mathematics, Probability, and Topology.

Interested individuals should send a vita and arrange for letters (if appropriate) to be sent to:

Dr. H. E. Lacey, Head  
Department of Mathematics  
Texas A&M University  
College Station, Texas 77843

Equal Opportunity through Affirmative Action

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### TEXAS A&M UNIVERSITY DEPARTMENT OF MATHEMATICS

Texas A&M University and the Department of Mathematics invites applicants for the OWEN CHAIR in Mathematics. This is an endowed chair established by the gift of George Arthur and Mary Emolene Owen. The successful candidate must have a distinguished research record and considerable stature in the international mathematical community. The position is open to all areas of Mathematics. The Department has active research groups in Algebra, Approximation Theory, Functional Analysis, Geometry and Non-Linear Analysis, Number Theory and Combinatorics, Partial Differential Equations and Applied Mathematics, Probability, and Topology.

Interested individuals should contact:

Dr. H. E. Lacey, Head  
Department of Mathematics  
Texas A&M University  
College Station, Texas 77843

Equal Opportunity through Affirmative Action

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### DEPARTMENT OF MATHEMATICS UNIVERSITY OF ALABAMA IN BIRMINGHAM

A tenure-track position for fall 1984. Candidates must have an established record of quality research and be able to enhance the current research efforts of the department. Department members are currently active in algebra, applied mathematics, ordinary and partial differential equations and point set topology. Appointments will be made at the rank of assistant professor, associate professor or professor, depending on qualifications and experience. Salary negotiable. Applicants should send letter of application, vita and three letters of reference to Professor Louis Dale, Mathematics Department, University of Alabama in Birmingham, Birmingham, AL 35294. UAB is an Affirmative Action/Equal Opportunity Employer.

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Pending final budgetary approval, Associate or Full Professor tenured position beginning fall 1984. Must have distinguished research record. Inquiries to Leo Breiman, Chair, Personnel, Department of Statistics, University of California, Berkeley, CA 94720, by January 15, 1984. The University of California is an Equal Opportunity, Affirmative Action Employer.

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Pending final budgetary approval, tenure-track Assistant Professor position beginning fall 1984. Must have strong research potential, preferably in statistics. Résumés to Leo Breiman, Chair, Personnel, Department of Statistics, University of California, Berkeley, CA 94720, by January 15, 1984. Names of three references also required. The University of California is an Equal Opportunity, Affirmative Action Employer.

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## POSITIONS AVAILABLE

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### UNIVERSITY OF UTAH DEPARTMENT OF MATHEMATICS

invites applications for the following positions

1. Three or four non-renewable 3-year Instructorships. Persons of any age receiving Ph.D. degrees in 1983 or 1984 are eligible. Applicants will be selected on the basis of ability and potential in teaching and research. Starting salary this year is \$21,500 and cost of living increases are contingent on action by the State Legislature. Duties consist of teaching two courses through the academic year.
2. One visiting position of one year or less. Selection criteria are teaching ability and potential contribution to our research environment.
3. Permanent senior level positions may become available. Selection will be based on availability of funds, research expertise and teaching ability.

Applications must include curriculum vita, bibliography and three references. (Instructorship applications must also include an abstract of thesis and a list of graduate courses completed or transcripts.) Applications will not be accepted after our deadline date of March 31, 1984.

Please send your application to:

#### COMMITTEE ON STAFFING DEPARTMENT OF MATHEMATICS UNIVERSITY OF UTAH SALT LAKE CITY, UTAH 84112

The University of Utah is an equal opportunity—affirmative action employer

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### APPLIED MATHEMATICS

University of Wyoming

One or more tenure-track positions are anticipated in applied mathematics. Emphasis on energy-related research, interaction with the scientific and engineering communities, and leadership within the Mathematics Department. Excellent research opportunities.

Inquiries or applications should be sent to Professor Richard E. Ewing, Personnel Committee, Department of Mathematics, The University of Wyoming, Laramie, Wyoming 82071.

The University of Wyoming is an Equal Opportunity/Affirmative Action Employer.

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### WESLEYAN UNIVERSITY DEPARTMENT OF MATHEMATICS

Applications are invited for a tenure-track position in traditional mathematics, at the Assistant Professor level, with a preference for someone working in analysis or probability. However, applications from any area are welcome. The position begins in 1984–1985, with the initial appointment normally for four years.

Wesleyan is a university of 2,500 students. The department has 14 members and conducts a small graduate program (roughly 12 students with two Ph.D.'s awarded each year).

To apply, please arrange that a vita and three letters of reference be sent by January 15, 1984 (earlier if possible) to: Search Committee, Department of Mathematics, Wesleyan University, Middletown, Connecticut 06457.

Wesleyan University is an Equal Opportunity/Affirmative Action employer.

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### ARIZONA STATE UNIVERSITY Department of Mathematics

Applications are invited for positions at ranks of Assistant and Associate Professor. There is a possibility of appointments at Professor rank. Visiting positions are also expected. Send vita and direct 3 letters of recommendation to J. Bustoz, Chair, Department of Mathematics, Arizona State University, Tempe, AZ 85287. A. S. U. is an equal opportunity employer.

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### GEORGETOWN UNIVERSITY Department of Mathematics

Applications are invited for a tenure-track position at the assistant professor level. Ph.D. is required with research credentials in one of the following areas: harmonic analysis, partial differential equations, differential equations in function spaces. Strong interest in undergraduate teaching with some experience is preferred. Send a detailed vita and reprints or preprints, if available, and arrange to have three letters of reference sent to:

Chairman  
Department of Mathematics  
Georgetown University  
Washington, D.C. 20057

Georgetown University is an Equal Employment Opportunity/Affirmative Action Institution in employment and admissions.

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CLEVELAND STATE UNIVERSITY, Mathematics department, offers tenure-track position available September 15, 1984; rank open. This position requires Ph.D. in mathematics, established record or strong potential for research, a commitment to excellence in teaching, and broad undergraduate teaching interests. The ideal candidate will have, in addition to above, research interest or experience in partial differential equations, numerical analysis, statistics, operations research. Duties include teaching graduate and undergraduate mathematics courses (normal load, two courses per quarter) and mathematics research. Competitive salary with excellent fringe benefits. Send vita and at least three letters of recommendation by January 6, 1984 to T. W. Hungerford, Chairperson, Department of Mathematics, Cleveland State University, 1983 E. 24th Street, Cleveland, OH 44115.

Equal Opportunity Employer M/F/H

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### UNIVERSITY OF SOUTH ALABAMA Department of Mathematics and Statistics

Applications are being accepted for at least two tenure-track positions at the rank of Assistant Professor. A successful applicant must possess a Ph.D. in Mathematics. Preferred specialties include differential equations, dynamical systems, ergodic theory, functional analysis, geometric topology, information theory, number theory, and numerical analysis. The duties of these positions include teaching undergraduate and graduate mathematics courses, carrying out research or other creative activity, and contributing to a scholarly atmosphere. The appointment will begin September 1984. Applicants should send a detailed resumé, transcripts, and three letters of recommendation to Dr. S. Gene Crossley, Chairman, Department of Mathematics and Statistics, University of South Alabama, Mobile, AL 36688. The closing date is February 1, 1984. USA is an equal opportunity/affirmative action employer.

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### COMPUTER SCIENCE/MATHEMATICS

GETTYSBURG COLLEGE invites applications for a tenure-track position in computer science and mathematics at the assistant professor level, to begin September 1984. A doctorate in mathematics or computer science is required. Computer science background at least at the masters level is preferred. Duties include teaching computer science and some mathematics. Salary is commensurate with qualifications.

Gettysburg College is a four-year coeducational, selective liberal arts college related to the Lutheran Church in America. It has approximately 1850 students, with a student-faculty ratio of 13:1, and is located near Baltimore and Washington, D.C. Computing facilities include a Burroughs 5920 and a Microcomputer Laboratory with 28 Apple II computers.

Send resumé and three letters of reference to David Flesner, Acting Chairman, Department of Computer Studies, Gettysburg College, Gettysburg, PA 17325. To insure consideration, submit application by February 1, 1984. An Equal Opportunity/Affirmative Action Employer.

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## POSITIONS AVAILABLE

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### CLEMSON UNIVERSITY

#### DEPARTMENT OF MATHEMATICAL SCIENCES

The Clemson University Department of Mathematical Sciences has at least three approved faculty positions beginning Fall Semester 1984.

#### SENIOR POSITION (Full Professor)

The Department seeks a senior mathematical scientist with specialization in one of three areas: APPLIED ANALYSIS/COMPUTATIONAL MATHEMATICS, DISCRETE MATHEMATICS/OPERATIONS RESEARCH, OR STATISTICS. Interest in the computational aspects of the area is desirable as are research interests in the applications of the mathematical sciences to the solutions of real world problems. The salary is competitive and commensurate with experience.

#### ASSISTANT PROFESSORSHIPS

Each of at least two assistant professorships will be filled by a mathematical scientist possessing the Ph.D. degree with emphasis in one of the three areas: APPLIED ANALYSIS/COMPUTATIONAL MATHEMATICS, DISCRETE MATHEMATICS/OPERATIONS RESEARCH, OR STATISTICS. The completion of all requirements for the Ph.D. degree prior to August 15, 1984, may be substituted for the awarded Ph.D. degree. Strength in the computational aspects of the area is highly desirable as are research interests in the applications of the mathematical sciences to the solutions of real world problems. All approved positions will be nine-month, tenure-track positions and salaries will be competitive.

The Department of Mathematical Sciences at Clemson University embraces algebra/combinatorics, analysis, computational mathematics, operations research and statistics and integrates these mathematical sciences into its B.A., B.S., M.S., and Ph.D. programs. Applications will be accepted until all approved positions are filled. Vitae (with names and telephone numbers of three references), nominations, and requests for further information should be sent to: Dr. John D. Fulton, Head, Department of Mathematical Sciences, Clemson University, Clemson, SC 29631.

CLEMSON UNIVERSITY IS AN AFFIRMATIVE ACTION/EQUAL OPPORTUNITY EMPLOYER.

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### UNIVERSITY OF NORTH FLORIDA

Applications are invited for a visiting position in statistics for the spring semester (January-May), 1984. Rank is up to Associate Professor, depending upon qualifications. A Ph.D. in statistics is strongly preferred. Duties include teaching major and service courses, with some consulting available. A second visiting position at the Assistant Professor (Ph.D.) level for the same period in either mathematics or statistics is anticipated. Apply by December 1, 1983 to William Caldwell, Chairperson, Department of Mathematical Sciences, University of North Florida, Jacksonville, FL 32216.

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ASSISTANT PROFESSOR, Mathematics, full-time, January 1, 1984 to June 30, 1984, non-tenurable. Duties: Teach undergraduate courses in algebra, precalculus mathematics and applied mathematics. Minimum Qualifications: Ph.D. in mathematics or computer science. Salary: \$16,872-\$22,800 depending on qualifications and experience. Send letter of application, vita and three letters of reference to Robert G. Griswold, Chair, Mathematics Discipline, College of Arts and Sciences, University of Hawaii at Hilo, 1400 Kapiolani Street, Hilo, HI 96720; phone 808-961-9387. Deadline for receipt of applications: November 30, 1983. AA-EEO Employer.

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## APPLIED MATHEMATICS TRINITY UNIVERSITY

Trinity University invites applications and nominations for a tenure-track position in applied mathematics at the rank of Assistant Professor, appointment beginning August, 1984. Responsibilities include teaching nine credit hours per semester, continuing scholarly activity, developing and expanding applied mathematics offerings as appropriate to the needs of the department and the university, interacting in a creative way with other departments and programs, advising and the usual committee service.

Minimum qualifications are the Ph.D. in mathematics, applied mathematics or operations research, training and/or experience in discrete mathematics, excellence in and strong commitment to teaching. Salary is \$23,000 to \$24,000.

Trinity University is one of the thirty most heavily financed private institutions in America. Founded in 1869, it occupies a modern campus overlooking the San Antonio skyline. Purposely small and selective, with about 3000 students, Trinity stresses a high quality, largely undergraduate liberal arts program.

Send vita, transcripts and three letters of reference to Donald F. Bailey, Department of Mathematics, Trinity University, San Antonio, Texas 78284. Closing date for applications is February 25, 1984.

Trinity University is an equal opportunity, affirmative action employer.

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### CASE WESTERN RESERVE UNIVERSITY

Expected tenure-track and visiting positions in mathematics and statistics to begin August 15, 1984. Outstanding research record and/or proven research potential and teaching excellence required. Rank and area open. Contact Professor W. A. Woyczynski, Chairman, Department of Mathematics and Statistics, Case Western Reserve University, Cleveland, Ohio 44106.

An Equal Opportunity Employer.

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BURROUGHS CORPORATION, ADVANCED TECHNOLOGY DIVISION-AUSTIN RESEARCH CENTER has a research position available in mathematics/logic/computer science. Candidates must have solid theorem-proving ability and should have some training in mathematical logic. Familiarity with lambda-calculus, Scott-Strachey semantics, and higher-order logic is desirable. Computer science background in LISP, applicative languages, mechanical theorem proving, program verification, or A. I. is desirable. Applicant must be willing to work on specific problems in logic and semantics related to applicative (functional) programming languages. Send résumé to Dr. Carl Pixley, Burroughs Corporation, ATD-Austin Research Center, 12201 Technology Blvd., Austin, Texas 78727. Burroughs Corporation is an Equal Opportunity/Affirmative Action employer.

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UNIVERSITY OF WISCONSIN-MADISON, MATHEMATICS DEPARTMENT, VAN VLECK HALL, 480 Lincoln Drive, Madison, WI 53706. The Department of Mathematics solicits applications from Logicians of established excellence for a possible Assistant Professor appointment commencing in the Fall of 1984. Applications should be sent no later than December 1, 1983 to Professor J. Marshall Osborn, Ch., Department of Mathematics (address above). The University of Wisconsin is an Equal Opportunity Employer.

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University of Wisconsin-Milwaukee,  
Mathematics Department, Milwaukee, Wisconsin, 53201.

The Department of Mathematics solicits applications from algebraists for a possible senior and/or junior position commencing in the fall of 1984. Applications should be sent to Professor A. K. Boyle, Department of Mathematics (address above). The University of Wisconsin is an AA/EOE.

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## POSITIONS AVAILABLE

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Eastern Iowa Community College District  
2804 Eastern Avenue  
Davenport, Iowa 52803

Full-time instructor needed for 20 instructional hours/week for a growing department to teach freshman/sophomore mathematics and computer science (BASIC, FORTRAN or COBOL) or to teach freshman/sophomore mathematics and engineering related courses. Qualifications: Master's Degree or be able to meet Iowa Department of Public Instruction certification requirements. Salary: commensurate with education and experience. Starting date: January 9, 1984. Application deadline: November 15, 1983. Equal Opportunity Institution.

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**MATHEMATICS DEPARTMENT  
UNITED STATES NAVAL ACADEMY  
ANNAPOLIS, MARYLAND 21402**

Applications are invited for a three-year tenure-track appointment as Assistant Professor commencing January 1984 or August 1984. Ten-month salary \$21,000-\$28,000, commensurate with experience and qualifications. Research opportunities exist for augmenting salary during summer. Specialization in applied mathematics desired but not essential. Applicants must possess Ph.D., have a commitment to excellence in teaching, and be capable of pursuing independent research. Send inquiries and applications to Professor F. I. Davis, Chairman. Required of each applicant are a résumé, transcripts, and three letters of recommendation discussing applicant's teaching and research. The Naval Academy is an EO/AA employer.

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Applications are invited for four full-time, tenure-track positions, fall 1984. Ass't. Prof.-Prof. (\$22,000-\$38,000/yr. depending on qualifications). 12 units/semester, committee work, mathematical activity. Applicant must have Ph.D. in Math. or Stat. or Math Education. Teaching excellence a primary consideration. Qualified candidates should submit résumé, supporting documents and 3 letters of reference to Jim Jones, Chair, Department of Mathematics, California State University, Chico, CA 95929 by February 1, 1984. Affirmative Action Employer.

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### BRYN MAWR COLLEGE

Applications are invited for a tenure-track position in Mathematics at the Assistant Professor level, beginning September 1984. Candidates must have a Ph.D. in Mathematics and have demonstrated strong research potential and excellence in teaching. Applications, résumés and three letters of recommendation should be sent to M. Martelli, Acting Chairman, Department of Mathematics, Bryn Mawr College, Bryn Mawr, PA 19010 by January 15, 1984. Bryn Mawr College is an Equal Opportunity/Affirmative Action Employer.

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## FOR SALE

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**MATH SCI PRESS**, 53 Jordan Rd., Brookline, MA 02146; 617-738-0307. Just published: *Geometry of Riemannian Spaces*, by Elie Cartan. Translation by James Glazebrook of 1946 edition, notes by R. Hermann. \$50. 20% reduction on two or more volumes of entire list (see ad in Oct. '82 *Notices*) of 35 volumes.

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### Convergence of Solutions of the Kolmogorov Equation to Travelling Waves

**Maury Bramson**

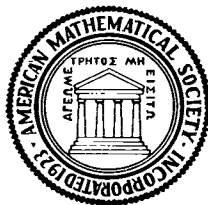
The classic Kolmogorov equation  $u_t = \frac{1}{2}u_{xx} + f(u)$  is investigated under general initial data. A necessary and sufficient condition on the initial data is given for convergence to a travelling wave as  $t \rightarrow \infty$ . In the case of convergence, a formula is given for computing the position of the wave. The methodology involves use of the Feynman-Kac integral and sample path estimates for Brownian motion.

#### Contents

1. Introduction
2. Some properties of Brownian motion and Brownian bridge
3. Basic properties of the Kolmogorov equation
4. Asymptotic behavior of the Kolmogorov equation under full heating
5. Convergence of the Kolmogorov equation in the case  $\lambda > 2^{1/2}$
6. Hitting probabilities for Brownian bridge
7. Estimates for the Kolmogorov equation in the case  $\lambda = 2^{1/2}$
8. Convergence of the Kolmogorov equation in the case  $\lambda = 2^{1/2}$  for finite initial mass
9. Convergence of the Kolmogorov equation in the case  $\lambda = 2^{1/2}$  for infinite initial mass

1980 *Mathematics Subject Classifications*: 60J60, 35K55  
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## REVIEWS IN RING THEORY

Compiled and Edited by Lance W. Small

Department of Mathematics, University of California, San Diego

These volumes collect 5,396 reviews from *Mathematical Reviews* of papers in noncommutative ring theory. All reviews of papers in ring theory from Volume 21 (1960) through Volume 58 (1979) appear here. Additionally, the editor has collected those papers from Volume 1 through Volume 20 which are necessary background. Papers on group rings, homological questions, and enveloping algebras with ring theoretic interest are also included.

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January 26–28, 1984

MUST BE RECEIVED IN PROVIDENCE NO LATER THAN DECEMBER 5, 1983

Please complete this form and return it with your payment(s) to

MATHEMATICS MEETINGS HOUSING BUREAU

P. O. Box 6887, Providence, Rhode Island 02940, Telephone (401) 272-9500, Ext. 239

PREREGISTRATION: Deadline for receipt of preregistration fee(s) is December 5, 1983.

HOUSING BUREAU SERVICES: Participants desiring to obtain confirmed reservations for hotel accommodations must preregister by the December 5, 1983 deadline.

CHANGES/CANCELLATIONS: Before January 15, 1984, make all changes to or cancellations of hotel reservations with the Mathematics Meetings Housing Bureau in Providence; after that date, changes or cancellations should be made with the Housing Office of the Louisville Convention and Visitors Bureau by telephoning 502-584-2144.

REFUNDS: Please note that only 50% of preregistration fee(s) is refundable if notification is received in Providence on or before January 23, 1984. After this date, there will be no refunds.

## REGISTRATION FEES

	Preregistration (by mail prior to 12/5)	At Meeting
<b>JOINT MATHEMATICS MEETINGS</b>		
Member of AMS and MAA	\$47	\$61
*Student, Unemployed, or Emeritus	\$12	\$15
Nonmember	\$71	\$93
<b>AMS SHORT COURSE</b>		
Member/Nonmember	\$25	\$30
*Student or Unemployed	\$ 5	\$10
<b>MAA MINICOURSES</b> (payable at meeting)		\$20
#1 – Linear programming		
#2 – Discrete algorithmic mathematics		
#3 – Teaching problems solving		
#4 – Applications of discrete mathematics		
#5 – Problems from industry		
#6 – Applications of computer graphics		
#7 – Conduit microcomputer software		
#8 – NonConduit microcomputer software		
<b>EMPLOYMENT REGISTER – Employer fee</b>	\$50	\$75

\* All full-time students currently working toward a degree or diploma qualify for the student registration fees, regardless of income. The unemployed status refers to any person currently unemployed, actively seeking employment, and who is not a student. It is not intended to include persons who have voluntarily resigned from their latest position. Persons who qualify for emeritus membership in either the AMS or MAA may register at the emeritus rate.

Please affix AMS or MAA label here.  
If none, complete 1–3 below.

PREREGISTRATION SECTION: Please check the function(s) for which you are preregistering:

Joint Mathematics Meetings ☐

AMS Short Course ☐

MAA Minicourses:

#1 ☐ #5 ☐

#2 ☐ #6 ☐

#3 ☐ #7 ☐

#4 ☐ #8 ☐

NOTE: I am preregistering for the Joint Meetings only  
in order to attend the MAA Minicourse(s). ☐

Employment Register – Applicant (no charge) ☐

NOTE: Applicants who wish to be included in the special  
issue of EIMS must submit applicant forms with preregistra-  
tion form and fee(s) by December 5.

Employment Register – Employer (fee \$50) ☐

Please be sure to complete and return herewith the appropri-  
ate Employment Register form.

- NAME (Please print) Surname First Middle
- ADDRESS Number and Street City State Zip Code
- AMS Member code \_\_\_\_\_ or MAA member code \_\_\_\_\_
- ADDRESS FOR CONFIRMATION OF ROOM RESERVATION IF OTHER THAN ABOVE
- Employing institution \_\_\_\_\_ Unemployed ☐ Emeritus ☐
- I am a student at \_\_\_\_\_ (7) Name of spouse \_\_\_\_\_  
(List if accompanying to meeting)
- Accompanying children (number) \_\_\_\_\_ (names, ages, sexes) \_\_\_\_\_
- Member of AMS ☐, MAA ☐, NONMEMBER ☐. (Member discount applies only to members of AMS and MAA.)  
Member of other organizations: AWM ☐, NAM ☐
- Joint Meetings fee enclosed \$ \_\_\_\_\_ (11) Employer fee enclosed \$ \_\_\_\_\_ (12) AMS Short Course fee enclosed \$ \_\_\_\_\_
- TOTAL AMOUNT ENCLOSED FOR 10 through 12 \$ \_\_\_\_\_ (Please make all checks payable to AMS. Canadian checks must be marked "In U.S. Funds". Do not include payment for MAA Minicourse(s).)
- HOUSING DEPOSIT CHECK enclosed \$ \_\_\_\_\_. N. B.! Please make this check payable to the Louisville Convention & Visitors Bureau and/or supply major credit card information on reverse where indicated.

☐ Please check here if you will not require a room.

PLEASE BE SURE TO COMPLETE THE SECTION ON NEXT PAGE IF YOU WILL REQUIRE HOTEL ACCOMMODATIONS.

# PREREGISTRATION AND HOUSING FORM, LOUISVILLE, KENTUCKY

## Housing Section:

January 1984

Please indicate at least five choices in order of preference by writing 1, 2, 3, etc., in spaces at left on form, and by circling the requested room and rate. If the rate requested is no longer available, you will be assigned a room at another hotel at the next best available rate. If not all hotels are ranked, and all rooms have been filled at the ranked hotels, the assignment will be made at an unranked hotel with the next lowest rate. The rates listed below are subject to 9.2% hotel tax.

1) Name \_\_\_\_\_ Phone number \_\_\_\_\_

2) Full address (for confirmation) \_\_\_\_\_

3) Will arrive (date) \_\_\_\_\_ at \_\_\_\_\_ a.m./p.m., and depart (date) \_\_\_\_\_ at \_\_\_\_\_ a.m./p.m.

4) Enclosed is one night's deposit for each room reserved below in the amount of \$ \_\_\_\_\_ Enclosed is my personal check (where applicable) made out to the Louisville Convention

& Visitors Bureau. Credit card type \_\_\_\_\_ Card number \_\_\_\_\_ Expiration date \_\_\_\_\_

Order of choice	Name of Hotel (Numbers in parentheses indicate location on map in NOTICES.)	Single \$	Double \$	Twin \$	Twin Dbl. \$	Triple \$	Quad \$	Other \$	Deposit Payments* (CHECK PAYABLE LC & VB)
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	<b>GALT HOUSE (2)</b>	40	43	N/A	43	46	48	Parlor suite--110	A or B
	<b>HOWARD JOHNSON'S (4)</b>	38	44	N/A	44	50	56		A or B
	<b>HYATT REGENCY (7)</b>	50	59	59	59	67	74	Suites 180, 285	A/CC or B
	<b>THE LOUISVILLE INN (9)</b>	38	N/A	46	46	52	58	Parlor/Bdrm--85	A/CC or B
	<b>RODEWAY (3)</b>	43	49	N/A	49	49	49		A/CC or B
	<b>SEELBACH HOTEL (8)</b>	48	54	54	54	60	66	Suites 100, 250	A/CC or B
	<b>LOUISVILLE TRAVELodge (6)</b>	33	38	N/A	43	48	53		B

\*A = Personal Checks; A/CC = Personal Checks with credit card identification; B = Major Credit Cards.

NOTE: Confirmation will be sent only to individual submitting form.

5) List other room occupants:

FULL NAME

ARRIVAL DATE

DEPARTURE DATE

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