NOTICES OF THE AMERICAN MATHEMATICAL SOCIETY

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Calendar of AMS Meetings and Conferences

This calendar lists all meetings which have been approved prior to the date this issue of *Notices* was sent to the 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 been assigned. *Programs* of the meetings will appear in the issues indicated below. *First* and *supplementary* 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, insofar as is possible. Abstracts should be submitted on special forms which are available in many departments of mathematics and from the headquarters office of the Society. 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 for consideration for presentation at special sessions is usually three weeks earlier than that specified below. For additional information, consult the meeting announcements and the list of organizers of special sessions.

Meetings

Meeting #		Date	Place	Abstract Deadline	Program Issue
855	*	March 16-17, 1990	Manhattan, Kansas	Expired	February
856	*	March 23-24, 1990	Fayetteville, Arkansas	Expired	February
857	*	April 7-8, 1990	University Park, Pennsylvania	Expired	March
858	*	April 19-22, 1990	Albuquerque, New Mexico	Expired	March
859	*	August 8-11, 1990 (93rd Summer Meeting)	Columbus, Ohio	May 18	July/August
		October 20-21,1990	Amherst, Massachusetts	August 6	October
		November 2-3, 1990	Denton, Texas	August 6	October
		January 16-19, 1991 (97th Annual Meeting)	San Francisco, California	October 10	December
		August 8-11, 1991 (94th Summer Meeting)	Orono, Maine		
		March 16-17, 1991	South Bend, Indiana		
		March 22-23,1991	Tampa, Florida		
		January 8-11, 1992 (98th Annual Meeting)	Baltimore, Maryland		
		June 29-July 1, 1992 (Joint Meeting with the London Mathematical Society)	Cambridge, England		
		January 13-16, 1993 (99th Annual Meeting)	San Antonio, Texas		
		January 5-8, 1994 (100th Annual Meeting)	Cincinnati, Ohio		

* Please refer to page 179 for listing of special sessions.

Conferences

June 7–July 4, 1990: Joint Summer Research Conferences in the Mathematical Sciences, University of Massachusetts at Amherst, Massachusetts.

June 18–29, 1990: AMS-SIAM Summer Seminar on Vortex Dynamics and Vortex Methods, University of Washington, Seattle, Washington.

July 8–28, 1990: AMS Summer Research Institute on Differential Geometry, University of California, Los Angeles, California

Events Cosponsored by the Society

February 15–20, 1990: Section A (Mathematics) Sessions at the AAAS Annual Meeting, New Orleans, Louisiana.

Deadlines

	April Issue	May-June Issue	July-August Issue	September Issue
Classified Ads*	March 6, 1990	April 23, 1990	June 14, 1990	July 30, 1990
News Items	March 5, 1990	April 25, 1990	June 18, 1990	August 3, 1990
Meeting Announcements**	Feb 27, 1990	April 16, 1990	May 29, 1990	July 19, 1990

* Please contact AMS Advertising Department for an Advertising Rate Card for display advertising deadlines.

** For material to appear in the Mathematical Sciences Meetings and Conferences section.

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ADVERTISING
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Planning

Quite a long essay could result by giving a brief description of all of the planning activities that routinely take place at the Society. The budgeting exercise has little meaning without management plans for member services, the publication program, personnel needs, capital needs, and on and on. Several management groups maintain a continuing overview of Society operations and anticipate future needs to carry on Society activities. The information gained from the work of these groups then feeds into the year-long process of arriving at expenses to carry on the Society's activities and the setting of revenues to cover expenses. The FY1991 budgeting process started in early December 1989 and will culminate in an authorized budget for Society operations for FY1991 at the conclusion of the November 1990 Board of Trustees meeting.

These are interesting processes to the members; however, they are processes that deal with the mechanisms of implementing philosophical and strategical Society planning. How are these philosophical and strategical plans formulated? There is no brief answer to this question, but there are two very important review and planning processes just beginning in the Society which illustrate the early aspects of Society planning and which point to channels by which members can voice opinions about the planning process.

First is the appropriately named Long Range Planning Committee (LRPC), a standing Committee of the Board of Trustees. While its charge can be simply stated, the scope of its charge is enormous. The LRPC is to review the functioning of the Society and to report its conclusions to the Executive Committee of the Council and to the Board of Trustees. The work of this Committee has been very influential on the policies of the Society affecting governance, development/fund raising activity, publications, management, and budget. Members of this Committee are the Chair of the Board, Treasurer, Secretary, third- and fourth-year members of the Executive Committee, and the Executive Director.

An earlier LRPC recommended that every five years the Committee become intensely active. Following this schedule, the LRPC is undertaking a serious review and planning during 1990. There is an open letter to the members of the Society from the Chair of the LRPC in the "Inside the AMS" Section of the January issue of *Notices*, page 17. This letter solicits members' ideas and responses.

The second planning process is carried out by the Executive Committee (EC) of the Council. The EC consists of the President, Secretary, the President-elect (even-numbered years) or Ex-president (odd-numbered years), and four elected members from the Council. The Council, which sets the scientific policy of the Society, has charged the EC to perform a continuing review of Society activities. This is done on a six-year cycle with three phases, each lasting two years. In these phases, the EC reviews meetings, publications, and everything other than meetings and publications. The EC is to complete the review of a phase in one year, if possible, and use the second year for study of a special topic. Presently under way is the review of publications.

For the 1990 review of publications, the EC has identified special areas of the publication program for study. Members of the EC have selected from these special areas those on which they will complete the review and report to the Council. This review process will involve other members of the Council, members of Society publication and editorial committees, AMS staff, and members at large.

Planning at the Society is a continuing activity which provides an opportunity for members to express their ideas.

William Jaco
Executive Director

Letters to the Editor

Small Travel Grants

The November *Notices* (p. 1212-1213) reported on the discussion in the science policy committee about the idea of travel grants. Some of the comments given by members of that committee were so bizarre that a letter to the editor seems in order.

First off, most members of the AMS (but not apparently some members of the science policy committee) know how hard it is for all but the very best mathematicians at the very best places to stay alive mathematically–to stay informed about what is 'happening' in mathematics. Moreover, the vast majority of active mathematicians receive litte or no encouragement that the research they are doing is worthwhile. The future 'super stars' among our undergraduates will probably go into mathematics regardless–but what about other, potential Ph.D.'s? Everyone agrees that we need to attract bright students to mathematics. Additional graduate fellowships or postdocs are less meaningful then one might think–if the teachers of these self-same students are honest and say: "Well you will get support for a few years but, unless you turn into a super star, you'll get no help thereafter." After all, consider how little hope even a "better than average" researcher has of receiving support. This is the point. Not ad hominum comments about who is or who is not worthy of a research grant.

Perhaps we should restrict these proposed travel grants to people who have not had a research grant in the last n years (pick you favorite value of n). Perhaps they should come out of the educational division in DMS. I neither know nor care. But I do know that something is seriously wrong with the mathematical infrastructure in the United States and we had better do something about it–fast.

Some specific comments about concerns raised by members of the committee:

1. Travel grants will help mathematicians stay "mathematically alive". This improves the infrastructure of mathematics in the U.S. (If properly pitched this is politically potent.) And, so is the "return on the investment" that McDonald asked about. Also pitched this way, Polking's comments are also irrelevant as the grants are for "infrastructure" or "continuing education" rather than pure "research grants".

The Association for Women in Mathematics currently administers a program similar to the one proposed (funded by NSF in fact). Obviously, sex plays no role except (given the extra problems faced by women in science) to explain why they had the idea first. It's a good idea, period. Therefore:

2. Lipsman says the plan sounds like "welfare". His comments are especially bizarre considering the kind of people who are not getting support. The cutoff is now so high that people who have won Sloan fellowships, continue to be active, can't be assured of support. (Does he think that all women receiving travel grants from the NSF (via the AWM) are on "welfare"?)

3. Does Glimm mean to imply that everyone applying but not getting a grant is a "loser"? By this kind of reasoning the vast majority of mathematicians are "double losers".

One needs super-highways–one also needs feeder roads. This is ultimately the reason for a small grants program.

Gary Cornell
University of Connecticut &
Visiting Scientist, IBM Watson Labs
(Received November 22, 1989)

In Allyn Jackson's article "Science Policy Committee Looks at Accreditation and Travel Grants," several concerns about the implementation of a small travel grant program funded by the NSF were expressed. First, the Foundation expressed reservations about producing a class system among researchers, with those receiving travel grants constituting a "second class." Second, there is the fear of spreading already inadequate funds too thinly, thereby detracting from the strength of the basic research enterprise in this country. Finally, some members of the Science Policy Committee opposed the plan on the grounds that it sounded like "welfare" and would create a group of "double losers." While I fully agree that the second issue is a valid objection to what would be a costly program, I would like to cite the first

Policy on Letters to the Editor

Letters submitted for publication in *Notices* are reviewed by the Editorial Committee, whose task is to determine which ones are suitable for publication. The publication schedule normally requires from two to four months between receipt of the letter in Providence and publication of the earliest issue of *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. Letters which have been, or may be, published elsewhere will be considered, but the Managing Editor of *Notices* should be informed of this fact when the letter is submitted.

The committee reserves the right to edit letters.

Notices does not ordinarily publish complaints about reviews of books or articles, although rebuttals and correspondence concerning reviews in *Bulletin of the American Mathematical Society* will be considered for publication. All published letters must include the name of the author.

Letters should be typed and in legible form or they will be returned to the sender, possibly resulting in a delay of publication.

Letters should be mailed to the Editor of *Notices*, American Mathematical Society, P.O. Box 6248, Providence, RI 02940, and will be acknowledged on receipt.

and third as examples of how the view from the top often gives us a distorted picture, and is not the only one that should be considered. (Fortunately, it appears that other members of the Committee have taken the broader view, and the plan is still alive.)

With over 19,000 working mathematicians unfunded in any way and, therefore, eligible at best for grants regarded as second-class, it is no wonder our profession is in trouble. From the position of most hard-working mathematicians trying to do research with little institutional funding and no hope of first-class support, a travel grant program is quite attractive. When (deservedly) well-funded mathematicians who probably have little idea of what life is like for most of the membership of the AMS decide that such grants would constitute welfare, they seriously undermine the integrity of their constituency. Let mathematicians make those decisions for themselves. Application is not, after all, mandatory.

The community already has one example of a successful travel grant program that is functioning on a much smaller scale than the AMS program would, but has in the past year provided partial support for twenty-five women with no other outside funding to attend research conferences in their fields. The Association for Women in Mathematics has a three-year grant from the NSF to award travel grants to women; while we have had to turn away more applicants than we would like, this disappointment is far outweighed by the pleasure of supporting these research efforts. We've had no complaints that those women who have received the grants feel like second-class citizens. The grants have not been difficult to administer, and the panels, meeting via conference call, have found the work rewarding. The response to this program is much greater than we expected, and demonstrates that (women) mathematicians need travel funds and are willing to apply for them. If the AMS can convince the NSF to fund such a program without jeopardizing the basic research effort, I sincerely hope that the Science Policy Committee will see this as a most worthwhile program, affecting a wide range of mathematicians, and deserving of its most enthusiastic endorsement.

Rhonda J. Hughes
Past-President, AWM
Bryn Mawr College
(Received November 27, 1989)

Mentoring and the Mathematics Postdoc

As three 'mentored' postdocs, we were excited to read William Jaco's statement on the health of the postdoctoral program in mathematics. In particular, he points out that the mathematics community, in contrast to related disciplines, does not view the postdoc 'as a continuing education/training period' and that no active component of mentoring is generally found in a postdoc program. We feel fortunate to be postdocs at St. Olaf College where mentoring *is* an active component of the program. The situation at St. Olaf is perhaps the exception more than the rule, but we hope that this innovative program will serve as a model and an incentive to other colleges and universities.

The aim of this program is to help us develop as researchers *and* as teachers. Like postdocs in more traditional programs, we receive financial support for research (in the form of half of the normal teaching load, supported by a grant from the Fund for the Improvement of Post-Secondary Education), allowing us to expand our individual research programs. Unlike most postdocs, we have mentors who help us, primarily by facilitating our development as teachers. We meet weekly to discuss classroom issues, local and national curriculum reform trends, and the maintenance of a vibrant mathematics program. Other features of the program, designed to help with teaching, include student observers and videotaping. St. Olaf is well qualified to carry out such a program; the department has a broad curriculum as well as a very strong commitment to excellence in teaching, and the proximity to (and cooperation of) the University of Minnesota make a research library and seminars easily accessible.

We believe that mentoring should play a role for more postdocs and that mentored postdoc programs make sense at a wide range of institutions (at four year schools as well as at research universities). Nearly all mathematicians teach, and our discipline can only benefit if its new members are effective and stimulating teachers. A mentored postdoc program can also be used to attract Ph.D.'s from allied areas (such as statistics, computer science and operations research), who often have limited teaching experience, to teach in our undergraduate mathematics programs.

We hope to see a cooperation between undergraduate institutions, research universities, professional societies and funding agencies that will lead to a revitalization of the national mathematics postdoc program.

Steve Benson
Tim Hesterberg
Karen Saxe
St. Olaf College
(Received November 16, 1989)

Feminist Critiques of Science

The recent critiques of the "Feminist Critiques of Science" in the July/August 1989 issue of *Notices* prompt me to record a few observations.

1) In this era of indiscriminate articulation mathematicians are indeed among the most vulnerable and conspicuous targets for pent up resentments let loose in the guise of sociological studies. Vulnerable, because communication with Mathematics is so delicate and intimate that it requires peace and privacy, whether pursued by a team or in isolation. Mystifying publicity only

stirs up grudges in those that feel left out. Serious expositions are a totally different matter. They do not need to resort to the human touch to appease or amuse the reader. Rather than any of the ordinary frailties it is the mathematician's total absorption, baffling enthusiasm and hidden sufferings that arouse envy and discomfort. But, most of all, the proverbially forbidding difficulty of Mathematics makes us both conspicuous and suspect. Family ties associate us with the notorious scapegoat "responsible" for all evils of technocracy. As if Mathematics and Physics had not for a long time been aware of their limitations in a very precise form!

2) Is there any need to bring in the dichotomy between "masculine" and "feminine" to confuse the issue of popular misconceptions about role, nature and claims of the sciences? Do we have to engage in debates? Can we not let our work speak for itself, show instead of discuss? How about educating the public by competent objective expository writing, without apologizing for difficulties and unresolved problems inherent in the subject matter?

3) To be sure, a woman in Mathematics has to face additional obstacles, from her colleagues as well as from the outside world. But that is a can of worms that I am not ready to open yet.

4) Would a girl, who thinks for herself and genuinely loves to do maths, let public opinion deter her from going into Mathematics?

5) What would be lost if only women motivated as in 4) were to choose Mathematics as a profession? In fact, is there any other valid reason for this choice? Might one of the causes for the scarcity of women among mathematicians be that women are less likely to choose a difficult career for wrong reasons like a craving for prestige or a need for a subterfuge from the more messy human endeavors?

Let me admit that I have just retired after "biting myself through" a variety of struggles (and mistakes) and that I feel as good about Mathematics as I did when I was 12. I still believe that the best a woman scientist can do for the women's cause is to do her own very best in her work. But I do feel now that I owe it to my students and collegues to sort out my thoughts about women in mathematics. It is a maze, an intimidating maze.

Verena Huber-Dyson
Vancouver, B.C., Canada
(Received October 5, 1989)

I was pleased that *Notices* published the article entitled "Feminist Critiques of Science," by Allyn Jackson, in the July/August issue. The article describes a debate that has been ongoing between radical feminists and a number of scientists and mathematicians.

I agree with the comment by Anita Solow in her letter in the October issue of *Notices* that part of the problem is terminology. However, when radical feminists say that science is masculine, what people hear is that science is an activity done by men. If radical feminists mean that "... Western society has declared science to be masculine, not that women are inherently incapable of doing science," then that's what they should say. Calling science "male" only reinforces the societal stereotypes that women don't do science.

Robert Bix, in his letter in the Oct. issue of *Notices*, talks about ways in which women are discouraged from pursuing careers in science, and I agree with much of what he says. I wish that I could also agree with his contention that because the quotes from the radical feminists are short and not in context that they represent distortions. Unfortunately, some of the things I have heard are, if anything, more extreme and absurd.

At a conference on women and computers, organized a few years ago by a women's studies department, the conference organizer asked the questions: What is feminist software? How would computers have developed differently had they been developed by women? This is another example of a problem of terminology. I inferred from later comments that the organizer had in mind good human factors when she talked about feminist software. I couldn't figure out the other portion of her question, but I think it has something to do with applications to which computers are put. (Presumably, she didn't mean that computers would be less phallic).

This is not to say that poor human factors are the only problems with software. There are a number of violent computer games, some of which tend to be off-putting to girls and women. (A particularly grotesque example is one in which the goal was to kill the Indian braves and rape the Indian maiden). But poor human factors, violent, racist, or sexist games, and ethical issues surrounding applications of technology should be confronted for what they are. It clouds the issue to talk about all science and technology in male/female terms.

My interpretation of most radical feminists who talk about science as being male is that they feel threatened by science and math, which they do not understand very well. Unfortunately, their view has received some acceptance by the mainstream feminist movement, most of the leaders of which are trained in the humanities. Consequently, we feminist scientists, who are working at getting more women into math, science, and engineering, are having our efforts sabotaged by people who claim to be helping us. Is it any wonder that some people are angry?

Barbara Simons
Almaden Research Center, IBM
(Received November 17, 1989)

Shigefumi Mori Awarded 1990 Cole Prize in Algebra

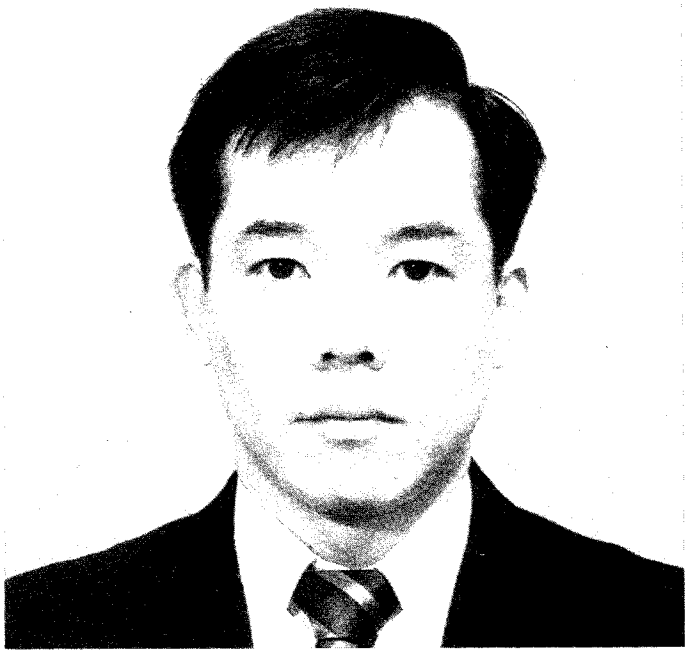
The Frank Nelson Cole Prize in Algebra is awarded every five years for a notable research memoir in algebra which has appeared during the previous five years. This prize, as well as the Frank Nelson Cole Prize in Number Theory, was founded in honor of Professor Frank Nelson Cole on the occasion of his retirement as Secretary of the American Mathematical Society after twenty-five years and as Editor-in-Chief of the Bulletin for twenty-one years. The original fund was donated by Professor Cole from moneys presented to him on his retirement. It has been augmented by contributions from members of the Society, including a gift made in 1929 by Charles A. Cole, Professor Cole's son, which more than doubled the size of the fund. In recent years, the Cole Prizes have been augmented by awards from the Leroy P. Steele Fund and currently amount to $4,000.

The Twenty-Third Cole Prize was awarded to SHIGEFUMI MORI of Nagoya University. The prize was awarded at the Society's ninety-sixth Annual Meeting in Louisville. The Cole Prize was awarded by the Council of the American Mathematical Society, acting through a selection committee consisting of Michael Artin, Walter Feit, and Melvin Hochster (Chairman).

The text below includes the Committee's citation and a brief biographical sketch of the recipient. Professor Mori was unable to attend the Annual Meeting to receive the prize in person. He did, however, send a written response to the award.

Citation

The Committee unanimously recommends that the 1990 Cole Prize in Algebra be awarded to Shigefumi Mori for his outstanding work on the classification of algebraic varieties. Mori took the decisive steps over a ten-year period in extending the classical theory of algebraic surfaces to dimension three: prior to Mori's breakthroughs this problem seemed out of reach. Mori's beautiful work also makes major inroads into the problem in higher dimensions. The committee notes, in particular, his paper, "Flip theorem and the existence of minimal models for 3-folds" in the first issue of the *Journal of the American Mathematical Society*, January, 1988. In this paper Mori proves the existence of minimal models for three-folds, which essentially finishes his program. Consequences include the analogue of Enriques' theorem (that if all plurigenera vanish then the variety is uniruled), the finite generation of the canonical ring (this implies that three-folds of general type with given numerical invariants form a limited family — the first big step in constructing moduli), and the classification of Fano three-folds.



Shigefumi Mori

Response

I am greatly honored to have been awarded the Cole Prize for my paper on the 3-dimensional minimal models, and I feel especially happy because much of my research has been done with the support of the cultural exchange of Japan and U.S.A. I am most grateful to the American Mathematical Society.

The new approach to 3-folds in the last decade originated from two directions; one was the extremal ray theory by myself which goes back to the Hironaka-Kleiman cone, and the other was the notion of terminal and canonical singularities introduced by M. Reid as 3-fold analogue of smooth and Du Val points on a surface. The latter arose naturally in the study of finitely generated canonical rings.

On the basis of these, the theory was developed along the lines of Reid's conjectures by X. Benveniste, Y. Kawamata, J. Kollár, V. V. Shokurov and others. The minimal model theory developed for threefolds actually works in arbitrary dimensions except for one key process called the "flip". For the (important but still special) semistable case of 3-folds, the flip process was done independently by S. Tsunoda, V. V. Shokurov, Y. Kawamata and myself. These approaches were different and my paper cited by the Cole Prize Committee finished the flip process based on Y. Kawamata's approach. At least for 3-folds, we can now start a systematic program of research. Typical results in this direction are the finite generation of canonical rings for 3-folds by T. Fujita, Y. Kawamata and X. Benveniste, the uniruledness of 3-folds with all plurigenera zero by Y. Miyaoka, and the study of surface singularities by J. Kollár and N. Shepherd-Barron.

What amazes me is the role of the anti-canonical divisors in this study, as pointed out by M. Reid in the case of 3-fold terminal singularities. At the current state of our knowledge, however, this role emerges only after a rather detailed classification of the singularities which occur. I hope one can understand this mystery someday and gain more insight in the higher dimensional case.

Biographical Sketch

Shigefumi Mori was born on February 23, 1951 in Nagoya, Japan. He received his B.A. (1973), M.A. (1975), and Ph.D. (1978) all from Kyoto University. He wrote his thesis, "The endomorphism rings of some abelian varieties", under the direction of Masayoshi Nagata.

Professor Mori held the position of assistant at Kyoto University from 1975 to 1980. In 1980 he joined the faculty at Nagoya University as a lecturer and was promoted to associate professor in 1982. In 1988 he was promoted to his current position of full professor at that university. During this time, Mori also held visiting positions at Harvard University (1977-80 and spring, 1981), Institute for Advanced Study (1981-1982), Max Planck Institute (spring, 1982), Columbia University (1985-1987), and the University of Utah (summer, 1987 and fall, 1988). Under the U.S.-Japan cooperative program, he visited the University of Utah in fall, 1989.

Professor Mori is the editor of the *Nagoya Mathematical Journal* and *International Journal of Mathematics* and an associate editor for *Annals of Mathematics* and *Journal of Differential Geometry*.

In 1981, Professor Mori presented the C.I.M.E. Lecture Series, in Varenna, Italy. In 1983, he received the Japan Mathematical Society's Yanaga Prize and was an Invited Speaker at the International Congress of Mathematicians in Warsaw. He received the Chunichi Culture Prize in 1984. In 1988, he shared the Japan Mathematical Society's Fall Prize with Yujiro Kawamata for their "outstanding work in the minimal model theory for algebraic varieties"; and, in 1989, received the Inoue Prize for Science for his "outstanding work in the theory of higher dimensional algebraic varieties and in particular for the proof of existence of minimal models for 3-dimensional algebraic varieties".

COLORING THEORIES

Steve Fisk

(Contemporary Mathematics, Volume 103)

The focus of this work is the study of global properties of various kinds of colorings and maps of simplicial complexes. In addition to the usual sorts of coloring, the author studies colorings determined by groups, colorings based on regular polyhedra, and continuous colorings in finitely and infinitely many colors. The emphasis is on how all the colorings fit together, rather than on the existence of colorings or the number of colorings. Beginning with some fundamental properties of simplicial complexes and colorings, the author shows how colorings relate to various aspects of group theory, geometry, graph theory, and topology.

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Award for Distinguished Public Service Presented to Kenneth M. Hoffman

Proper recognition for mathematicians who contribute valuable service to the profession is a matter of great importance to the Society. The continued growth and health of the discipline is greatly dependent on those individuals who contribute their time to public service activities in support of mathematics. To provide encouragement and recognition for such service, the Council of the American Mathematical Society, responding to a recommendation from the Society's Committee on Science Policy, established the Award for Distinguished Public Service. The amount of the Award is $2,500.

The Award is to be presented every two years to a research mathematician who has made a distinguished contribution to the mathematics profession through public service during the preceding five years. The first Award for Distinguished Public Service was presented to KENNETH M. HOFFMAN of the Massachusetts Institute of Technology and the Mathematical Sciences Education Board. The Award was made by the Council of the American Mathematical Society, acting through a selection committee consisting of Ronald G. Douglas, Robert M. Fossum (Chairman), John C. Polking, David P. Roselle, and David Sanchez.

The text below includes the Committee's citation, the recipient's response on presentation of the award, and a brief biographical sketch of the recipient.

Citation

The 1990 AMS Award for Distinguished Public Service is presented to Kenneth M. Hoffman for his outstanding leadership in establishing channels of communication between the mathematical community and makers of public policy as well as the general public.

After a distinguished career as a research mathematician, head of a major research department of mathematics, and other significant accomplishments in his university, Hoffman was instrumental in a host of major public policy achievements in the last decade. He was Executive Director of the Committee on Resources for the Mathematical Sciences (the David Committee) and was heavily involved in the formation of the Board on Mathematical Sciences (BMS) and the Mathematical Sciences Education Board (MSEB), both activities of the National Research Council. He served as chair of the AMS Committee on Science Policy and later created the "Washington Presence" as the first head of the Office of Governmental and Public Affairs of the Joint Policy Board for Mathematics of the AMS, MAA, and SIAM. Through his efforts, the awareness of the importance of mathematics and the support of mathematical research has been significantly heightened in the general public, among makers of science policy in the government, and among university administrators.

Kenneth M. Hoffman

Response

I am deeply honored to be the recipient of the Society's first Award for Distinguished Public Service. It has even greater meaning for me to have the Award presented

by Bill Browder, who was responsible for getting me involved with matters of public policy almost exactly 10 years ago. This involvement with the needs and responsibilities of our profession began when we were putting together Bill's brainchild, the first David Committee.

No working mathematician will be surprised if I say that when Bill asked me to become Executive Director of the David Committee I hadn't the slightest intention of staying in Washington for years, much less 10 years. But life has a way of choosing our careers for us. This career has turned out to be a fascinating and rewarding experience for me. In fact, I just signed on for another five year tour of duty to direct the Mathematical Sciences Education Board.

During the decade of the 80s, our relations with government and the public have changed in ways few of us even imagined in 1980. Our community has made its presence felt in policy circles as never before; we have begun to truly reach people through the media; and we have put in place lasting structures to better enable us to relate to our several publics—such structures as the Joint Policy Board, the Board on Mathematical Sciences, and the Mathematical Sciences Education Board. Out of these boards in 1989 and 1990 are flowing coordinated national game plans and strategies for revitalizing the mathematics research enterprise, the K-12 math education system, and the teaching of mathematics at the college-university level. It will be up to our broad community to implement these ambitious plans and strategies.

The growing group of colleagues who labor on your behalf in the vineyards of Washington has gotten the effort started. The fruits of their labors thus far include an increase in federal research funding for mathematics of 90% over the last six years, and placement of mathematics at the forefront of the national education reform effort now being led by the President and the governors.

If you're an analyst, as I am, you won't be surprised at the fact that you haven't felt the impact of the near doubling of research funding for our field. Any analyst knows that for all practical purposes, 2E behaves just like E—when E is very small. And we certainly started from a small research funding base. What we must keep firmly in mind over the next decade is the archimedean principle familiar to all mathematians: no matter how small E may be, eventually NE gets large. In plain English, we have to stay the course set during the 80s—use the game plans and the structures that have been devised; get more of our colleagues involved; stick at it for another decade or more.

The leadership group responsible for initiating a new cycle of change in our community is quite sizable—much too large to receive a single award; and that's why I am up here. I've been lucky to sit somewhere near the middle of the action over the last decade, carrying out general plans while serving as a combination catalytic coordinator and foot in the seat of the community's pants. This is not a role designed to make one popular, which is another reason this Award from the Society means a great deal to me.

I cannot take the time to thank individually the 100 or more key leaders from our community who should be standing here with me. This list includes a succession of Presidents and Executive Directors of AMS, MAA and SIAM; strings of division directors in federal agencies; and a battery of individual mathematicians who need no official position to provide leadership. To prune the list is to risk offending someone. Nevertheless, I feel compelled to express my personal thanks to several people with whom I have worked very closely and who have made all the difference for me at critical transition points: Bill Browder, Iz Singer, Jim Infante, David Fox, Hirsh Cohen, Bill LeVeque, Lynn Steen, Shirley Hill, Marcia Sward, Jennifer Vance, Kathleen Holmay, and my Washington mentor Ed David.

In addition, I want to thank my friend and colleague, Paul E. Gray, President of M.I.T., who has supported and continues to support my Washington involvement, using the principle that such involvement is part of my duties as a faculty member and part of the responsibilities of M.I.T. He has supplied more than half a million dollars to give practical meaning to that principle.

Finally, my thanks to the Selection Committee and the Executive Committee. Their task cannot have been an easy one, and I am pleased to have been selected.

Biographical Sketch

Born in 1930 in Long Beach, California, Kenneth Myron Hoffman received the A.B. in mathematics from Occidental College in Los Angeles in 1952. He was awarded the M.A. and Ph.D., both in mathematics, from the University of California at Los Angeles, in 1954 and 1956. He joined the staff of M.I.T. in 1956 as an instructor and in 1957 was appointed C.L.E. Moore Instructor. He was promoted to assistant professor in 1959 and to full professor in 1963. He became chairman of the Committee on Pure Mathematics in 1968 and in 1971 was appointed department head, a position he held for eight years.

Professor Hoffman has been a member of the M.I.T. faculty since 1959. Since 1981, he has been active at the interface of mathematics and public policy. From 1981 to 1984, he served as Executive Director of the Committee on Resources for the Mathematical Sciences of the National Research Council. This panel's 1984 report, "Renewing U.S. Mathematics: Critical Resource for the Future," is commonly known as "The David Report." It received nationwide press coverage and documented a serious imbalance between federal support for the math-

ematical sciences and support for related fields of science and engineering. Hoffman was subsequently instrumental in the formation of two boards at the National Research Council, the Board on Mathematical Sciences and the Mathematical Sciences Education Board, of which he was a member from 1985 to 1988. He became Executive Director of the Mathematical Sciences Education Board on September 1, 1989, a position he holds concurrently with his M.I.T. professorship.

From 1981 to 1984, Hoffman was chairman of the Committee on Science Policy of the American Mathematical Society, and in 1984-1985 chairman of the Advisory Committee for Science and Engineering Education at the National Science Foundation. From 1984 to 1989 he headed the Office of Governmental and Public Affairs of the Joint Policy Board for Mathematics, which develops policy analyses on behalf of the national mathematics community and presents them to the executive and legislative branches of the government as well as to the public. This office led the effort to implement the recommendations of the 1984 David Report and is credited with the remarkable increase in media coverage of mathematics which has occurred in the United States in the past 5 years. In August, 1986, Hoffman was awarded the Public Service Award of the Joint Policy Board for Mathematics "for his far-sighted and effective initiation... of a national mathematical sciences policy."

In his eight years as a department head, Professor Hoffman further strengthened the mathematics faculty at M.I.T. He also created the position of Undergraduate Chairman, brought a strong statistics program into the department, and developed an affirmative action plan which became the national model for departmental plans.

Hoffman's main area of mathematical interest is function algebras, a subject which was discovered in the mid 1930's but lay dormant until the 1950's, when it was revived by Richard Arens, I.M. Singer, and their student, Kenneth Hoffman. They recognized the close relationship between Banach algebras and newly developing approaches to complex analysis. The work of Hoffman at this interface represents a fundamental contribution to both complex and abstract analysis, two major branches of mathematics. Much subsequent research in this area has been based on the work in Hoffman's numerous research publications.

Professor Hoffman has taught mathematics courses from freshman calculus through advanced graduate courses and has written texts at all levels. He is co-author, with Ray Kunze, of the basic undergraduate text, *Linear Algebra* (Prentice-Hall, 1961), which has been used widely throughout the world for nearly 30 years. Other books include *Fundamentals of Banach Algebras* (Instituto da Universidado do Parana, Curitiba, Brazil, 1962), *Analysis in Euclidean Space* (Prentice-Hall, 1975), and *Banach Spaces of Analytic Functions* (Prentice-Hall, 1967). For several years he also taught a special M.I.T. course on *Writing In and About Mathematics.*

Professor Hoffman was a Sloan Foundation Fellow, 1964-1966. He is a member and former Council member of both the American Mathematical Society and the American Association for the Advancement of Science. He is also a member of the Mathematical Association of America, the Society for Industrial and Applied Mathematics, the National Council of Teachers of Mathematics, the Association for Women in Mathematics, the American Statistical Association, the Institute of Mathematical Statistics, and the Operations Research Society of America.

ALGEBRAIC TOPOLOGY

Mark Mahowald and Stewart Priddy
(Contemporary Mathematics, Volume 96)

This book will provide readers with an overview of some of the major developments in current research in algebraic topology. Representing some of the leading researchers in the field, the book contains the proceedings of the International Conference on Algebraic Topology, held at Northwestern University in March, 1988. Several of the lectures at the conference were expository and will therefore appeal to topologists in a broad range of areas.

The primary emphasis of the book is on homotopy theory and its applications. The topics covered include elliptic cohomology, stable and unstable homotopy theory, classifying spaces, and equivariant homotopy and cohomology. Geometric topics—such as knot theory, divisors and configurations on surfaces, foliations, and Siegel spaces—are also discussed. Researchers wishing to follow current trends in algebraic topology will find this book a valuable resource.

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Computers and Mathematics

Edited by Jon Barwise

Editorial notes

I start off this month by admitting two embarrassing lapses.

Who developed those programs?

I have a set of guidelines I send out to software reviewers. One thing I forgot to mention in those guidelines was that a review should always indicate who developed the software. A couple of recent reviews have failed to do this, and readers have let me know about it in no uncertain terms. I regret these omissions and have added a new sentence to my guidelines.

One omission, ironically, was in the review of *Tarski's World* by Mark Seligman in the November 1989 issue. It happens that this logic courseware program was developed by John Etchemendy and me, with the support of the FAD program at Stanford University.

The other was in the review of *Exploring Small Groups* by Suzanne Molnar in the December 1989 issue. This program was developed by Ladnor Geissinger, who also wrote the manual. Geissinger is Professor of Mathematics at the University of North Carolina at Chapel Hill and a Fellow of the Institute for Academic Technology. He was given programming and technical support by an IBM/UNC software development project grant.

Correspondence

More on proving computer correctness

In the September 1989 column I wrote a piece reporting on a debate over proofs of program correctness. I also attempted to shed some light on that debate by appealing to the distinction between real world phenomena, and mathematical models of them. I analyzed the problem as a failure to distinguish carefully between the two.

By and large, the response to this article has been quite positive. A number of people in the program correctness community have said that it somehow managed to both shed light on, and cool, the controversy. By contrast, Richard Dudley of the M.I.T. mathematics department writes:

Program Verification

Barwise [1] reports on a discussion among philosophers, especially Fetzer [4], computer scientists, and now mathematicians: can correctness of executable computer programs be proved? But essentially everyone agrees that it cannot be proved, in the strict mathematical sense, that a physical computer will execute a program correctly. A problem has been raised by use of the word "proof" about program verification. There is wide agreement that program verification is (currently) part of applied rather than pure mathematics, but mathematicians may well think of proofs as characteristic of pure mathematics. One might, for example, predict the orbit of a satellite very accurately without claiming to *prove* that it will be in a specific small region at a future time. I suppose very few applied mathematicians or scientists would claim to prove, in the sense of mathematical proof, anything about the physical world.

If, as Dobson and Randell [3] well say, "the hypothesis 'this program will execute correctly' is one that can never be proven, only falsified", and a 'proof' of a program's correctness shows "only that certain kinds of errors are not possible", then we are dealing with relatively weak, perhaps new (to mathematicians) meanings of "proof" and/or "correctness," which one should be clear about. Other central mathematical notions such as equality have acquired new meanings in computing: the computer-language equation $S = S + x$, where x is not 0, for example, in the context of a summation loop, might be understood as the mathematical equation $S(n) = S(n-1) + x(n)$, while in many computer languages "$S + x = S$" is a syntax error.

On another point, actual programs are usually written in higher-level languages such as Fortran or C, then translated by a compiler or interpreter into a lower-level language and executed in connection with operating system software. Such systems programs may in turn have been written in higher-level languages and compiled by (another or partial) compiler. Systems software (and hardware) provide the environment about which Hoare [6] wrote: "Computer programming is an exact science in that all the properties of a program and all the consequences of executing it *in any given environment* can, in principle, be found out from the text of the program itself by means of purely deductive reasoning" [emphasis added]. Unfortunately Barwise [1] calls this a "famous quotation" but omits the phrase I emphasized, without even an ellipsis (...). Even if the misquote was found in another secondary source, the role of the environment should not have been overlooked. Fetzer [5] also mentions and criticizes the "famous passage" without noting the misquotation.

Fetzer [4] was, in turn, primarily a reaction to DeMillo, Lipton and Perlis [2], who said more or less that correctness of

programs was not being proved effectively in the 1970s because people were not checking others' proofs. Fetzer thought that one should go further and say that proofs of program correctness are not possible. For opinions in favor of such proofs both Fetzer [4,5] and Barwise [1] cite Hoare [6,7]. Fetzer [4] quoted selectively from Hoare [7], who did write:

"I hold the opinion that the construction of computer programs is a mathematical activity like the solution of differential equations, that programs can be derived from their specifications through mathematical insight, calculation, and proof, using algebraic laws as simple and elegant as those of elementary arithmetic ... . Computers are mathematical machines ... computer programs are mathematical expressions ... a programming language is a mathematical theory ... programming is a mathematical activity."

But neither Fetzer nor Barwise tells us that Hoare [7] went on as follows:

"HOWEVER ... [emphasis in original]

These are general philosophical and moral principles, but all the actual evidence is against them. Nothing is as I have described it, neither computers nor programs nor programming languages nor even programmers."

I'm afraid Barwise and Fetzer have done us a disservice by their incomplete quotations. But at the beginning of [4], Fetzer wrote "There are those, such as Hoare ... who maintain that computer programming should strive to become more like mathematics." That, I believe, is a fair summary of what Hoare was actually saying, and it may be arguable, but in full and in context I think Hoare was addressing a question of what will work best in the future for computer programmers. Hoare [7], even according to one quote given in Fetzer [4, p. 1058] (but not Fetzer [5] or Barwise [1]) was negative about proofs of program correctness in typical current environments.

There are mathematically interesting and difficult issues in precisely deriving a program from its specifications. Even if the specification calls for evaluating a given polynomial, the results are non-unique since in current computer arithmetic addition, done to a fixed number of binary or decimal places, is not associative. It is unfortunate that these real issues were obscured in the philosophical discussion.

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Reply: I plead guilty to misquoting Hoare, omitting the phrase "in any given environment." I simply took the quote from Fetzer's article without checking the original. Fetzer tells me that there was an elipsis in earlier versions of his article, but that it somehow disappeared along the way. If the missing words are replaced, the ambiguity between the real world and the mathematical phenomena persists, since the term "environment" has two meanings. One reading would take it to be the actual environment in which a program is run on a physical computer. The other usage is where environments are certain abstract mathematical objects. Both are quite common in computer science. In terms of my analysis of the larger debate, the term "environment" is itself ambiguous between the physical environment, and a mathematical model of it, or rather, of certain aspect of it omitted from the model of the computer itself. If we interpret all this in terms of the real thing, then Fetzer's argument applies and proving programs correct is impossible. If we interpret it as applying to the mathematical model, then it is possible, but only as useful as the fit between the model and the real thing. Which Hoare had in mind, if he was in fact clear about the distinction, does not seem to important. For the point of my piece was not to attack or defend Hoare or Fetzer or anyone else, but to try to illuminate a controversial special case of applied mathematics.

Uses of computers in mathematics

This portion of the column is devoted to short articles detailing ways mathematicians have found to use computers in some aspect of mathematics: teaching, research, writing, ... Readers are invited to submit articles to the editor: Jon Barwise, CSLI, Ventura Hall, Stanford, CA 94305, or in LaTeX by email at: barwise@csli.stanford.edu.

Computers in Mathematics at Lafayette College

Clifford A. Reiter and Thomas R. Yuster
Lafayette College

The computational environment at Lafayette is different than at Grinnel and the University of Wisconsin-Madison as described in this column by Gene Herman in March 1989 and Rod Smart in May/June 1989. Yet there are some obvious similarities in the hardware and instructional use. You will see that our department is active in using computing in teaching but does not have any grand programs (yet). We have acquired most of our equipment with support from the college administration and Pennsylvania state grants. The department has been active in letting the administration know its needs.

Lafayette College has just under 2000 full time undergraduate students and a small part time program but no graduate program. Engineering accounts for 20–30% of the student body. Computer Science is a separate department. The mathematics department has 16 full time faculty. About ten sections of the scientific calculus sequence are taught each semester with 24 students per

section typical. We graduate 10–15 mathematics majors each year.

Some Apple II Graphics:
The college maintained an HP3000 during the early part of the 1980s. Students in Differential Equations and Numerical Analysis were often expected to run or program examples of numerical techniques using Fortran on the mainframe. Computer graphics first entered the classroom when the department acquired an Apple II+ microcomputer. It was connected to two 19″ monochrome monitors mounted on carts. We used ArbPlot for various graphics demonstrations and Surfaces for Multivariable Calculus was used for plotting surfaces. Both these packages were from Conduit. The hardware setup was quite cumbersome, the two monitors split the students' attention, and instructors did not have flexibility in selecting options for the demonstrations. Color capabilities were missed by the department. Instructors wrote differential equations and partial differential equations graphics demonstrations. The speed of the Apple made it impossible to run some of the more computationally complex programs during class. The system was used infrequently and by only a few of the mathematics faculty. In 1984 another Apple II with cart displays was acquired. Two years later this second Apple was declared surplus equipment; it plunged 5 feet to its death before it could be hauled away.

APL in Linear Algebra:
In the fall of 1984, the department head at that time, Bill Jones, requested and received college support for providing APL (A Programming Language) to give linear algebra students experience with computational exercises. We used three IBM PC's and I. P. Sharp's APL/PC interpreter. We chose APL for these exercises since it was powerful, used a mathematical function like notation, and required little class time to be introduced. Some examples of the assignments given to students: discovering the convergence of stochastic matrices, least squares fitting to polynomials, and implementing and comparing the power method and the Rayleigh quotient iteration for estimating eigenvalues. At first, the students came to a classroom with student proctors at designated hours to use the software. The students had little difficulty completing the exercises and many had good first experiences using computers. Introducing assignments such as these required considerable effort on the part of the faculty–especially if they did not know APL. It is remarkable that several of our faculty who did not know APL made that effort.

Sharp's APL is a very good product–it handles complex arithmetic, has very fast binary arithmetic, and has enclosed arrays (a matrix can be an element of an array). It is somewhat slow for certain operations and it does not come with a PC graphics interface. The APL character set was obtained by our replacing a chip on the monochrome display card. (Does anyone need an original IBM character ROM cheap?)

Student access to APL on these PCs was awkward at best. Fortunately, the college installed 17 IBM AT's during 1986 in public use areas and met the substantial cost of the APL licenses. These machines allowed the APL characters to be displayed via software and greatly improved accessibility for our students. This APL interpreter is still available but it is now shareware.

Ideas Program:
The Ben Franklin Consortium of schools in Pennsylvania ran the "Ideas" program during the summers of 1984–1986. The major goal of that program was the production, by educators, of educational software. Mark Michael and Tom Yuster participated and produced software for Topology and Abstract Algebra. Tom also wrote color graphics software for calculus demonstrations on the IBM PC. This eventually resulted in the package Calculus Graphics (Polygonal Press) which we now use extensively in our calculus sequence.

Color Graphics Demonstrations:
Near the end of 1986 we obtained a Sony Color Projection System (CGA resolution) in order to be able to do classroom demonstrations–primarily to run software written by Tom Yuster. We have the special pleasure of being able to bug the author to add the features we want (They delight in this – Tom) (You should have seen his original version – Cliff). We use this software for short classroom demonstrations and in laboratories. Examples are: graphically displaying Newton's method, numerical integration, plotting level curves, direction fields for first order differential equations, and Taylor polynomial approximations to functions (the radius of convergence is a simple idea once you have seen it illustrated graphically).

Again the department head, by this time Jim Crawford, made a case for the department's need for this equipment. We added a CGA graphics card and a mathematics coprocessor to an IBM PC to drive the projector. (Coprocessors should be standard equipment on computers used to do mathematics.) At first we worked with the projector and computer on separate wheeled tables. With careful wiring only a couple of connections were required. Faculty made more use of this system than they had of the previous system, but it was still more likely that an instructor would teach a section of calculus and not use the computer than it was that the computer would be used.

The next year we put the projector and computer onto a single cart with 5 inch rubber wheels. This change turned out to make a bigger difference in ease of use than one might have suspected. Normally the projection cart

is wheeled into the instructor's classroom for use. It takes about 2 minutes to plug in the cart, insert an appropriate diskette, throw the power switch, and position the cart for focusing. The usage of the system increased significantly. *Instructors are much more willing to use equipment when it is easy to use.* It is so easy to use that many times it has been used in one class during the beginning of an hour, rolled down the hallway at an agreed upon minute, and used in another class for the second half of the hour. Student response to demonstrations with the projector has been generally quite positive. See the following page for how we recently updated this projection system.

We have also used SURFACE PLOTTER by Elm Software for animating surfaces. The use of these animations has become increasingly popular among the instructors of our multivariate calculus course.

Some Faculty Machines:
During the academic year 1986-1987, the first few mathematics faculty were given PC's for their offices. We put together 3 computer systems using a Pennsylvania state instrumentation grant. These systems ended up being Zenith 159 computers with a hard disk, an EGA display card, and NEC multisync monitors. We actually ordered Zenith 158's and separate EGA cards. However, when the Zeniths arrived they were 159's with built in EGA cards. We still have the extra EGA cards we ordered. (We'll make you a package deal along with the IBM ROMs.) *One of the problems with piecing together a computer system is a change in one vendor's product can put the whole system at risk.* We were lucky that we ended up with better machines and extra display cards as our only "problem". Our experiences with the Zeniths have been very good.

More faculty have received machines on their desks over the past few years due to a program begun by the Provost. We now have an IBM compatible (mostly PS/2 50s) or a MacIntosh in every mathematics faculty office except one.

Word Processing:
Of course, faculty needed word processors. We searched for a technical word processor suitable for faculty and the department secretary in the fall of 1986. We selected TechWriter (CMI Software) because it provided support for the QMS Kiss Laser printer, it allowed user definition of special characters at full laser resolution, and it was already being used by some of the college's engineering departments. Because of our request for the laser printer, the department head had to shout at an administrator about how important it was for secretaries to have quiet offices. Of course, he was lectured on the horrendous costs of laser ownership. We got the printer.

TechWriter is a powerful word processing package. Its printer drivers are remarkably good. It is a markup language with a carefully crafted editor in that the marked up text rarely needs to be accessed. Its spell checker is intolerably slow and the entire package is dated since it doesn't support proportional or scaleable fonts or grahics. We understand a major update is expected in 1990.

Several faculty and the secretary also use Wordperfect 5.0 for documents that do not contain mathematical equations. This has a very good spell checker and thesaurus and is the college standard word processor.

A Computer Room:
In 1985 the mathematics department felt the need for a computer room in our building that could be used for teaching. The Mathematics and English departments combined their requests. In 1986, a combination of purchases and gifts from IBM provided a room with almost two dozen IBM ATs and a color EGA projection system. In 1988 the room was partitioned, the projection system was ceiling mounted, and the computers turned to face the projection screen. The room is now very usable for teaching in a laboratory environment. Occasionally calculus classes use the room for graphics exercises but it is now primarily used by the department for SAS, a statistical package. Other departments use the room frequently.

Exercises in Probability and Statistics:
By 1986 some sections of our statistics course for nonmajors used Minitab for a few practice exercises. Then the college obtained a SAS site license and the department was encouraged to switch to SAS. It is still using SAS. Typical computer exercises are creating histograms, computing sample statistics, graphing scatterplots, computing regression lines and correlation coefficients, sampling from various distributions to see the effects of sample size and the central limit theorem, computing confidence intervals, and hypotheses testing. Many of Lafayette's mathematics faculty have made considerable time investments in order to introduce computational exercises into the statistics courses. As the computer rooms on campus have become suitable for teaching, some of these exercises are being done as laboratories in these rooms.

We have also used demonstration packages in the statistics sequences. Henryka Komanska used STAT DISTRIBUTIONS by Martin Richter of Lehigh which was developed as part of the Ideas program. The code was written by a Lafayette student. Evan Fisher has used GASP (see this column, February 1989) for both classroom presentations and general audience talks. Both packages contain good simulation capabilities and GASP has some especially attractive graphics (if you like frogs).

Colorful Printing:
The department projection system was limited by the fact that it provides only CGA level graphics. The EGA projector was ceiling mounted in a computer classroom. We felt the need for using higher quality graphics during lectures, but upgrading to a VGA system was not financially practical at that time. Moreover, a couple of faculty were creating images of chaotic systems and wanted to be able to display images on bulletin boards (you know, the cork kind). An HP PaintJet printer was attractive since it was capable of better than VGA resolution graphics and could be used both for creating color prints and overhead transparencies. Moreover, it only cost about $1000. In fact, when we made the case for this printer to the department head he wrote a personal check. *If you need equipment, bug your Department Head.* You may not have the same success we had.

The printer came with a print screen utility that does a nice job printing EGA graphics. We also use ColoRIX VGA Paint for capturing, modifying and printing images. The printer has been used by faculty to create a number of graphics based talks. Color images posted on faculty office doors have engendered some considerable student interest. *High quality color fractal images are hard to beat if you want to attract students.* The printer has also been used by a couple of students doing research work. It is a highly valued resource.

Research with Students:
Lafayette is very committed to supporting undergraduate education. In recent years there has been a fine effort to support student research. Several mathematics faculty have become involved in such programs. Cliff Reiter worked with students on images from multidimensional chaotic systems and continued fractions, Tom Yuster worked with a student developing a graphing utility, Tom Wood worked with a student on Kalman Filtering, and Gary Gordon worked with a student on graph theoretic invariants. These projects all had computational aspects. This is not to suggest that we all become applied mathematicians or computer scientists. But *computational aspects of a faculty members specialty may well provide opportunities for research with undergraduates.*

Upgrading the Projection System:
The Sony projection system has been upgraded twice. First, in the fall of 1988 we added a VCR for showing video tapes. Switching between the computer and VCR requires throwing one switch. In the fall of 1989 we upgraded the PC which drives the projector. We added a 40MB Plus HardCard (this is a "drop in" hard disk). Of course, having the hard disk means using the projector in the classroom is easier. We also added an Intel InBoard 386/PC with a coprocessor. It was easy to install. This greatly speeds up the computations although the PC takes longer to boot since there is more memory to check. See PC Week's October 2, 1989 issue for a long list of companies selling 386 accelerator cards. Lastly, we added a VGA card capable of outputting a video signal that the projector can accept. For a few hundred dollars we upgraded the projector from a CGA to an interlaced VGA system. We bought Willow Peripherals' VGA-TV card and their RGB and sync cable for connecting to the Sony Projector. The graphics are very good. The projection system has become so popular that we need a second system to alleviate conflicts. We expect to purchase a VGA (color mapped) Liquid Crystal Display projection system soon.

A 386 Computer:
During the summer of 1989 the department acquired an IBM PS2/70 to run Mathematica. The computer is fast, has a 120MB hard disk, and came with 2M of memory. We added 4M more of IBM memory which required taking out the floppy drive and the chassis holding the hard disk. We had to do that several times since one of the memory modules made a bad connection on the first attempt at installation. It is easy and fun to take apart the PC (That is Cliff talking. It is frightening to watch – Tom) but we do not understand why this memory was not installed at the factory. We also added a math coprocessor. That was nerve wracking – the (very flimsy) pins were bent a couple of times before it was installed.

We installed DOS 4.0 and have had no problems except with the keyboard redefinition used by TechWriter which wreaks havoc with the entire system. The computer is connected to a QMS 810 Postscript laser printer and to the HP PaintJet which gives the PC very good graphics printing capabilities. Mathematica was easy to install. For all the aggravations of installation this is a fast computer and a pleasure to use.

This machine is in a mathematics faculty room which is the only "fair" place to put it. It is inconvenient for faculty to learn Mathematica there. We hope to put Mathematica capable machines on all faculty desks. *Faculty need their computational tools on their desks so that they can learn to use them during low quality time.* (While the coffee brews, while you wait for TechWriter's spell checker, while you should be grading, etc.)

Mathematica:
The department has been interested in obtaining some symbolic calculating software for several years. The college has adopted an MS DOS standard for PC based instructional computing. Hence the department's request for the IBM discussed above to run Mathematica. We hope in the next 2 or 3 years to put machines which are capable of symbolic calculating on all mathematics faculty desks. Two more Mathematica capable 386 machines for individual faculty members were recently

made possible by a Pennsylvania state grant. They are on order. Steve Buyske, who has a MacIntosh at home, runs Mathematica on it to help with his research in Differential Geometry.

We are just learning how to use the Mathematica software – it is impressive. Mathematica provides a very powerful environment in which to work. It requires substantial effort to learn but it provides considerable computational punch for that effort. Informal timing tests of one and two variable factoring problems showed Mathematica on the PS/2 running 20 to 100 times faster than Reduce does on a Vax 750.

The graphics capabilities of Mathematica are very good. For example, doing a 3D color plot of the real part of sin(z) with 2500 points on the surface takes 45 seconds on the PS/2. It is a simple matter to get a black and white hardcopy of graphics on the PostScript printer and it is fairly simple to capture a VGA color image with ColoRIX VGA Paint and print it on the PaintJet. Mathematica uses color dithering schemes so it is hard to believe it is using only 16 colors – it looks like many more.

Networking:
The college at present has a Vax 750, a Vax 780, an AT&T 3B15 (Pizza Hut has one of these), and an IBM mainframe for academic computing. The department still has only one connection to these machines and it is used largely for electronic mail and news. Computer classrooms in the library and in the Computer Science department already have local networks. The department is just starting to make use of these classrooms.

The college wide token ring network is well under way. The plan is for every dorm room, office, classroom, and public site to be connected to the network. Several of the dorms have already been wired and each dorm room is provided with a PC to connect to the system. Printers, including lasers, are available on each floor. Our building is slated to be wired in the next month or two.

The Future Symbolic Calculus Classroom:
The department has endorsed the idea of introducing a computer laboratory experience into the calculus curriculum. This is to include numerical calculations, symbolic computations, and lots of grahics. We expect these exercises to provide an experience that involves exploration and discovery. Students and faculty will interact in a new setting. Laboratory reports will provide opportunities for students to write about their mathematical experiences and the laboratory problems should encourage discussion among students. We expect to provide students with a 75 minute laboratory each week which will replace one 50 minute lecture in the present course. We are working with the administration to find funding for the laboratory, for the faculty equipment needed, and for the development of materials.

Such a project will place considerable demands on our faculty. Here is where our previous experience is of value to us. At this point all of our full time faculty have bought in to the idea that computing can and should play a significant role in mathematics education. If your faculty is similar to ours, this will not happen over night, it will take years. *Faculty have to convince themselves that appropriate introductions of computing into the curriculum have pedagogical value. They need time to make such decisions and to develop the necessary skills.*

Homework Assignments by Computer Mail

*Stephen B. Maurer**

Here's an effective use of computers that seems little tried. Your campus needs to be at least partly networked, with network access relatively easy for both you and your students. The use is: make homework assignments by computer mail ("email"). I've done this for several years in all my classes, from precalculus to the "senior conference" for majors.

But why bother, you ask? It's easy enough to write the numbers of assigned problems on the board, or to provide them in handouts (perhaps at the beginning of the semester) if you really don't think problems from the text are enough.

I have several answers. Most important, by using email, I can customize my assignments to what actually went on in class and thus don't feel compelled to rush through the material so that everything needed for a prefabricated assignment has been covered. Better yet, if an interesting point or question comes up in class, I can create one or more problems that deal with that point directly. Of course, one could put such special problems on a handout given out next time, but then the impact of immediate response is lost. I try to post my assignments within an hour or two of class and make them due at the next class (or, in classes with homework due weekly, I give a bonus for handing them in at the next class).

Second, I find I annotate problems when I post them on email. Even problems from the text often deserve some comment or customization, but it would be too time consuming to do these things in class.

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Third, I find I start to include with the assignments a number of other things: announcements of tests or special lectures, elaboration of points I felt I did not explain well enough in class, information about careers for math majors, etc.

Fourth, I invite students to send me questions, comments, and complaints via email, for private response or public (as they wish). Prompted by their experience receiving email from me, some find this approach more agreeable than coming to my office or asking questions in class.

At Swarthmore, classes meet for just 13 weeks a semester, 2.5 hours/week. Email allows me to reserve all of this limited time for talking about mathematics.

What are the downsides? I have to spend a little time teaching students how to use the campus email system. (Except for first-term freshmen, maybe half already know how.) I refer them to the Computer Center's handout, give them another of my own, and meet with the most computer-adverse students myself. (Most computer systems allow for distribution lists for mailing and for private bulletin boards, which makes communication between and among professor and class relatively easy.) Second, some students never like having to log on several times a week, especially if the nearest public access area is far from their dorm. On the other hand, some other students (non-math types) have thanked me for forcing them to learn the mail system – they proceed to use it with their friends at schools around the country. Third, I end up spending more time making up assignments than I used to – but the tradeoff is that I make better assignments. But at least it's no physical inconvenience – I type fast and a networked computer sits in my office. Finally, to date the only type of messages email will send (at least here) is pure ASCII. What if I want to send a problem with complicated mathematics in it? I could write it in TEX code and have students "compile" it at the other end, but this would add another layer of effort for them (remember, some are mathphobic). My solution is to introduce a few elements of TEX (like underline for subscript), to format things as best I can, and to write out much more than I would usually (e.g., call a vector "x-bar", or say that "in this assignment u,v,x are vectors"). It works out ok.

I'd be very pleased to hear suggestions from others who have used email for communication with their classes.

Reviews of Mathematical Software

Review of True BASIC, Inc. CALCULUS 3.0

Reviewed by J. R. Moschovakis[1,2]
Y. Matsubara[1]
G. B. White[1]

The Kemeny/Kurtz Math Series of software includes True BASIC programs for computer assisted instruction in high school mathematics and one-variable calculus. This review focuses on the CALCULUS program, version 3.0 (now updated to 3.01 for the PC and 3.02 for the Macintosh), which we used in 1988-1989 at Occidental College to enhance the first two terms of the standard calculus sequence. The calculus routines were written by John G. Kemeny and the common user interface by Thomas E. Kurtz; both are Professors of Mathematics at Dartmouth College. The program, which is contained on one diskette, is meant to supplement (not replace) any standard text and hand-done homework; an instructor's guide with instructions for modifying the software and a supplementary student workbook may be obtained at extra cost.

The program is available for the IBM PC or PS/2 with 256K and a graphics adaptor, and for the Apple Macintosh, Commodore Amiga, and Atari ST with 512K. True BASIC, Inc. offers site licenses at $350 for one type of computer and $175 for the second; the per-copy cost is $49.95 (due to increase to $79.95 in 1990) but institutions receive a 40% discount on five to nine copies and a 60% discount on ten or more. We asked students to buy individual copies, then showed them how to make backup boot copies and print out the contents of the screen. With this minimal help from their instructors, most of our students were able to hand in hard copy for several assignments. Predictably, some students found this computer work useful and interesting while others resented it; we were pleased enough with the software to continue its use in 1989-1990.

The program is entirely menu driven. Each topic has several examples, a Help menu, and a Glossary menu which partially accesses a common nontechnical dictionary. Glossary entries can be altered; see the instructor's guide for details. We used mostly the *General* routine, which covers symbolic differentiation and

[1]The authors are all in the Mathematics Department of Occidental College. Moschovakis can be reached by email at Joan@math.ucla.edu.
[2]Thanks to Tony Chan, UCLA and MSRI for computer privileges.

graphing, and the *Areas* routine, which does numerical integration and the standard approximations (left- and right-endpoint, midpoint, trapezoidal, and Simpson's) and sketches the regions involved. Other topics are *Limits, Tangent, l'Hopital, Parametric, Taylor,* and *Differential Equations.*

It is easy to record a session to be played back later; short messages may be added in a transitory window which appears when Help is requested. (In theory one can add comments and repair errors by editing the resulting .trs file, but this is not particularly easy.) The prerecorded demonstrations Limits and Parameters are excellent.

Upon entering CALCULUS one sees a brief menu at the top of a screen divided into two square windows (for formulas and graphing, respectively) and a rectangular message window. Choosing the *General* topic produces a new menu including Options and Plot/Print in addition to the standard Glossary and Help. Under Options one may choose to enter a new function, pick an example from a given list, differentiate the current function (may be done repeatedly for second, third, etc. derivatives), or print a table of values of the current function. The Plot/Print menu allows one to graph or not to graph the current function (using different colors or styles of lines for the graphs of different functions), to print or not to print the formula for the current function, and to rescale the graph.

Functions and parameters are entered in a transitory dialog box which is fully editable; illegal entries produce helpful error messages. Built-in functions include trigonometric and inverse trigonometric, square root, exponential, and the natural logarithm. The booklet accompanying the software explains the (standard) functional notation. Numbers may be entered in fractional, decimal, or scientific notation, and may involve the constant π as in `(2*pi)/3`; the * is obligatory even when the intent would be clear without it. The program initially requests x-bounds for the graph of the first function; the Rescale option (essential when several functions are graphed on the same set of axes) allows one to revise these and to specify y-bounds as well.

We found the *General* routine particularly useful for illustrating the relationships among the graphs of a function and its first and second derivatives. While the cumbersome notation makes multiple derivatives hard to read, there is space in the formula window for students to compute these by hand on the hard copy; one could argue that this is good for them anyhow. A basic bug is that the program seems unaware that odd roots of negative numbers exist; thus only the positive part of the graph of $f(x) = x^{1/3}$ for x from -1 to 1 is shown even when Rescale is used to request y from -1 to 1. Another annoying limitation is that x and f are the only variable and function symbols recognized, reinforcing the typical student's prejudice in this direction.

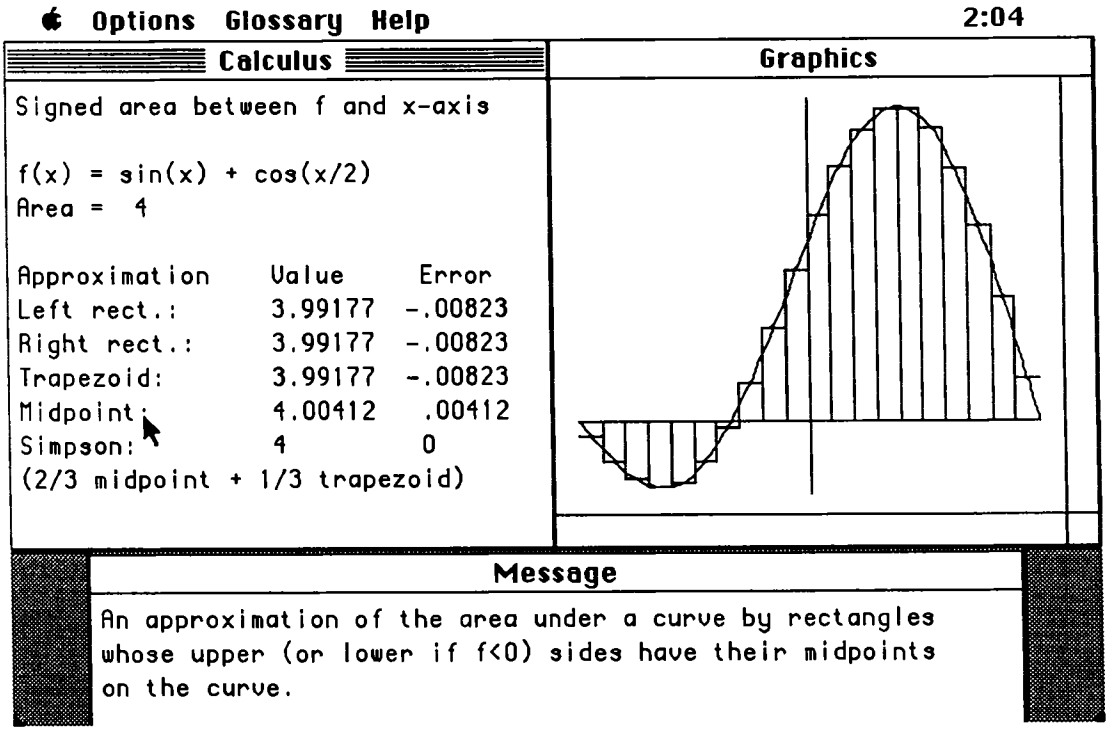
The *Limits* routine produces decimal approximations (even when the limit is rational or π). The *Areas* routine uses partitions with ten or twenty subintervals ("single" or "double" approximation) to illustrate the relationship between a proper definite integral and its numerical approximations. Errors are listed, making it easy to compare accuracy of methods. There is no way to request only the trapezoidal approximation, for example; once one chooses "Approximation" it's all or nothing. The axes are not labeled so it's easy to forget the interval of integration. There is no symbolic integration or provision for improper integrals.

The *Tangents* routine sketches one nonvertical tangent line at a time; a vertical tangent produces an error message. The *Minimum/Maximum* routine doesn't consistently label points of inflection, and can't handle $f(x) = x^{1/3}$ even on [0,1]. The *Parametric* routine has some beautiful examples of polar graphs, though again it recognizes no independent variable but t. The *Taylor* routine gives the first four nontrivial terms of a Taylor expansion about zero and graphs the corresponding Taylor approximations together with the function. Least satisfactory is the *l'Hopital* routine, which works only in the 0/0 case. The *Differential Equations* option gives general and particular solutions to linear homogeneous second order differential equations with constant coefficients.

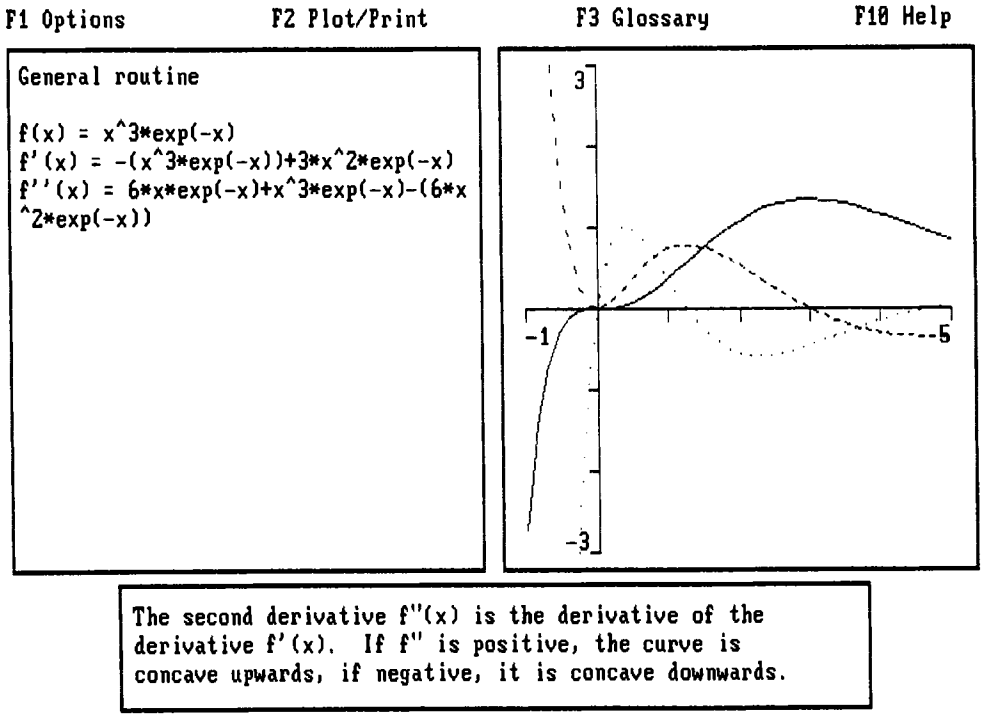
We hope that in a future edition the glossary entries, which often lack rigor and sometimes are so abbreviated as to be confusing, will be improved. A few lines of instruction on screen printing for the Macintosh would be useful; while "caps lock, apple, 4" works with the Macintosh SE and a dot matrix printer, there seem to be difficulties with the Mac II. It would be nice to be able to print out only *part* of the screen (just the graph, for example); we weren't able to do this with an IBM PC. The *Differential Equations* routine could be improved by allowing arbitrary conditions, not just initial ones. A lot of space in the workbook is wasted on awkward uniform "graph paper" inserts; simple drawn axes would be more useful and less distracting. These considerations may be addressed in version 4.0, which is due out in the spring.

The bottom line is that True BASIC CALCULUS is a versatile, moderately priced, user friendly resource for one-variable calculus instruction. A conscientious student can learn a lot by exploring and questioning the results obtained using this software. A minimally computer-competent instructor can use it to generate large numbers of useful tables and graphs (for tests, homework solutions, etc. as well as for class examples). Just don't ask it for the graph of $f(x) = sin(1/x)$ unless you are prepared to discuss the limitations of numerical methods!

Areas Routine for the Macintosh



General Routine for the IBM PC



Inside the AMS

The Mathematical Reviews Database: The Power of Modern Technology

William B. Woolf

Introduction

Mathematical Reviews (MR) is traditionally thought of as a journal–one gets it in the mail or at the library, examines it to discover what is new in the literature in one's areas of interest, and then consults it (or its indexes) as the need for bibliographic references arises. Up until about a decade ago, that was all that it was: the information in MR was accessible only from the physical volumes. At the MR offices, bibliographic information was maintained only on cards or on ditto masters. Review manuscripts were assembled each month and sent off to a compositor in England for typesetting in hot lead. When an issue was printed, the hot lead was melted and no version of the information other than the printed issue remained, except for the original manuscripts and the card file of bibliographic information.

Computers (and appropriate software) provide tools for greatly improving this situation. Over the last decade or more, MR has been transformed to an active database which provides many sorts of sophisticated access to the traditional information, and which promises to become accessible in even more novel ways as the next decade progresses. In this note the developments from paper journal (and other printed products) to computerized database are traced, the various new modes of access are described, and a glance is taken at possible future developments.

Printed products

Because until recently printing was the only readily available method of mass distribution of information, and because users find different modes of access preferable for different purposes, MR has traditionally provided alternate printed versions of its information. Unfortunately, before the computer, many of these products required either a separate (costly) keyboarding of the information into the new format (as in the case of indexes), or the laborious cutting and pasting of original reviews into special purpose collections (as in Review Volumes). Besides MR itself, these versions include:

MR Sections, which are personal-sized slices of MR, containing the reviews–exactly as they appear in MR–that are in areas of interest to the subscriber. (Thirty-eight different classification sets are available.)

Current Mathematical Publications (CMP), a tri-weekly journal containing the bibliographic description of items as they arrive at the Ann Arbor office and are selected for review in MR (CMP also contains the listings of a substantial number of items that are not reviewed in MR). Semi-annual cumulative indexes aid in speeding larger searches. In addition, CMP contains reproductions of the tables of contents of many important journals, lists of recent books, etc.

Cumulative Indexes, prepared to assist users of MR in performing comprehensive searches of the literature, or in locating specific items from the past. Author indexes are available for the periods 1940–1959, 1960–1964, and 1965–1972. Subject indexes are available for 1940–1958 and 1959–1972. Combined Author and Subject Cumulative Indexes are available for the periods 1973–1979 and 1980–1984.

Review Volumes, which are collections of reviews in a specific subject area, covering a span of several years. These volumes are intended to help researchers survey the literature in a given field. The AMS has published (in reverse order of publication) the following Review Volumes: Functional analysis (1980–1986), Operator theory (1980–1986), Complex analysis (1980–1986), Global analysis (1980–1986), Numerical analysis (1980–1986), Partial differential equations (1980–1986), K-theory (1940–1984), Number theory (1940–1972 and 1973–1983), Ring theory (1960–1979 and 1980–1984), Graph theory (1940–1978), Finite groups (1940–1970), Infinite groups (1940–1970), and Algebraic and differential topology, topological groups, and homological algebra (1940–1967).

The beginnings of computerization

Starting in the late 1970s, efforts were undertaken to computerize the MR operation. The first effort computerized the reviewer files (for the limited purpose of assisting the MR editors in the process of assigning articles to reviewers). The next effort, completed early in 1980, added a complete bibliographic database to an expanded reviewer database. These efforts were undertaken by the MR staff in Ann Arbor, using the Stanford Public Information Retrieval System (SPIRES) on the mainframe computers at the University of Michigan. In 1982-1983, the database was moved to a Codasyl-based database management system (DBMS) located on the DEC machines in the AMS offices in Providence. Information regarding each item is stored in various "fields" (author, title, language of the item, paging, classification, journal identifier, etc.) which allow selection of items on the basis of elements in the fields (for example, all English language papers on Riemann Surfaces published since 1979).

At about the same time (mid-1979), MR switched to a computerized typesetting system, which greatly simplified the creation of indexes; during the seventies, volume and annual indexes had been created by retyping the bibliographic information onto index sheets using IBM Selectric typewriters and then photographing those sheets. Starting in 1980, indexes were prepared by simply re-sorting the computer files from which the issues had been prepared. Data from 1973–1979 were input into computer files from which the 1973–1979 cumulative index was printed, and, later, data from 1959–1972 were input in order to create a cumulative subject index for 1959–1972; both of these efforts significantly expanded the scope of coverage by machine-readable bibliographic data. Unfortunately, since the typesetting system was proprietary, typeset output could be acquired only from the vendor. Starting in 1985, this restriction was eliminated by switching to TEX as the typesetting language.

On-line versions

Starting in the early 1980s, these computerized files of bibliographic information were made available (under the name MathFile) to commercial distributors of bibliographic databases (Dialog, BRS, etc.) each of which accompanies the data with a sophisticated search and retrieval program which enables complicated compound queries of the data based on numerous data elements, such as author, title, classification, words in the review text, language of publication, journal name, year of publication, etc.

Recently the Society has changed the name of this service to MathSci to reflect the fact that it also includes data from Computing Reviews, the Guide to Computing Literature, The Tukey and Ross Index to Statistics and Probability, and the Current Index to Statistics. This information is now available in several forms:

MathSci On-line contains the bibliographic information in MR from 1959 to the present, and the reviews from mid-1979 to the present, as well as the items in CMP that are not reviewed in MR. It also contains data from the statistics and computer science sources listed above. It can be accessed through various commercial database vendors (Dialog, BRS, European Space Agency).

MathSci Disc is a CD-ROM (Compact Disk–Read Only Memory) version of the last five years of MR and CMP, available from the AMS. It provides access from a personal computer without the connect-time costs (or per hit costs) which sometimes inhibit users from effective use of the on-line version.

MathSci Tape Loads allow academic or commercial installations to load the MathSci information on their mainframe computers and to provide access to that information along their local networks. The institution must provide the necessary retrieval software, which can be acquired commercially or developed on site.

Current developments

During 1989-1990, taking advantage of significant improvements in computer technology, the MR staff are undertaking a migration of the MR database to INGRES, a relational DBMS, on workstations at the MR offices in Ann Arbor. This version will include a significant expansion to support the acquisitions efforts of the MR Library (in 1989, MR handled 3,475 books and 8,166 journal issues). Specifically, as MR librarians review catalogues of publishers, searching for publications within the scope of MR, they can easily search files reporting which orders have already been placed; moreover, claims letters requesting journal issues or books which should have arrived in Ann Arbor but haven't can be generated automatically from the computer files (for checking, signing and mailing by a staff librarian). The new version will also include an integrated assigning function, allowing the MR editors to check quickly what other work by an author has been reviewed, and by whom, or whether authors cited in a bibliography are reviewers who might be appropriate to review the item in hand.

Expenses

As modern technology develops even more efficient means of distribution of technical information (e.g., CD-ROMs), it is tempting to believe that as a consequence the information in MR ought to be available at some greatly reduced price. Many people are surprised when they learn that the major fraction (about 90%) of the

costs of MR derives from the preparation of the data for the database, and that the actual costs of distribution of the data (whether for paper, printing and postage for the paper volume, for mastering and duplicating a compact disk, or for preparing a computer tape) are relatively minor. Data preparation activity, however, includes many expensive steps (for more detail on some of these steps, see the article "From Published Paper to MR Review: How Does it Happen?" in this column in the December, 1989 issue of *Notices*, pp. 1362–1365.):

> The MR Library staff identifies, acquires, records and catalogs the books and journals which are the raw material entering the front end of the MR production pipeline (this labor-intensive effort is expensive, even if most publishers provide copies of their books or journals at no cost–or in exchange for a copy of some equivalently priced AMS publication).
>
> The MR Editors scan each item for possible inclusion in MR and, for those selected, identify an appropriate treatment (e.g., include in the indexes only, use the author's summary, extract a portion from the introduction to the paper, or obtain a full review–in which case they must select a reviewer to whom to assign the item).
>
> Staff prepare and input the bibliographic data for all covered items and produce review forms which are sent to the reviewers (or, in cases where the item is not to be reviewed, to which are affixed the selected summary or portion of the introduction). (Sending a book to an appropriate reviewer in Europe or Asia is expensive.)
>
> Returned manuscripts of reviews (and other treatments) are copy-edited by the MR copyeditors, and then edited for mathematical content by the MR editors. Unreturned reviews (an expensive burden on this process) require reminder letters and, if that is unavailing, duplication and reassignment of the item.
>
> Edited review manuscripts are sent to keyboarders in Providence or Ann Arbor, where they are input into TEX source files. It is becoming increasingly common for reviewers to send their reviews to MR via electronic mail, following a prescribed format (for which see the reverse side of the table of contents page in any recent issue of MR).
>
> Galleys produced from the TEX files are proofread by both the copyeditors and the editors, and then corrected by the keyboarders.

Only at this stage, when camera-ready pages are produced from the Society's typesetting machine and sent to the printer, does the process turn specifically to the production of the printed journal; every earlier step was as much a preparation for the electronic version of the database.

Funding

How is MR funded? Essentially all of its income comes from subscription fees for MR itself and for related products. Over its history the total expenses of creating those products have occasionally exceeded by as much as 5% or 10% the revenues generated by subscriptions, sometimes because of a conscious decision by the AMS Board of Trustees to hold the prices of MR down in order to facilitate broad distribution of this important service to the community. In these years, the deficits have been made up from the general funds of the Society. As various new means of distribution arise from technological advances, it remains essential that each user of the information somehow participate in the funding of its creation. The problem of determining pricing policies for the various products so as to accomplish this equitably is not an easy one; the AMS staff and Board of Trustees struggle with it regularly.

Future developments

As computer and document-handling technology advance, access to the information in Mathematical Reviews will continue to be made available to the mathematical community in forms taking advantage of the resulting increase in the efficiency and effectiveness of methods for information retrieval. Efforts are currently underway to examine the usefulness and economy of hypermedia techniques and of image-processing capabilities. As forms of electronic distribution of information develop, their utility for the distribution of MR, CMP, and MathSci will be explored, with an eye to providing the most effective access to accurate and up-to-date information about the literature of mathematics.

Washington Outlook

This month's column is co-written by A. B. Willcox, who is acting director of the Office of Governmental and Public Affairs of the Joint Policy Board for Mathematics in Washington, D.C., and Hans J. Oser, who is a consultant to that Office.

By the time you read this the calendar will have advanced to 1990. Though not yet the beginning of the last decade of the century, it does mark the start of the 90s, and the occasion calls for a look back at some of the events of the 80s and some thoughts on how they influenced our professional lives. It is also quite appropriate, at this time, to provide you with a perspective of the work of the Office of Governmental and Public Affairs of the Joint Policy Board for Mathematics, an office that came into existence during this period and that has become a prominent actor on the Washington scene.

Highlights of the Decade

1. **1981** - The Mathematical Sciences Research Institute at UC-Berkeley and the Institute for Mathematics and its Applications at the University of Minneapolis are created with NSF support.
2. **1981** - The National Research Council of the NAS/NAE establishes a prestigious committee of scientists and engineers to review health and support of research in the mathematical sciences. Chairman is Edward E. David, Jr.
3. **1982** - The Browder Briefing Panel reports to the President's Science Adviser on research opportunities in mathematics, the first of six science panels.
4. **1983** - AMS, MAA, and SIAM create a nine-member joint executive action arm, the Joint Policy Board for Mathematics, JPBM, to begin implementation of the David Committee's recommendations.
5. **1984** - The David Report: "Renewing Mathematics: Critical Resource for the Future" presents a ten-year plan to redress the imbalance between support for mathematics and other fields of science.
6. **1984** - The National Research Council establishes the Board on Mathematical Sciences.
7. **1985** - The National Research Council establishes the Mathematical Sciences Education Board.
8. **1986** - JPBM establishes a Washington Office of Governmental and Public Affairs, OGPA, to start a "long-term, coordinated effort" in public information as recommended by the David Committee.
9. **1987** - SIAM celebrates its 35th Anniversary.
10. **1988** - 100 Years of American Mathematics - Celebrating the centennial of the American Mathematical Society.
11. **1989** - "Everybody Counts" - BMS/MSEB issue their first 'Report to the Nation', on the state of U. S. mathematics education from kindergarten through college.
12. **1990** - Update of the David Report scheduled for late Spring.
13. **1990** - "MS 2000", the "Second Report to the Nation" and concludes Project MS 2000.
14. **1990** - MAA celebrates its 75th Anniversary.

Federal Support of Mathematics in 1982 and 1990

	FY 82 (mill. $)	FY 90 (mill. $)	Incr. % curr. $	Incr. % const. $
Department of Defense				
AFOSR	6.70	16.50	146	86
ARO	6.00	12.00	100	51
ONR	10.60	12.20	15	-13
DARPA	–	9.50	NA	NA
NSA	–	3.00	NA	NA
Total DOD	23.30	53.20	128	73
Departm. Energy	2.30	6.85	198	125
Other Agencies	2.00	1.00	-50	-62
Total Non NSF	27.60	61.05	121	67
NSF				
DMS	31.20	76.05	144	85
Other	3.00	10.00	233	152
Total NSF	34.20	86.05	152	90
Total	61.80	147.10	138	80

The Total Federal R&D Budget, for Comparison (billion $)

Total Fed. Govt.	42.10	70.10	67	21
Defense Dept.	22.10	45.30	105	55

Footnote: The numbers in this table are taken from the AAAS Reports on R&D in FY 1989 and FY 1990, and the AAAS Special Report: R&D in the 1980s (by Albert H.Teich and Kathleen M. Gramp).

The National Science Foundation remained the dominant source of federal funding for mathematics research during the decade, with a fairly constant share of 55%. The fraction funded by the Department of Defense declined somewhat, but less severely had not DARPA and the National Security Agency substantially increased their support during this time. The Department of Energy also began to play a greater role in supporting research in mathematics.

The table conveys neither the dynamics of the annual budget process nor the changes in the nature of this federal support. The 1990 NSF mathematics budget, for example, contains a significant amount for the Science and Technology Centers which did not exist in 1982. Support from the DoD agencies has become more concentrated on mission-oriented projects, influenced by the arms build-up and the strategic defense initiative. The mathematics community reacted strongly, yet rather un-evenly, to this trend.

The anticipated winding down of the defense budget in coming years creates uncertainty about the amount and nature of future support from DoD. Our community needs to be aware of that. On the other hand, a reappraisal of the long-term goals of the defense agencies may lead to a broadening of their research horizons. Those active in mathematics research in the early 1950s remember when ONR was by far the most generous source of funding for pure mathematics in the defense department.

A significant change from the 1960s and 1970s was the ascendance of the U.S. Congress. Highly competent technical staffs were added to the committees, and the Office of Technology Assessment acquired strong leadership during the past decade. One message from Congress in 1989 was loud and clear: we must provide a first-rate education in mathematics, science, and engineering for our youth from kindergarten through college, in order to prepare our young for technical careers in coming decades. This realization repeatedly led Congress to boost the budget for science education beyond the administration's requests.

From the dollar figures it would appear that the 1980s were a golden decade for mathematics. Yet, the number of individual research grants has not grown, and the prospects for entering mathematicians to obtain sustained research funding are actually worse now than they were in 1980. Also, the overall NSF budget has grown less rapidly than the mathematics budget which points to increasing budget competition from the other disciplines in the future. The deficit reduction imperative already seems to have stalled the administration's ambitious plan to double the Foundation's budget over a five-year period. It is clear now that support for mathematics in fiscal year 1990 will barely stay ahead of inflation. The other sciences are in the same boat. Deficit reduction is important, but the health of the nation's scientific enterprise is vital to our economic future. The mathematical community will have to pay closer attention to the legislative process.

Joint Policy Board for Mathematics

The Joint Policy Board for Mathematics (JPBM) was formed in 1983 by AMS, MAA, and SIAM. The main purpose of this board was "to develop areas of common interest to the mathematical community, to interpret and publicize mathematics and its goals to policy makers in government, foundations and associations, and to communicate concerns of these external entities back to mathematicians as a basis for articulating goals and policies to achieve these goals".

By creating this nine-member joint executive arm, the three societies intended to provide a mechanism for a coordinated implementation of the first David Report. By 1986, JPBM opened the Office of Governmental and Public Affairs (OGPA) in Washington. One of the first visible actions was to launch what has now become an annual event, a national Mathematics Awareness Week (MAW), following a Congressional Resolution that year. That resolution did not just happen; it was carefully ushered through the legislative process by Kenneth Hoffman, Jennifer Vance (then OGPA's congressional consultant), and James Murphy, the AAAS Congressional Fellow sponsored by the three JPBM member societies.

It is unfortunate that budgetary constraints forced the three societies to terminate their support for the Congressional Fellows program. The Congressional experience can be valuable for one who decides to take a break at mid-career to find out what drives the science enterprise in Washington.

The JPBM created a public information department of OGPA under Kathleen Holmay. She has been the focus for the publicity about Mathematics Awareness Week and has, through well-crafted press releases and a carefully assembled network of science writers, brought about a major change in reporting by the national media on mathematics activities. We now have the national press attending our annual meetings, we hold special press briefings for reporters, and we have launched an annual JPBM Communications Award, which is given to an individual for distinguished reporting on mathematics to the general public.

Congressional liaison is the responsibility of one of the authors, Hans Oser, a part-time consultant to OGPA. He monitors progress of legislation affecting mathematics, covers hearings on science policy, keeps track of federal science budgets, and reports on what he learns in these pages. He also sends his weekly "TIDBITS from Washington" to the JPBM member societies.

After Kenneth Hoffman's move to the Mathematical Sciences Education Board (MSEB), Alfred Willcox, retiring MAA Executive Director, took over as Interim Director of OGPA. His mission is to lead OGPA through a move from the offices of the National Academy of Sciences to a suite in the MAA headquarters complex, maintain and increase the momentum developed by Hoffman through the Spring of 1990 and assist in the transition to new leadership.

OGPA expects to increase its liaison activities on Capitol Hill and to become pro-active, rather than re-active, in monitoring the legislative agenda on matters affecting mathematics. We cannot do this alone, and we will have to call more often on the leaders of the societies to bring the concerns of mathematics to the attention of the executive and legislative leaders of our nation.

We always enjoy hearing from you. Our telephone number is 202-234-9570, or we can be reached by email (jpbm@athena.umd.edu).

American Mathematical Society

Manager Russian Translation Program
Position Open

The Society is seeking applications from individuals with a broad-based background in mathematics and fluent Russian. Publishing experience or participation in a translation program would be helpful.

The manager will be expected to provide long-range planning for the translation program. Responsibilities will include identifying and developing real or potential projects and authors, acting as liaison between consultants and the Translation Editorial Committee, serving as the interface between the Society and appropriate Soviet agencies and publishing houses, and directing the activities of the translations editorial staff.

The person selected will work in the Society's Providence Office. Travel to the Soviet Union will be necessary.

Applications should be sent to:

Director of Publications
American Mathematical Society
P.O. Box 6248
Providence, RI 02940

The Society is an equal opportunity employer and has a generous fringe-benefit program including TIAA/CREF.

News and Announcements

Math Awareness Week 1990

This year, Mathematics Awareness Week will be held April 22–28, 1990. This national event gives the mathematical sciences community an opportunity to celebrate mathematics and communicate to the public the importance, relevance, and beauty of the discipline.

The Office of Governmental and Public Affairs of the Joint Policy Board for Mathematics is coordinating a variety of Math Awareness Week activities. This year's theme is "Communicating Mathematics." The activities are coordinated with the Year of National Dialogue, a series of events centered on discussion of the state of American mathematics and education.

During Math Awareness Week last year, a range of activities were organized around the country. For example, Columbia University offered a series of public colloquia on Recent Advances in Pure and Applied Mathematics to mathematics teachers, professors, and undergraduate and graduate students. At the University of Michigan in Flint, there was a mathematical poster contest that drew over 250 entries from 40 public and private schools. "MathConn '89" was a day-long program for 200 seventh and eighth grade girls, held at Cedar Crest College in Allentown, Pennsylvania. There were group sessions with women who work in math-related fields and presentations by two prominent women mathematicians. Many other schools, colleges, and universities organized successful programs.

For more information about ideas for celebrating Math Awareness Week in your area, contact the Office of Governmental and Public Affairs, Joint Policy Board for Mathematics, 1529 Eighteenth Street NW, Washington, DC 20036; telephone: 202-234-9570.

New Soviet Math Institute Planned

The government of the U.S.S.R. recently decided to organize an international institute for advanced studies in mathematics and its applications. Named after the mathematician and physicist Leonhard Euler, the Euler Mathematical Institute will be based in Leningrad and will commence its activities during the 1990-1991 year.

One goal of the Institute is to extend the cooperation between the Soviet and international mathematical communities. The Institute is to function as follows. Each scientific year will consist of three trimesters followed by workshops. The programs of the trimesters will be determined in advance by an International Advisory Board. The Institute will invite foreign and Soviet mathematicians for joint work, consisting of collective and individual research, discussions, seminars, lectures, etc. The Institute will also publish a journal, *Transactions of the Euler Mathematical Institute.*

Leningrad authorities have provided the Institute with appropriate land, a building (now being restored), and fifteen apartments for visitors. The Soviet government has provided a modest fund to furnish the Institute with modern word processors and copying facilities. Organizers also expect to have FAX services available when the Institute opens and, eventually, electronic mail facilities. In addition, the scientific programs will be coordinated with those of other centers of international mathematical research, such as IHES in France, MSRI in the U.S., the Mittag-Leffler Institute in Sweden, the Max Planck Institute in West Germany, and RIMS in Japan.

For more information, contact: L. D. Fadeev, Director-Organizer, Euler Mathematical Institute, Leningrad D-11, Fontanka 27, U.S.S.R. 191011.

Fulbright Scholars Announced

The Council for International Exchange of Scholars (CIES) has announced the names of approximately 1000 American scholars who have been awarded Fulbright grants to lecture or conduct research abroad. During the 1989-1990 academic year, these scholars will hold various appointments in about 100 countries around the world. CIES, an affiliate of the American Council of Learned Societies, cooperates with the United States Information Agency in administering the Fulbright program.

Listed below are the names of this year's Fulbright scholars in mathematics and in computer science. Following each name is the individual's home institution, his or her research area, and the country to be visited.

Mathematics: DEANE EUGENE ARGANBRIGHT, Whitworth College,

mathematics and computer science, New Guinea; SHRIKANT I. BANGDIWALA, University of North Carolina-Chapel Hill, biostatistics, Costa Rica; STAVROS N. BUSENBERG, Harvey Mudd College, mathematics problem-solving clinic, New Zealand; JAMES E. FALK, George Washington University, optimization methods and applications, Czechoslovakia; LOUIS GORDON, University of Southern California, Los Angeles, sequential methods for nonparametric detection of a change in distribution, Israel; OMAR B. HIJAB, Temple University, problems in filtering and control, Jordan; RALPH N. MCKENZIE, University of California at Berkeley, classification of varieties, Australia; PAUL C. SHIELDS, University of Toledo, ergodic theory and its applications, Hungary; GERARD A. VENEMA, Calvin College, topology of 4-manifolds, Yugoslavia; ANDREW J. VINCE, University of Florida, mathematics and computer science, Malawi; JAMES E. WARD, Bowdoin College, mathematics, Lesotho; JOSEPH E. YUKICH, Lehigh University, probability theory, France.

Computer science: ALKIVIADIS G. AKRITAS, University of Kansas, computer algebra, U.S.S.R.; DAVID W. CLAY, Florida Institute of Technology, computer science, Lesotho; M. DEAN FENTON, Pennsylvania State University, computer science, Liberia; RONALD ROBERT GOFORTH, Universiy of Arkansas, computer science and computer-based service applications, Fiji; AMAR MUKHERJEE, University of Central Florida, computer science, India; SYED SHAHABUDDIN, Central Michigan University, computer information technology and underdeveloped countries: a case study of Pakistan, Pakistan; PETER B. VON MERTENS, Lesley College, computers as tools for management, Tanzania.

For information on applying for Fulbright awards, write to: Council for International Exchange of Scholars, Eleven Dupont Circle, Suite 300, Washington, DC 20036-1257.

Australian Math Society Award

Michael Cowling of the University of New South Wales was awarded the 1989 Australian Mathematical Society Medal at the Society's meeting in July, 1989. The citation for the medal read:

"Michael George Cowling is a harmonic analyst of great distinction who first achieved international fame for his beautiful solution and explanation of the Kunze-Stein phenomenon. Subsequently he has applied transference techniques in an original way in the study of Fourier multipliers, has cleverly exploited fractional integrals in the estimation of maximal functions, and, together with Haagerup, has deepened our understanding of lattice structure in Lie groups. His work is characterized by a combination of the fine skills of a classical analyst with the penetrating insight of an abstract structuralist."

Math Communications Award to Playwright

Hugh Whitemore, a playwright, has received the second annual Communications Award from the Joint Policy Board for Mathematics. The award recognizes Whitemore's contribution to communicating mathematics to the public in his play, "Breaking the Code," which chronicles the brilliant but troubled life of the British mathematician Alan Turing. Turing, a logician who was largely responsible for breaking the German code during World War II, developed the important concept of a Turing machine, which set the foundation for the creation of the modern digital computer.

At the Joint Mathematics Meetings in Louisville last month, officers and executive directors of the AMS, the Mathematical Association of America (MAA), and the Society for Industrial and Applied Mathematics (SIAM) joined with other leaders in the mathematical community to honor Whitemore. The Communications Award consists of a citation and $1000. The host for the ceremony was Peter Hilton of the State University of New York at Binghamton, who worked with Turing in England at the time when Turing was decyphering messages from the German Enigma machine.

A former student of London's Royal Academy, Whitemore was an actor before he became a playwright, and his first stage play was produced in London in 1977. With the well-known actor Derek Jacobi playing Turing, "Breaking the Code" had a successful run in London's West End and on Broadway. Whitemore has written many plays for British television and has worked extensively for the cinema.

The Joint Policy Board for Mathematics is the public affairs arm of the AMS, the MAA, and SIAM. Last year's Communications Award went to James Gleick for his best-selling book, *Chaos: Making a New Science.*

MSEB Awards Grants for Math Coalitions

The Mathematical Sciences Education Board (MSEB) of the National Research Council has made awards of approximately $10,000 each to twenty-five organizations for the planning of state mathematics coalitions. As the administrator of one of the grants, the AMS will be involved in the formation of a mathematics coalition in the Society's home state of Rhode Island.

The awards, funded by a major grant from the Exxon Education Foundation, with additional support from the Carnegie Corporation of New York, constitute the first phase of an effort to establish a coalition in each state to improve the quality of mathematics teaching and learning. The coalitions are designed to promote state and local actions that will move curriculum, instruction, and assessment toward the goals proposed in two recent reports, *Everybody Counts,* published by the National Research Council, and *Curriculum and Evaluation Standards for School Mathematics,* published

by the National Council of Teachers of Mathematics.

According to Robert Kansky, the MSEB project officer in charge of the state coalitions, the program is "designed to bring together educators, business representatives, and developers of public policy for the purpose of 'thinking nationally but acting locally' in developing mathematics programs tailored to state and local needs." The objectives of the coalitions include helping to communicate the specifics of proposed changes in mathematics education, stimulating development of state goals compatible with national ones, and promoting adoption of policies which foster long-term improvement.

The states receiving planning grants are: Arizona, California, Colorado, Georgia, Idaho, Illinois, Kansas, Kentucky, Louisiana, Massachusetts, Missouri, Montana, Nebraska, New Hampshire, New Mexico, Ohio, Oregon, Rhode Island, South Carolina, Utah, Vermont, Washington, Wisconsin, West Virginia, and Wyoming.

The project in which the AMS is involved, the Rhode Island Mathematical Sciences Education Board (RIMSEB), is headed by James T. Sedlock, professor of mathematics at Rhode Island College. The grant will support planning activities to formulate a permanent RIMSEB that will act as a focal point for various constituencies having an interest in improving mathematics education and as a resource for information about local and national issues pertaining to mathematics education.

As the parent organization for RIMSEB, the AMS will provide meeting facilities and support for the planning activities and will administer the grant. In addition, two AMS staff members are on the RIMSEB plannng committee, William H. Jaco, AMS Executive Director, and James W. Maxwell, AMS Associate Executive Director.

This year, the Washington, DC-based MSEB hopes to offer funding for implementation grants to support first-year activities of established state mathematics coalitions. These multi-year grants will be used to launch projects that would eventually be supported entirely by non-MSEB sources. For more information about the MSEB State Mathematics Coalitions Project, contact Rober J. Kansky, Senior Project Officer, Mathematical Sciences Education Board, 818 Connecticut Ave., NW, Suite 500, Washington, DC 20006; telephone: 202-334-1486.

Leitzel Named to NSF Post

Joan Leitzel, a mathematician and associate provost at Ohio State University, has been named as the director of the Division for Materials Development, Research, and Informal Science Education at the National Science Foundation (NSF). She began the NSF position on January 1.

In this position, Leitzel oversees four NSF educational programs funding projects primarily at the precollege level: Applications of Advanced Technologies, Informal Science Education, Instructional Materials Development, and Research in Teaching and Learning. These programs comprise a staff of ten professional scientists who act as program directors and ten support personnel; the budget for fiscal year 1989 was $44 million.

Leitzel says that increasing the involvement of research mathematicians in educational issues is "very important." "A lot of progress has been made in bringing the NSF's research directorates and education directorate closer together on issues of common importance," she notes. "That will be a goal for me at the NSF." She also is enthusiastic about the opportunity to play a role in science and engineering education at a time when national interest in education is high.

After receiving her Ph.D. in mathematics in 1965 from Indiana University, Leitzel went to Ohio State, where she has been ever since. She served as vice-chair and acting chair of the department of mathematics before being named associate provost in 1985. Her plan is to return to the faculty of Ohio State some time in the future.

As associate provost, Leitzel has had considerable administrative experience that will assist her in her NSF post. Her responsibilities included overseeing instruction and curriculum, which entailed university-wide review of the undergraduate curriculum, selective admissions, enrollment management, advising, teaching evaluation and improvement, interdisciplinary instruction, support programs for at-risk students, and articulation with high schools.

Smale to Give Pitcher Lectures

The next series of Everett Pitcher Lectures will be held March 26, 27, and 28, 1990 on the campus of Lehigh University in Bethlehem, Pennsylvania. They will be delivered by Professor Stephen Smale of the University of California at Berkeley. The title of his lectures is *Theory of Computation. Extending the Problem "$P \neq NP$" to the Real and Complex Numbers.*

The lectures are open to the public and are held in honor of Everett Pitcher, former Secretary of the AMS, who served in the Mathematics Department at Lehigh from 1938 until 1978, retiring as Distinguished Professor of Mathematics. Further information can be obtained by writing Pitcher Lecture Series, Department of Mathematics, Lehigh University, Bethlehem, PA 18015, or by calling: 215-758-3753.

News from the Mathematical Sciences Institute

Cornell University

The first of two MSI summer workshops will be on the topic "Percolation Models of Material Failure." Organized by S. Leigh Phoenix, Cornell University, the workshop will focus on probability models of material breakdown wherein the material is

modeled as a network or lattice of elements, each of which may be present or absent with a certain probability, or have a randomly distributed strength, of fail in time according to a distribution which is a prescribed functional of the load history. A key feature is stress redistribution from failed to surviving elements, thus enhancing their rates of failure. Models of this sort, which have a close connection to the theory of percolation and particle systems, have been used to explain the breakdown and size effects in strength of diverse structures such as fibrous composites, dielectrics, superconducting networks, random fuse networks and general multiphase materials.

Workshop participants with diverse backgrounds will present talks on behavior of asymptotic distributions for strength and lifetime, scaling phenomena, critical points and transitions in global behavior, fractal behavior, localization, universality, renormalization, fracture toughness and interface effects among elements.

Invited speakers include: P. Beale, A. Chudnovski, H. Daniels, R. Durrett, P. Duxbury, J. Goddard, M. Grigoriu, G. Harlow, H. Herrmann, C. Hui, H. Kesten, P. Leath, J. McCoy, W. Newman, M. Ostoja-Starzewski, S. Redner, R. Smith, D. Srolovitz, H. Taylor, and Y. Termonia.

To register, contact MSI through Patricia Giordano at 201 Caldwell Hall, Cornell University, Ithaca, NY 14853-2602, 607-255-8005. For more information about the scientific content, contact S. Leigh Phoenix, Cornell University, Department of Theoretical and Applied Mechanics, 321 Thurston Hall, Ithaca, NY 14853, 607-255-3462 or 8818.

MSI is sponsoring a major symposium on "Modern Perspectives of Mathematics: Mathematics as a Consumer Good, Mathematics in Academia," March 29–31, 1990, at Cornell University. See this column in the November *Notices* and the display advertisement in the December and January issues for a full description. Registration packets are now available: Contact conference secretary Diana Drake at the same address and phone number listed above.

Research Experiences for Undergraduates Awards Announced

The Division of Mathematical Sciences of the National Science Foundation (NSF) has announced the 1990 awards in the Research Experiences for Undergraduates (REU) program. The program gives students hands-on experience in research in science, mathematics, and engineering. Designed to encourage talented students to pursue careers in research, REU gives the students a chance to experience the excitement of research while they are still in the process of making career choices.

The REU program makes two different kinds of awards: *Sites* and *Supplements*. REU Sites bring together groups of students during the summer for an organized program of research activities. The programs vary in size from six to twelve students and generally last seven or more weeks. REU Supplements permit a principal investigator to add an undergraduate student to his or her research grant.

Notices readers may wish to encourage talented undergraduates to seek information on participating in one of the REU Site programs. In addition to providing valuable and exciting experiences, the REU Sites also provide each student with a stipend.

This year, out of sixteen new proposals for REU Sites, there were nine new awards; there were also six continuing awards. The total DMS budget for the REU Sites is around $0.5 million. What follows is a list of REU Sites planned for the summer of 1990, giving the names of the principal investigators, their institutions, and the mathematical emphasis of each program.

STEVEN L. BLUMSACK, Florida State University, *Topics in applied and pure mathematics*; JAMES H. CURRY, University of Colorado, *Geometry of iterations and dynamical systems*; EDWARD CURTIS, University of Washington, *Problems in inverse conductivity*; JOSEPH A. GALLIAN, University of Minnesota, Duluth, *Graph theory and combinatorics*; PAUL R. GOODEY, University of Oklahoma, *Experimentation in group theory and dynamics*; APARNA W. HIGGINS, University of Dayton, *Algebraic graph theory*; DAVID L. HOUSMAN, Drew University, *Cooperative game theory*; LAWRENCE S. HUSCH, University of Tennessee, *Selected research topics*; REX K. KINCAID, College of William and Mary, *Matrix analysis and applications*; STEVEN G. KRANTZ, Washington University, *Harmonic analysis algorithms*; FRANK MORGAN, Williams College, *SMALL geometry project*; DONAL B. O'SHEA, Mount Holyoke College, *Selected computational activities*; ROBERT O. ROBSON, Oregon State University, *Experimental mathematical studies*; BRIGITTE SERVATIUS, Worcester Polytechnic Institute, *Discrete and applied mathematics*; GARY J. SHERMAN, Rose-Hulman Institute of Technology, *Computational group theory*.

The deadline to submit proposals for the 1991 REU Sites will likely be **October 10, 1990**. For more information, contact John V. Ryff, Program Director, Research Experiences for Undergraduates, Division of Mathematical Sciences, Room 339, National Science Foundation, 1800 G Street, NW, Washington, DC 20550; telephone: 202-357-3456; electronic mail: jryff@note.nsf.gov (Internet) or jryff@nsf (Bitnet).

Requests for REU Supplements may be submitted at any time. For more information, interested individuals should contact the DMS program director handling his or her research grant.

Visiting Scientist Positions at NSF

The Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) expects to hire several "Visiting Scientists" as Program Directors for the fall of 1990. Mathematical scientists in all research areas will be considered.

These Visiting Scientists (also known informally as "rotators") hold one- or two-year appointments at the DMS while on leave from universities, colleges, industry, or national laboratories. The positions involve responsibility for the planning, coordination, and management of the DMS support for basic research activities. In addition to participation in the management of research grants and contracts, the positions involve budgeting and long-range planning for the DMS, travel to U.S. institutions through scientific site visits, and NSF outreach.

Applicants for these positions should have a Ph.D. or equivalent training in a field of the mathematical sciences, a broad knowledge of one of the active research areas of the DMS, several years of successful independent scientific research, some administrative experience, a knowledge of the general scientific community, skill in written communication techniques and preparation of technical reports, and the ability to communicate orally, including conducting briefings, site visits, workshops, and outreach.

The general duties and responsibilites of a Program Director are as follows:

- Plans, coordinates, and manages a program which supports basic and applied research that has an impact on major areas of the mathematical sciences; serves as recognized program authority in the DMS.
- Coordinates program budget and operating requirements to ensure that funds are appropriately allocated for the fulfillment of Program, Division, and Foundation goals and objectives.
- Designs and implements the proposal review and evaluation process for the Program to ensure quality of research proposals and appropriateness of review.
- Provides guidance and consultation on matters relating the Program to other NSF elements.
- Maintains liaison with other agencies and institutions within the mathematical sciences community and related disciplines to keep apprised of and to exchange information.
- Organizes and arranges committees and meetings to review current research activities, plan future research directions, and to initiate new research emphases, policies, and procedures.

The Division has taken pride in having one of the best staffs among all of the NSF divisions. The DMS and the Foundation provide extensive initial program management training. Further, professional training opportunities in personnel management, governmental process and relations, and science policy are available through the Foundation, and Program Directors are encouraged to participate.

Program Directors often interact with science managers in other science agencies and have the opportunity to represent the DMS through cross-directorate activities, international cooperative science activities, science education, and interdisciplinary research planning.

For information on Visiting Scientists' experiences in the DMS, see "Reflections of Departing DMS Rotators," *Notices*, September 1988, pp. 1007–1009.

The NSF is currently located in downtown Washington, DC, two blocks from the White House, a short walk from the Mall, and a block from George Washington University. Our national capital is noted as a beautiful international city of boulevards, parks, famous museums, fascinating history, good transportation, and outstanding restaurants and theatre. It is close to the Appalachian mountains, the Chesapeake bay, and the Atlantic Ocean recreation areas.

For additional information, contact Judith S. Sunley, Director, Division of Mathematical Sciences, National Science Foundation, Washington, D.C. 20550; telephone: 202-357-9669.

Report on Funding Policy in Computer Science

A report on federal funding policy in computer science contains information that may be of interest to *Notices* readers, as it parallels some of the research funding policy issues that have been debated in the mathematical sciences community in recent years. The report, which will be released in late spring, was initiated by the Science Policy Committee of the Special Interest Group on Automata and Computability Theory (SIGACT) of the Association for Computing Machinery (ACM).

The report states that, although there are significant difficulties in categorizing basic and applied research, a number of general trends can be detected. For example, in academic computer science, support for basic research has declined relative to applied research, primarily because of increased emphasis in the military agencies on programs budgeted as applied research and development. According to the report, some in the field are concerned that this emphasis may distort the direction of the field and inhibit advances in its scientific foundations.

Entitled "A field in transition: Current trends and issues in academic computer science," the report is being written by Joel S. Yudken, Project Director, Project on Funding Policy in Computer Science, and Barbara Simons, vice-chair of SIGACT. Yudken is an NSF Fellow in Science, Technology, and Society at the Tremont Research Institute; Simons is a member of the research staff at the IBM Almaden Research Center. The project is sponsored by the

SIGACT Science Policy Committee, together with a number of other organizations. The Association for Women in Mathematics and several other scientific organizations have also endorsed the project.

In addition to examining academic computer science funding, the report presents figures for overall federal funding of computer science research. For example, in the past twelve years, federal funding for computer science and engineering research grew faster than any other discipline; within the Department of Defense (DOD), funding of all computer science research grew approximately 250% in constant dollars between 1976 and 1988. In that same period, the percentage of DOD funding going to basic computer science research fell from 31% to 20%, reflecting the fact that the DOD is a relatively small supporter of basic research.

The report will compare the roles of other government agencies, such as the National Science Foundatiqon and the National Aeronautics and Space Administration, in federal funding of computer science research. A breakdown by subfields will also be presented, as well as information about new funding initiatives.

The report will contain some of the most current data available on computer science funding. Copies of the report will be available from Funding Policy in Computer Science, P.O. Box 9896, Stanford, CA 94309-0210.

NSF Ends Support for Supercomputing Center

The National Science Foundation (NSF) has decided to terminate support for one of its five supercomputing centers, the John von Neumann Center (JvNC) in Princeton, New Jersey. Launched in 1985 as a consortium of thirteen universities, JvNC suffered a serious setback when ETA Systems, a subsidiary of Control Data Corporation and the maker of the processors used at the Center, closed its doors last year. NSF funding for JvNC will be phased out by October of this year.

Originally, the NSF gave JvNC six months to prepare an alternative plan to using ETA products. The Center responded in time with a plan to replace their ETA supercomputers with a Cray Y-MP, but the NSF was not convinced the Center had sufficient support from its consortium members and turned down the $70 million request for the next five years.

With an operating budget this year of $12 million, the Center currently supports more than 1400 users around the country and has an in-house staff of 65. The NSF decision should not affect current users of the JvNC facilities, who can be absorbed by the other NSF centers. But it is likely that, without federal support, the Center will soon cease operation. JvNC officials are seeking financing from other federal, state, and private sources to keep the center going.

New TEX Features from AMS

In response to calls from the mathematical sciences community, the Society has developed some new features and upgrades for TEX products. This work was done as a service to the mathematical sciences community, as well as to the broader computer typesetting community, by making high-quality mathematical and technical typesetting more accessible, flexible, and powerful.

AMS-TEX Version 2.0 and AMSFonts Version 2.0

Perhaps the main improvement the Society made was the development of Version 2.0 of the AMS-TEX mathematical typesetting package. AMS-TEX, created by Michael Spivak with the sponsorship of the AMS, consists of TEX macros that facilitate the typesetting of complex mathematical formulas and displays. Version 2.0, prepared by Spivak and AMS staff members, incorporates a number of improvements and changes suggested by users of AMS-TEX. In the new version, many of the error messages and help messages are clearer, and many bugs that surfaced in special cases in using AMS-TEX macros have now been eliminated. There have been refinements in some of the macros, and changes have been made to conserve memory space. In addition, access to fonts other than those defined in plain TEX has been simplified. The AMS-TEX macros have now been fully documented by Spivak in a separate file called AMS-TEX.doc.

The AMS-TEX preprint style file (AMSPPT.STY) has been rewritten to allow for many optional formatting features and thus provide users with greater flexibility. Among the new features are styles for chapters in books, in addition to journal articles, running heads, alternate page sizes, and tables of contents.

The AMSFonts package has been updated and expanded to include many fonts that users have requested. AMSFonts 2.0 includes

- the Euler fonts (Fraktur, 'Roman' cursive, and Script);
- a variety of Cyrillic fonts (lightface, bold, italic, caps and small caps, and san serif), developed at the University of Washington;
- new point sizes of Computer Modern caps and small caps, and bold versions of the CM math italic and symbol fonts;
- two math symbol fonts, including a newly designed blackboard bold;
- an Euler compatible version of the Math extension font.

There will be two implementations of the new collection – one for PCs and mainframes, and one for use with *Textures* on the Macintosh. All the standard TEX magnifications will be available for both implementations.

Users of the older versions of AMS-TEX and AMSFonts can obtain the new versions from the AMS free of charge until September 1, 1990. The upgrade packages will include In-

stallation and User's Guides. Users should know that because of some changes in the way fonts are treated there is no cross-compatibility between $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX 2.0 and AMSFonts 2.0, and the older versions of both. You can use new with new, or old with old, but you cannot use any combination of new and old.

Those wishing to obtain upgrades of either $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX or AMSFonts should contact

Customer Services Department
American Mathematical Society
P.O. Box 6248
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$\mathcal{A}\mathcal{M}\mathcal{S}$-TEX / LATEX Style Files

In an effort to make $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX and LATEX more compatible, the Society has sponsored the development of several document styles for LATEX. The first is an $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX style option that allows LATEX users to use many of the $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX mathematical macros within existing LATEX document styles (this is different from LAMS-TEX, a macro package Spivak is developing to incorporate some LATEX features into $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX). Two document styles, AMSBOOK and AMSART, use the $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX style option and provide formats suitable for a typical book, or for an article that might appear in either a journal or a collection. If an author uses one of these document styles to prepare a manuscript in LATEX, then that manuscript can be submitted electronically to any AMS publication, whereas only $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX electronic manuscripts were acceptable before. These files will be ready for distribution in late February.

Most TEX vendors have agreed to include the files which implement the $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX styles in LATEX packages they sell in the future, and to make this upgrade available to current LATEX users. In addition, the files will be available free of charge from the AMS and will reside in the public domain archives.

The $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX files for LATEX may be obtained in two ways. Users of electronic mail can receive the files electronically, by sending a request on Internet to:
AMS-LATEX@MATH.AMS.COM.
Users may also receive the files on IBM or Macintosh diskettes by contacting Rosanne Granatiero in the Publications Division, at the Society's address given above. Anyone requesting the $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX files for LATEX should specify whether they want to receive the files for a PC or a Macintosh.

Addendum to Newton's Principia, Read 300 Years Later

The following is an addendum to the article *Newton's Principia, Read 300 Years Later*, by V. I. Arnol'd and V. A. Vasil'ev, that appeared in the November 1989 *Notices* pp. 1148–1154.

Remark 3. At the Gibbs symposium at Yale (May 1989) some physicist informed the elder author that this duality law still holds in quantum mechanics.

Let $w(z)$ be any conformal mapping. Let $U(z) = |dw/dz|^2$ and $V(w) = -|dz/dw|^2$. Then the mapping $z \mapsto w$ transforms the trajectories of the motion in the field of forces with potential U into the trajectories of the motion in the field with potential V.

Indeed, the Maupertuis integrands are essentially the same:
$\sqrt{2(E-U)}|dz|$
$= \sqrt{E}\sqrt{2(E'-V)}|dw|, \quad EE' = -1.$

Hence our duality is the duality between E and U in the expression $E - U$.

The quantum case is related to a similar identity for the quadratic forms in ψ:
$\iint |\frac{\partial\psi}{\partial z}|^2 + (a + bU)|\psi|^2 dz\, d\bar{z}$
$= \iint |\frac{\partial\psi}{\partial w}|^2 + (b - aV)|\psi|^2 dw\, d\bar{w}.$

One of the particularly interesting cases is $w = e^z$. It shows that e^{2x} is a "natural value" of r^∞. Other interesting cases are $w = \sin z$ and $w = \operatorname{tg} z$, corresponding to $V = -|w^2 - 1|^{-1}$ and $V = -|1 + w^2|^{-2}$.

The quantum duality was discovered in 1953 by a Saigon mathematician, R. Faure. See R. Faure, *Transformations conformes en mécanique ondulatoire*, C.R.A.S. Paris, t. 237, pp. 603–605, Séance du 21 septembre 1953.

Funding Information for the Mathematical Sciences

NSF Expands Curriculum Development

The National Science Foundation (NSF) has announced an expanded program to support major changes to reshape and strengthen undergraduate courses, curricula, and laboratories in engineering, mathematics, and the sciences. The program is similar in spirit and purpose to the NSF's program on calculus curriculum development, but addresses courses in all areas. This year, the program will emphasize proposals affecting introductory-level courses.

The principal goal of the program is to support fresh approaches and experiments to produce major changes in U.S. undergraduate education. Entitled Undergraduate Curriculum and Course Development in Engineering, Mathematics, and the Sciences, the program will support projects in all fields normally supported by the Foundation. Multidisciplinary and interdisciplinary proposals are especially encouraged.

For mathematics, the primary focus is on proposals dealing with non-calculus, introductory courses such as precalculus, discrete mathematics, geometry, and statistics. Similarly, proposals that would include elements of calculus in broad courses aimed at mathematical literacy or in interdisciplinary courses would be appropriate for this program. Proposers interested in calculus and related courses, such as the differential equations and linear algebra courses typically included in the two-year calculus sequence, should submit to the Undergraduate Curriculum Development in Mathematics: Calculus Program.

Proposals will be accepted for two categories: Comprehensive Development Projects, and Prototype and Pilot Projects. Proposals submitted under the first category should describe a well-defined vision and well-formulated plans for comprehensive introductory-level curriculum development. The NSF anticipates supporting a few major projects that involve a broad-based, cohesive set of activities to significantly change undergraduate education at the introductory level.

Proposals submitted under the second category should present more focused activities as typified by individual courses, laboratories and topic areas at the introductory level. Also appropriate under this category are proposals for activities such as workshops, studies, or pilot projects to improve the probability for success of a future comprehensive project. The NSF expects to support a modest number of projects having the potential to produce significant improvements in the undergraduate learning experience.

The closing date for proposals in both categories is **April 9, 1990**; awards are expected to be made in the fall of 1990. Projects may request support for a period of up to five years. The number of awards in each category will depend on the quality of proposals received and the availability of funds for this program.

The program announcement (publication number NSF 89-125), with more detailed information and the forms to be included in a proposal, is available from Forms and Publications Unit, Room 232, National Science Foundation, 1800 G Street NW, Washington DC 20550; telephone 202-357-7668; electronic mail: pubs@note.nsf.gov (Internet) or pubs@nsf (Bitnet).

Further information is available from Spud Bradley, director of the calculus curriculum development program, at: National Science Foundation, Room 639, 1800 G Street NW, Washington, DC 20550; telephone: 202-357-7051; electronic mail: sbradley@note.nsf.gov (Internet) or sbradley@nsf (Bitnet). Another contact is Deborah Lockhart, program director for Special Projects in the Division of Mathematical Sciences, at: National Science Foundation, Room 339, 1800 G Street NW, Washington, DC 20550; telephone: 202-357-3453; electronic mail: dlockhar@note.nsf.gov (Internet) or dlockhar@nsf (Bitnet).

1991-1992 Fulbright Competition Opens

The Council for International Exchange of Scholars has opened the competition for Fulbright grants in research and university lecturing abroad during the 1991-1992 academic year.

Approximately 1000 grants will be awarded for periods ranging from three months to a full academic year. There are openings in over 100 coun-

tries, and, in many regions, there is opportunity for multi-country research. Fulbright awards are made in virtually all disciplines and all academic ranks. Applications are encouraged from retired faculty and independent scholars.

Grant benefits, which vary by country, generally include round-trip travel for the grantee and, for most full-academic year awards, one dependent; stipend in U.S. dollars and/or local currency; tuition allowance for school-age children in many countries; and book and baggage allowances.

The basic eligibility requirements are: U.S. citizenship; Ph.D. or comparable professional qualifications; university or college teaching experience; and, for selected assignments, proficiency in a foreign language. There is no limit on the number of Fulbright grants a single scholar may receive, but there must be a three-year interval between awards.

Application deadlines for the awards are:

June 15, 1990. Australasia, India, U.S.S.R., and Latin America, except Mexico, Venezuela, and the Caribbean.

August 1, 1990. Africa, Asia, Western Europe, Eastern Europe, the Middle East, and lecturing awards to Mexico, Venezuela, and the Caribbean; travel-only awards to France, Italy, and Federal Republic of Germany.

November 1, 1990. Institutional proposals for the Scholar-in-Residence Program; and International Education Administrators Program in Federal Republic of Germany, United Kingdom, and Japan.

January 1, 1990. NATO Research Fellowships and Spain Research Fellowships.

Application materials will be available in March. For more information and applications, contact: Council for International Exchange of Scholars, 3400 International Drive, Suite M-500, Washington, DC 20008-3097; telephone: 202-686-7866.

Deadlines for NSF International Programs

The National Science Foundation sponsors a number of programs to facilitate international collaborations among researchers in science, mathematics, and engineering. Some of these programs have deadlines or target dates in the spring of 1990 (in programs with target dates, it is preferable to submit proposals by that date, but they may be submitted at any time).

These programs are listed below, together with brief descriptions, deadlines or target dates, and a contact person. All telephone numbers are in the 202 area code. The mailing address is Division of International Programs, National Science Foundation, 1800 G Street NW, Washington, DC 20550.

Long-term Research Opportunities in Japan. Visits for U.S. researchers at Japanese government, university and industrial laboratories for six to 24 months; target date March 1; Myra McAuliffe, 357-9558.

Cooperative Science Activities. Cooperative science, engineering, and science education programs with Austria, Denmark, the Netherlands, Norway, Finland, Sweden, the United Kingdom, the Federal Republic of Germany, and Switzerland; deadline March 1; Christine French or Christine Glenday, 357-9700.

U.S.-India Cooperative Science. Joint workshops and seminars, and individual travel; deadline March 1; Osman Shinaishin, 357-9402.

Science in Developing Countries. Visits, research participation, seminars, and dissertation improvement; target date March 1. For North Africa and Turkey: Ed Field, 357-9402; East Asia and Sub-Saharan Africa: Gerald Edwards, 357-9537; South and West Asia: Osman Shinaishin, 357-9402; Latin America and the Caribbean: Harold Stolberg and David Kelland, 357-7421.

State-of-the-art Survey Teams. Support for expert reviews of specific disciplinary and interdisciplinary areas, especially those most promising for U.S researchers' participation; target date March 1; Charles Owens, 357-9632.

U.S.-Australia Cooperative Science Program. Proposals for joint research, seminars, and visits; deadline April 1; Carole Ganz, 357-9700.

U.S.-People's Republic of China Cooperative Science. Cooperative research only, no travel requests or unsolicited proposals for joint seminars and workshops; target date April 1; Alice Hogan or William Y. B. Chang, 357-7393, or Russell Sveda, 357-9824.

U.S.-Yugoslavia Joint Board for Scientific and Technological Cooperation. Joint research, bilateral workshops, and project development visits; deadline April 1; Rose Bader, 357-7393.

U.S.-Eastern Europe Cooperative Science. Cooperative research projects or bilateral seminars in Bulgaria, Czechoslovakia, Hungary, Poland, and Romania; target date May 1; Gerson Sher, 357-7494.

U.S.-France Cooperative Science. Cooperative research projects and joint workshops and seminars; deadline May 1; Christine Glenday, 357-7554.

U.S.-Italy Cooperative Science. Cooperative research projects, joint seminars and workshops; target date May 1; Harold Stolberg, 357-7421.

U.S.-Latin America Cooperative Science Programs. Cooperative research (partial support), bilateral workshops, and scientific visits. Foreign collaborator must submit a parallel proposal to a counterpart agency; deadline May 1. For Argentina and Brazil: David Kelland, 357-9564; for Mexico and Venezuela: Harold Stolberg and Kelland, 357-7421.

U.S.-Japan Cooperative Science Program. Cooperative research and joint seminar activities; May 15; Myra McAuliffe, 357-9558.

Research Fellowships in India

The Council for International Exchange of Scholars has announced

the availability of twelve long-term (6–10 months) and nine short-term (2-3 months) awards for research in India during 1991-1992. These grants are available in all academic disciplines except clinical medicine.

The purpose of the program is to open new channels of communication between academic and professional groups in the U.S. and India and to encourage a wider range of research activity between the two countries than currently exists. Scholars and professionals with limited or no prior experience in India are especially encouraged to apply.

Applicants must be U.S. citizens at the postdoctoral or equivalent level. The terms of the fellowships include $1500 per month, of which $350 per month is payable in dollars and the balance in rupees, and an allowance for books, study and travel in India, and international travel for the grantee. Longterm grantees receive additional allowances, including funds for dependents.

The program is sponsored by the Indo-U.S. Subcommission on Education and Culture and is funded by the United States Information Agency, the National Science Foundation, the Smithsonian Institution, and the Government of India. The application deadline is **June 15, 1990**. Application forms and further information are available from: Council for International Exchange of Scholars, Attn: Indo-American Fellowship Program, 3400 International Drive, Suite M-500, Washington, DC 20008-3097; telephone: 202-686-4013.

Mittag-Leffler Institute 1990-1991 Grants

The Mittag-Leffler Institute announces a number of grants for the year 1990-1991. The program of the institute starts on September 1 and ends on May 31. The grants are intended for recent Ph.D.'s or advanced graduate students and amount to 8.500 Swedish crowns per month, or 85.000 for those who attend for the duration of the program. Housing on the premises of the institute can be offered to some of the participants.

The subject for 1990-1991 is *Operator theory and complex analysis.*

Several aspects of the field will be treated, such as

- Hankel operators
- Toeplitz operator
- Model operator
- Paracommutators
- Wavelets
- Hilbert and other spaces of analytic functions
- Reproducing kernels
- Quantization
- Operator calculi
- Clifford analysis

The following experts in the field have already agreed to take part in the program for an extended period:

Milne Anderson, Jonathan Arazy, Sheldon Axler, Jacob Burbea, Lewin Coburn, Mischa Cotlar, Hans Feichtinger, Stephen Fisher, Karlheinz Gröchenig, Sergei Khruschchev, Dmitry Khavinson, Bernd Kirstein, Chun Li, Alan McIntosh, Gadadhar Misra, Nikolai Nikolskii, Thierry Paul, A. A. Pekarskii, V. V. Peller, Tao Qian, Richard Rochberg, Cora Sadosky, Richard Timoney, Dan Timotin, Harald Upmeier, Kehe Zhu.

The following Scandinavians also plan to stay at the institute during some period:

Björn Jawerth, Henrik Martens, Lassi Päivärinta, Peter Sjögren, Jan-Olov Strömberg.

Application forms can be obtained from the institute and should be returned to: The Board of the Mittag-Leffler Institute, Auravägen 17, S-182 62 Djursholm, Sweden, before **March 31, 1990**. Telephone (46) 80-755 1809.

Improving Research at Minority Institutions

The National Science Foundation sponsors a program to improve the research capabilities of academic institutions with substantial minority enrollments. Entitled Research Improvement at Minority Institutions, the program supports faculty research and student participation, research equipment acquisition, and cooperative research between industry and academia. The program is also designed to enhance the ability of historically black colleges and universities to participate in federally-sponsored programs.

For an institution to be eligible, more than 50% of its student body must be Black, Hispanic, American Indian, Alaskan Native, or Native Pacific Islander, or 20% of any one of these underrepresented minority groups. In addition, institutions must offer engineering programs or graduate programs in science.

In fiscal year 1990, there were two awards in the mathematical sciences, out of a total of fifteen awards (for brief descriptions of the projects, see *Notices*, January 1990, page 27). The deadline for proposals for the next round of awards is **March 1, 1990**.

For more information, contact Roosevelt Calbert, Program Director, Research Improvement at Minority Institutions, Division of Research Initiation and Improvement, National Science Foundation, 1800 G Street NW, Washington, DC 20550; telephone: 202-357-7350; electronic mail: rcalbert@nsf.

Manhattan, Kansas
Kansas State University
March 16–17

Program

The eight-hundred-and-fifty-fifth meeting of the American Mathematical Society will be held at Kansas State University in Manhattan, Kansas on Friday, March 16, and Saturday, March 17, 1990.

Invited Addresses

By invitation of the Central Section Program Committee, there will be four invited one-hour addresses. The speakers, their affiliations, the titles of their talks, and the scheduled times of presentation are:

J. BRIAN CONREY, Oklahoma State University, Stillwater, *Modular forms and the Riemann zeta-function*, 11:00 a.m. Friday.

STEWART B. PRIDDY, Northwestern University, *Representation theory and stable homotopy of finite groups*, 1:30 p.m. Friday.

JEAN-PIERRE ROSAY, University of Wisconsin, Madison, *Examples of Cauchy-Riemann structures*, 11:00 a.m. Saturday.

JANG-MEI WU, University of Illinois at Urbana-Champaign, *Harmonic measure and applications*, 1:30 p.m. Saturday.

Special Sessions

By invitation of the same committee, there will be eleven special sessions of selected twenty-minute papers. The topics, the names and affiliations of the organizers, and the speakers are as follows:

Harmonic analysis and probability theory, ANDREW G. BENNETT, Kansas State University. Nakhle Asmar, Rodrigo Bañuelos, William Beckner, Andrew G. Bennett, Eric A. Carlen, J.-A. Chao, Michael Cranston, Burgess Davis, Uwe Einmahl, Richard Holley, Pei Hsu, Roger L. Jones, Michael Lacey, Charles Moore, Carl Mueller, Joseph Rosenblatt, Kenneth A. Ross, Anton Thalmaier, and Gang Wang.

Orthostructures, DAVID J. FOULIS, University of Massachusetts at Amherst, and RICHARD J. GREECHIE, Kansas State University. Larry Cammack, Tae Ho Choe, Gary D. Crown, David J. Foulis, Andrew S. Golfin, Jr., Richard Greechie, Stanley Gudder, John R. Harding, Matthias P. Kläy, William David Miller, Robert Piziak, Gottfried T. Rüttimann, Christian Schindler, Gerald Schrag, Otmar Spinas, Alexander Wilce, and Matthew B. Younce.

Numerical analysis, KADOSA M. HALASI and QISU ZOU, Kansas State University. John H. Bolstad, Ching Lung Chang, Shiyi Chen, Thomas K. DeLillo, Donald Greenspan, Karl Gustafson, Yue-Kuen Kwok, Steve Pennell, Chi-Wang Shu, John Strikwerda, C. H. Su, Abdullah J. Tamraz, and Gretar Tryggvason.

Geometric function theory, DAVID H. HAMILTON, University of Maryland, College Park, and JOHN F. ROSSI, Virginia Polytech Institute and State University. Karl Barth, Tom Carroll, David Drasin, P. L. Duren, Gary G. Gundersen, David H. Hamilton, Juha Heinonen, David A. Herron, A. Hinkkanen, Dmitry Khavinson, Boris Korenblum, Y. J. Leung, John Lewis, Juan Manfredi, M. Jean McKemie, David Minda, Richard Rochberg, Daniel Shea, Li-Chien Shen, Wayne Smith, Susan G. Staples, David A. Stegenga, Kenneth Stephenson, Carl Sundberg, and Enrique Villamor.

Partial differential equations, LIGE LI, Kansas State University. Nicholas D. Alikakos, Robert Stephen Cantrell, Chris Cosner, Allan Edelson, Alan Elcrat, Robert Gardner, Jerome A. Goldstein, Karl Gustafson, Nela Lakoš, Anthony Leung, Chin-Yuan Lin, Roger Lui, Gisele Ruiz Rieder, Renate Schaaf, Andreas Stahel, Izumi Takagi, and Horst R. Thieme.

Commutative algebra, SATYAGOPOL MANDAL, University of Kansas. Ian M. Aberbach, Shreeram S. Abhyankar, D. D. Anderson, Sankar Prasad Dutta, Bernard Johnston, Jee Koh, Gennady Lyubeznik, Thomas Marley, T. T. Moh, M. P. Murthy, Budh Nashier, A. Prabhakar Rao, Christel Rotthaus, Avinash Sathaye, Hema Srinivasan, Bernd Ulrich, Jugal Verma, Dana T. Weston, Roger Wiegand, Sylvia Wiegand, and David Wright.

Inverse problems and scattering theory, ALEXANDER G. RAMM, Kansas State University. Carlos Berenstein, Y. M. Chen, Mikhail V. Klibanov, Joyce R. McLaughlin, Reese T. Prosser, A. G. Ramm, William Rundell, Paul E. Sacks, and Ziqi Sun.

Ergodic theory, JOSEPH M. ROSENBLATT, Ohio State University. Idris Assani, Alexandra Bellow, Vitaly Bergelson, Christopher Bose, R. E. Bradley, Dogan Comez, Alan Forrest, Roger L. Jones, I. Kornfeld, James H. Olsen, Karl Petersen, M. B. Rao, Karin Reinhold-Larsson, Daniel J. Rudolph, Laszlo I. Szabo, M. Wierdl, and Andrés del Junco.

Graph theory, RICHARD H. SCHELP, Memphis State University. Lowell W. Beineke, Gary Chartrand, Fan R. K. Chung, R. C. Entringer, Paul Erdös, R. J. Faudree, R. L. Graham, Kathryn F. Jones, J. Richard Lundgren, Bennet Manvel, Saul Stahl, L. A. Székely, W. T. Trotter, John Watkins, and Robin J. Wilson.

Groups and geometries, ERNEST E. SHULT, Kansas State University. Michael Aschbacher, Curtis Bennett, Hans Cuypers, Daniel Frohardt, George Glauberman, Jonathan I. Hall, Diane Herrmann, Chat Yin Ho, Norman L. Johnson, Peter M. Johnson, Spyros S. Magliveras, Geoffrey Mason, Ulrich Meierfrankenfeld, Stanley E. Payne, Stephen D. Smith, H. Voelklein, Richard Weiss, and Satoshi Yoshiara.

Applications of category theory, GEORGE E. STRECKER, Kansas State University. H. L. Bentley, Gabriele Castellini, Eraldo Giuli, Jurgen Koslowski, Harriet M. Lord, Saunders Mac Lane, Ernest G. Manes, Michael W. Mislove, L. D. Nel, Frank J. Oles, Robert Pare, Guenther E. Richter, Helmut Rohrl, Sergio Salbany, David A. Schmidt, Friedhelm Schwarz, Walter Tholen, and Sibylle Weck-Schwarz.

Abstracts for consideration for these sessions should have been submitted by the **November 21, 1989** deadline. This deadline was previously published in the Calendar of AMS Meetings and Conferences and in the Invited Speakers and Special Sessions section of the *Notices*.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Late papers will not be accommodated.

Registration

The registration desk will be located inside the main entrance to Cardwell Hall, and will be open from 8:00 a.m. to 5:00 p.m. on Friday, March 16, and on Saturday, March 17, from 8:00 a.m. to noon. The registration fees are $30 for members of the AMS, $45 for nonmembers, and $10 for students or unemployed mathematicians.

Petition Table

A petition table will be set up in the registration area. Additional information about petition tables can be found in a box in the Louisville meeting announcement in the October 1989 issue of *Notices*.

Accommodations

All accommodations have restaurants in or adjacent to them. Aggieville, on the edge of the campus, offers a wide variety of fast food and full service restaurants. On campus the K-State Union Stateroom will be open for breakfast and lunch. Information on area restaurants will be included in a welcome packet available at the meeting registration desk. The AMS is not responsible for rate changes or accommodations offered by hotels/motels.

All Seasons Motel
1501 Tuttle Creek Bld, Manhattan, KS 66506
Telephone: 913-539-5391

Single $35.44 Double $39.87

Continental Inn
100 Bluemont Ave., Manhattan, KS 66506
Telephone: 913 776-4771

1 person/1 bed $35.28 1 person/2 beds $37.38
2 persons/1 bed $39.68 2 persons/2 beds $44.10

Holiday Inn/Holidome
530 Richards Drive, Manhattan, KS 66506
Telephone: 913-539-5311

Single $64.24 Poolside Single/Double $70.88

Motel 6
510 Tuttle Creek, Manhattan, KS 66506
Telephone: 913-537-1022

Single $21.95 Double $28.61

University Inn
17th & Anderson Avenue, Manhattan, KS 66506
Telephone: 913-539-7531

Single $38 Double $44
These are special rates offered to participants.

Super 8
200 Tuttle Creek, Manhattan, KS 66506
Telephone: 913-527-8468

1 person/1 bed $31.26 2 persons/1 bed $35.59
2 persons/2 beds $37.76

Travel

Kansas State University is located in Manhattan, eight miles north of Interstate 70, and one-hundred-and-thirty miles west of Kansas City. Flights are available to Kansas City International Airport in Kansas City, Missouri, on several major airlines with connections to the Manhattan Municipal Airport. Airport shuttle service is available to the campus at reasonable rates.

If traveling by car, participants should take Interstate 435 (south) and follow Interstate 70 (west) to State Highway 177 into Manhattan.

Parking

Parking is available on campus. A parking fee of $2 will be charged on Friday, March 16.

Weather

A wide range of weather is possible in Kansas in March. Participants are advised to note regional forecasts near the time of the meeting.

Kansas State University Campus Map

Parking — P

Cardwell Hall (29)

Program of the Sessions

The time limit for each contributed paper in the sessions is ten minutes. In the special sessions, the time limit varies from session to session and within sessions. To maintain the schedule, time limits will be strictly enforced.

Abstracts of papers presented in the sessions at this meeting will be found in the March 1990 issue of *Abstracts of papers presented to the American Mathematical Society*, ordered according to the numbers in parentheses following the listings below.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Friday, March 16

Special Session on Geometric Function Theory, I

8:30 a.m.–10:50 a.m. Room 144, Cardwell Hall

8:30 a.m. (1) *The maximum modulus and characteristic.*
David Drasin, Purdue University, West Lafayette (855-30-200)

9:00 a.m. (2) *Estimates for sets where a meromorphic function is large.*
Matts Essen, Uppsala Universirt, Sweden, **John Rossi**, Virginia Polytechnic Institute and State University, and **Daniel Shea***, University of Wisconsin, Madison (855-30-193)

9:30 a.m. (3) *An application of the spread relation to algebraic differential equations.*
Gary G. Gundersen, University of New Orleans (855-34-138)

10:00 a.m. (4) *On an L^2 inequality involving entire functions of exponential type.*
Li-Chien Shen, University of Florida (855-30-137) (Sponsored by Kermit N. Sigmon)

10:30 a.m. (5) *Stochastic Loewner equation.* Preliminary report.
David Rochberg and **Richard Rochberg***, Washington University (855-30-139)

Special Session on Inverse Problems and Scattering Theory, I

8:30 a.m.–10:50 a.m. Room 143, Cardwell Hall

8:30 a.m. (6) *Efficient numerical methods for solving inverse problems of PDE.*
Y. M. Chen, State University of New York, Stony Brook (855-65-02) (Sponsored by Ram P. Srivastav)

9:20 a.m. (7) *Recovery of coefficients in first order hyperbolic equations.*
Michael Pilant and **William Rundell***, Texas A & M University, College Station (855-35-73)

10:10 a.m. (8) *An iterative method for one-dimensional second order inverse spectral problems.* Preliminary report.
William Rundell, Texas A & M University, College Station, and **Paul E. Sacks***, Iowa State University (855-35-72)

Special Session on Harmonic Analysis and Probability Theory, I

9:00 a.m.–10:50 a.m. Room 131, Cardwell Hall

9:00 a.m. (9) *Martingale transforms and paraproducts.*
J.-A. Chao*, Cleveland State University, and **R.-L. Long**, Academia Sinica, People's Republic of China (855-60-51)

9:30 a.m. (10) *Conformal geometry, Sobolev inequalities and symmetrization.* Preliminary report.
William Beckner, University of Texas, Austin (855-42-69)

10:00 a.m. (11) *Fractional integration on tail σ-fields.*
Andrew G. Bennett, Kansas State University (855-60-109)

10:30 a.m. (12) *Superadditivity of Fisher's information and logarithmic Sobolev inequalities.*
Eric A. Carlen, Princeton University (855-62-170)

Special Session on Orthostructures, I

9:00 a.m.–10:50 a.m. Room 121, Cardwell Hall

9:00 a.m. (13) *Sheaf representation theorem for Baer and Rickart rings.*
Douglas G. Burkholder and **Gary D. Crown***, Wichita State University (855-16-161)

9:30 a.m. (14) *Graph theoretic properties in the context of orthomodular theory.* Preliminary report.
Gerald Schrag* and **Larry Cammack**, Central Missouri State University (855-06-185)

10:00 a.m. (15) *On states and generalized state spaces of the generalizations of the Greechie lattice.* Preliminary report.
Larry Cammack* and **Gerald Schrag**, Central Missouri State University (855-06-187)

Friday, March 16 (cont'd)

10:30 a.m. (16) *Computational systems for research on orthostructures.* Preliminary report.
William David Miller, Oklahoma State University, Stillwater (855-68-196)

Special Session on Partial Differential Equations, I

9:00 a.m.–10:50 a.m. Room 129, Cardwell Hall

9:00 a.m. (17) *Least-energy solutions to a semilinear Neumann problem related to biological pattern formation.*
Izumi Takagi, Tohoku University, Japan (855-35-188)

9:30 a.m. (18) *Spatially degenerate nonlinear diffusion with drift and the Wentzel boundary condition.* Preliminary report.
Jerome A. Goldstein*, Tulane University, and **Chin-Yuan Lin**, Texas A & M University, College Station (855-35-118)

10:00 a.m. (19) *Stability and Hopf bifurcation of solutions of the Dirichlet problem for diffusive predator-prey systems.* Preliminary report.
Robert Gardner, University of Massachusetts, Amherst (855-35-43)

10:30 a.m. (20) *A quasilinear parabolic problem in one space dimension.*
J. R. Dorroh and **Gisele Ruiz Rieder***, Louisiana State University, Baton Rouge (855-35-191)

Special Session on Commutative Algebra, I

9:00 a.m.–10:50 a.m. Room 102, Cardwell Hall

9:00 a.m. (21) *Galois theory on the line.*
Shreeram S. Abhyankar, Purdue University, West Lafayette (855-14-07)

9:30 a.m. (22) *Finite generation of monoids of fractional ideals.* Preliminary report.
D. D. Anderson, University of Iowa (855-13-12)

10:00 a.m. (23) *Intersection multiplicity of modules.*
Sankar Prasad Dutta, University of Illinois, Urbana-Champaign (855-13-146)

10:30 a.m. (24) *Finite phantom projective dimension.* Preliminary report.
Ian M. Aberbach, University of Michigan, Ann Arbor (855-13-95)

Special Session on Ergodic Theory, I

9:00 a.m.–10:50 a.m. Room 130, Cardwell Hall

9:00 a.m. (25) *Ergodic theorems for subsequences and moving averages.* Preliminary report.
Roger L. Jones, DePaul University (855-42-74)

9:30 a.m. (26) *A maximal inequality and its consequences in ergodic theory.*
J. Rosenblatt and **M. Wierdl***, Ohio State University, Columbus (855-28-179)

10:00 a.m. (27) *On induced operators.*
R. E. Bradley, Northwestern University (855-28-37)

10:30 a.m. (28) *Failure of the Wiener-Wintner property for the helical transform in L^1.* Preliminary report.
Idris Assani, University of North Carolina, Chapel Hill (855-28-39)

Special Session on Graph Theory, I

9:00 a.m.–10:50 a.m. Room 146, Cardwell Hall

9:00 a.m. (29) *Coloring tournaments.*
Kunwarjit S. Bagga, Ball State University, **Lowell W. Beineke***, Indiana University-Purdue University, Ft. Wayne, and **Frank Harary**, New Mexico State University, Las Cruces (855-05-114)

9:30 a.m. (30) *A combinatorial approach to the integral multicommodity flow problem with application to the packed routing.* Preliminary report.
F. Shahrokhi, North Texas University, and **L. A. Székely***, University of New Mexico (855-05-48)
(Sponsored by Richard H. Schelp)

10:00 a.m. (31) *k-graphs with uniformly distributed subgraphs.* Preliminary report.
F. R. K. Chung, Bell Communications Research, Morristown, NJ, and **R. L. Graham***, AT&T Bell Laboratories, Murray Hill, New Jersey (855-05-87)

10:30 a.m. (32) *Quasi-random classes of hypergraphs.*
Fan R. K. Chung, Bellcore, Morristown, New Jersey (855-05-113)

Special Session on Groups and Geometries, I

9:00 a.m.–10:50 a.m. Room 145, Cardwell Hall

9:00 a.m. (33) *Extending morphisms of groups and graphs.*
Michael Aschbacher*, California Institute of Technology, and **Yoav Segev**, Ben Gurion University, Israel (855-20-152)

9:30 a.m. (34) *A Cayley integer approach to the Leech lattice.* Preliminary report.
George Glauberman, University of Chicago (855-20-49)

10:00 a.m. (35) *Applications of algebraic curves to the representation theory of SL_2.* Preliminary report.
Geoffrey Mason, University of California, Santa Cruz (855-20-18)

10:30 a.m. (36) *Sharply transitive linear groups over algebraically closed fields.*
G. Cherlin, Rutgers University, New Brunswick, **T. Grundhöfer**, University Tübingen, Federal Republic of Germany, **A. Nesin**, University of California, Irvine, and **H. Voelklein***, University of Florida (855-20-40)

Special Session on Applications of Category Theory, I

9:00 a.m.–10:50 a.m. Room 103, Cardwell Hall

9:00 a.m. *Category-sorted algebra and its applications.*
(37) **David A. Schmidt**, Kansas State University (855-18-96) (Sponsored by George E. Strecker)

9:30 a.m. *Compact pairs and generalized perfect maps.*
(38) **Eraldo Giuli**, Università degli Studi di L'Aquila, Italy (855-18-31) (Sponsored by George E. Strecker)

10:00 a.m. *Groups of dualities.* Preliminary report.
(39) **Georgi D. Dimov**, Bulgarian Academy of Sciences, Bulgaria, and **Walter Tholen***, York University (855-18-29)

10:30 a.m. *Internal description of hulls.*
(40) **Friedhelm Schwarz** and **Sibylle Weck-Schwarz***, University of Toledo (855-18-86)

Session on Algebra

9:00 a.m.–10:30 a.m. Room 120, Cardwell Hall

9:00 a.m. *Rings of integer-valued polynomials over semi-local PID's.*
(41) **Jim Brewer*** and **Lee Klingler**, Florida Atlantic University (855-13-52)

9:20 a.m. *The Picard group for the commutative ring theorist.*
(42) Preliminary report.
F. W. Call*, University of Michigan, Ann Arbor, and **R. Heitmann**, University of Texas, Austin (855-13-24)

9:40 a.m. *Gröbner bases and automorphisms of polynomial ring.*
(43) Preliminary report.
Wei Li, Purdue University, West Lafayette (855-13-08)

10:00 a.m. *Infinitesimal extensions of glued varieties.*
(44) **Khomo T. S. Mohapeloa**, Pennsylvania State University, McKeesport, PA (855-14-183)

10:20 a.m. *On an extremal problem in the Bloch space.*
(45) **Flavia Colonna**, George Mason University (855-30-89)

Invited Address

11:00 a.m.– noon Room 101, Cardwell Hall

(46) *Modular forms and the Riemann zeta-function.*
J. Brian Conrey, Oklahoma State University (855-11-173)

Invited Address

1:30 p.m.–2:30 p.m. Room 101, Cardwell Hall

(47) *Representation theory and stable homotopy of finite groups.*
Stewart B. Priddy, Northwestern University (855-55-184)

Special Session on Harmonic Analysis and Probability Theory, II

3:00 p.m.–5:50 p.m. Room 131, Cardwell Hall

3:00 p.m. *Intrinsic ultracontractivity and eigenfuction estimates for the Schrodinger operators.* Preliminary report.
(48) **Rodrigo Bañuelos**, Purdue University, West Lafayette (855-31-36)

3:30 p.m. *Distribution function inequalities for the density of the area integral.*
(49) **Rodrigo Bañuelos** and **Charles Moore***, Purdue University, West Lafayette (855-31-141)

4:00 p.m. *On the almost sure behavior of sums of iid random variables in Hilbert space.*
(50) **Uwe Einmahl**, Indiana University, Bloomington (855-60-68) (Sponsored by James D. Kuelbs)

4:30 p.m. *On weak convergence in dynamical systems to self-similar processes.*
(51) **Michael Lacey**, Indiana University, Bloomington (855-60-54)

5:00 p.m. *Ergodic averages on spheres.* Preliminary report.
(52) **Roger L. Jones**, DePaul University (855-42-70)

5:30 p.m. *Almost everywhere convergence of convolution powers.*
(53) **A. Bellow**, Northwestern University, **R. Jones**, DePaul University, and **Joseph Rosenblatt***, Ohio State University, Columbus (855-60-157)

Special Session on Orthostructures, II

3:00 p.m.–5:20 p.m. Room 121, Cardwell Hall

3:00 p.m. *Filters in orthoalgebras and their relationship to supports in test spaces.*
(54) **Andrew S. Golfin, Jr.**, Gettysburg College (855-06-163)

3:30 p.m. *Coupled entities.* Preliminary report.
(55) **David J. Foulis**, University of Massachusetts, Amherst (855-81-162)

4:00 p.m. *Refinement and unique Mackey decomposition for manuals and orthoalgebras.*
(56) **Matthew B. Younce**, Rhode Island College (855-06-56)

4:30 p.m. *σ-manuals.* Preliminary report.
(57) **Alexander Wilce**, University of New Hampshire (855-06-160)

5:00 p.m. *Convergence of observables on quantum logics.*
(58) **Stanley Gudder**, University of Denver (855-06-03)

Friday, March 16 (cont'd)

Special Session on Numerical Analysis, I

3:00 p.m.–5:20 p.m. Room 122, Cardwell Hall

3:00 p.m. (59) *Vortex dynamics of hovering mode.* Preliminary report.
Karl Gustafson, University of Colorado, Boulder (855-65-05) (Sponsored by Albert T. Lundell)

3:30 p.m. (60) *Quasimolecular fluid modeling.*
Donald Greenspan, University of Texas, Arlington (855-65-78)

4:00 p.m. (61) *Lyapunov-Schmidt reduction for the crossing of two neutral curves in Taylor-Couette flow.*
John H. Bolstad*, University of California, Livermore, and **Michael E. Henderson**, IBM T. J. Watson Research Center, Yorktown Heights, New York (855-65-77)

4:30 p.m. (62) *Bifurcation of periodic solutions of singularly perturbed delay differential equation.*
Abdullah J. Tamraz, Wichita State University (855-65-128)

5:00 p.m. (63) *Numerical computation of water waves in a potential flow.*
C. H. Su, Brown University (855-65-76) (Sponsored by Qisu Zou)

Special Session on Geometric Function Theory, II

3:00 p.m.–6:20 p.m. Room 144, Cardwell Hall

3:00 p.m. (64) *On some almost everywhere overdetermined boundary value problems.*
John Lewis* and **Andrew Vogel**, University of Kentucky (855-31-22)

3:30 p.m. (65) *Note on A_∞ and level sets of conformal mappings.* Preliminary report.
Juha Heinonen, University of Michigan, Ann Arbor (855-30-102)

4:00 p.m. (66) *The Dirichlet problem for the ∞-Laplacian.* Preliminary report.
Tilak Bhattacharya, **Emanuelle DiBenedetto**, Northwestern University, and **Juan Manfredi***, University of Pittsburgh, Pittsburgh (855-35-116)

4:30 p.m. (67) *Composition operators and angular derivatives.*
Tom Carroll, Purdue University, West Lafayette (855-30-140) (Sponsored by John F. Rossi)

5:00 p.m. (68) *Discrete quasiconformal groups with small dilatation.*
M. Jean McKemie, St. Edward's University (855-30-94)

5:30 p.m. (69) *Boundary values for some classes of functions.* Preliminary report.
Enrique Villamor, Florida International University (855-30-115)

6:00 p.m. (70) *Generalised conformal welding.*
David H. Hamilton, University of Maryland, College Park (855-30-57) (Sponsored by John F. Rossi)

Special Session on Partial Differential Equations, II

3:00 p.m.–5:50 p.m. Room 129, Cardwell Hall

3:00 p.m. (71) *A Riemann-Lebesque lemma for mathematical ecology.*
Robert Stephen Cantrell* and **Chris Cosner**, University of Miami (855-35-125)

3:30 p.m. (72) *Positive solutions of systems of nonlinear eigenvalue problems.*
Nela Lakoš, Ohio State University, Columbus (855-35-182)

4:00 p.m. (73) *Minimal solutions of superlinear equations.*
Allan Edelson, University of California, Davis (855-35-194)

4:30 p.m. (74) *Semilinear elliptic problems at resonance – some space dimension dependent results.*
Renate Schaaf* and **Klaus Schmitt**, University of Utah (855-35-100) (Sponsored by Klaus Schmitt)

5:00 p.m. (75) *Towards a theory for quasilinear PDEs in structured population dynamics.* Preliminary report.
Horst R. Thieme, Arizona State University (855-35-199)

5:30 p.m. (76) *Rearrangements and vorticity.*
Alan Elcrat* and **Kenneth Miller**, Wichita State University (855-34-84)

Special Session on Commutative Algebra, II

3:00 p.m.–5:50 p.m. Room 102, Cardwell Hall

3:00 p.m. (77) *Curve singularities of finite Cohen-Macaulay type.*
Roger Wiegand, University of Nebraska, Lincoln (855-13-197)

3:30 p.m. (78) *Local cohomology of Rees algebras and Hilbert functions.* Preliminary report.
Bernard Johnston* and **Jugal Verma**, Louisiana State University, Baton Rouge (855-13-144)

4:00 p.m. (79) *Modules with linear syzygies.* Preliminary report.
David Eisenbud, Brandeis University, and **Jee Koh***, Indiana University, Bloomington (855-13-143)

4:30 p.m. (80) *Étale cohomology and the topology of algebraic varieties.*
Gennady Lyubeznik, University of Chicago (855-14-142)

5:00 p.m. (81) *Unmixed local rings of type two are Cohen-Macaulay.*
Thomas Marley, University of Nebraska, Lincoln (855-13-176)

5:30 p.m. (82) *Canonical resolution of hypersurface singularities of characteristic zero.*
T. T. Moh, Purdue University, West Lafayette (855-13-177)

Special Session on Inverse Problems and Scattering Theory, II

3:00 p.m.–5:30 p.m. Room 143, Cardwell Hall

3:00 p.m. (83) *Inverse scattering at fixed energy in three dimensions.* **A. G. Ramm**, University of Kansas (855-35-27)

3:55 p.m. (84) *Two inverse problems for partial differential equations.* **Mikhail V. Klibanov**, Courant Institute of Mathematical Sciences, New York University (855-35-63) (Sponsored by Rakesh)

4:50 p.m. (85) *Clifford Tori and overdetermined problems.* Preliminary report. **Carlos Berenstein*** and **Max Karlovitz**, University of Maryland, College Park (855-35-60)

Special Session on Ergodic Theory, II

3:00 p.m.–5:20 p.m. Room 130, Cardwell Hall

3:00 p.m. (86) *Cayley graphs and recurrence in dynamical systems.* **Alan Forrest**, Ohio State University, Columbus (855-28-38)

3:30 p.m. (87) *Some remarks on the convergence of weighted ergodic averages.* Preliminary report. **I. Kornfeld**, North Dakota State University (855-28-149) (Sponsored by Dogan Comez)

4:00 p.m. (88) *Random sampling of stationary processes.* **Karl Petersen**, University of North Carolina, Chapel Hill (855-28-62)

4:30 p.m. (89) *On almost everywhere convergence of convolution powers in $L^1(X)$.* Preliminary report. **Karin Reinhold-Larsson**, Ohio State University, Columbus (855-28-148)

5:00 p.m. (90) *Two applications of a theorem on invariant measures for multiplication.* **Daniel J. Rudolph**, University of Maryland, College Park (855-28-181)

Special Session on Graph Theory, II

3:00 p.m.–5:20 p.m. Room 146, Cardwell Hall

3:00 p.m. (91) *Unavoidable subgraphs of sparse graphs: Lagniappe.* **C. A. Barefoot**, **L. H. Clark**, **R. C. Entringer***, **A. A. Kooshesh** and **L. A. Székely**, University of New Mexico (855-05-75)

3:30 p.m. (92) *Homomorphisms with the lifting property.* **Bennet Manvel*** and **Richard Osborne**, Colorado State University (855-05-93) (Sponsored by Richard H. Schelp)

4:00 p.m. (93) *A prime number theorem for normed graphs.* Preliminary report. **Robin J. Wilson**, Open University, England (855-05-112) (Sponsored by Richard H. Schelp)

4:30 p.m. (94) *Size and independence in triangle-free graphs with fixed maximum degree.* Preliminary report. **Kathryn F. Jones**, University of Colorado (855-05-88)

5:00 p.m. (95) *An upper bound for the average number of regions.* Preliminary report. **Saul Stahl**, University of Kansas (855-05-21)

Special Session on Groups and Geometries, II

3:00 p.m.–4:50 p.m. Room 145, Cardwell Hall

3:00 p.m. (96) *High-weight modules for quotients of affine buildings.* **Stephen D. Smith**, University of Illinois, Chicago (855-20-11)

3:30 p.m. (97) *$Ru \leq E_7(5)$.* **Ulrich Meierfrankenfeld**, Michigan State University (855-20-159) (Sponsored by Jonathan I. Hall)

4:00 p.m. (98) *Groups generated by 3-transpositions.* Preliminary report. **Jonathan I. Hall**, Michigan State University (855-20-107)

4:30 p.m. Informal Discussion

Special Session on Applications of Category Theory, II

3:00 p.m.–5:20 p.m. Room 103, Cardwell Hall

3:00 p.m. (99) *Categorical foundations and set theory.* **Saunders Mac Lane**, University of Chicago (855-18-15)

3:30 p.m. (100) *Does anybody really know what a Hopf algebra is?* Preliminary report. **Robert Pare**, Dalhousie University (855-18-42) (Sponsored by Keith P. Johnson)

4:00 p.m. (101) *Metatheory of Boolean categories.* Preliminary report. **Ernest G. Manes**, University of Massachusetts, Amherst (855-18-35) (Sponsored by Frank A. Wattenberg)

4:30 p.m. (102) *Weak adjunctions between categories of CPO's.* Preliminary report. **Michael W. Mislove**, Tulane University, and **Frank J. Oles***, University of Pennsylvania and IBM T. J. Watson Research Center, Yorktown Heights, New York (855-68-127)

5:00 p.m. (103) *Completions of continuous posets and modules of concurrency.* **Michael W. Mislove**, Tulane University (855-68-192)

General Session

3:00 p.m.–4:30 p.m. Room 120, Cardwell Hall

3:00 p.m. (104) *The value of certain determinants with elements zero and one.* Preliminary report. **Dale Woods*** and **D. J. Boyce**, Central State University (855-15-136)

3:20 p.m. (105) *Total cosine of normal matrices.* Preliminary report. **Morteza Seddighin**, Panhandle State University (855-15-147) (Sponsored by Andy R. Magid)

Friday, March 16 (cont'd)

3:40 p.m. (106) *Expansions of chromatic polynomials and log-concavity.*
Francesco Brenti, University of Michigan, Ann Arbor (855-05-41)

4:00 p.m. (107) *An inverse convolution method for regular parabolic equations.*
B. A. Mair*, University of Florida, **D. S. Gilliam** and **C. F. Martin**, Texas Tech University (855-35-45)

4:20 p.m. (108) *Badug tablet.*
Myungkark Park, Prompter Publications, Cincinnati, Ohio (855-11-201)

Saturday, March 17

Special Session on Geometric Function Theory, III

8:00 a.m.–10:50 a.m. Room 144, Cardwell Hall

8:00 a.m. (109) *A maximum principle for the Bergman space.*
Boris Korenblum, State University of New York, Albany (855-30-04)

8:30 a.m. (110) *Maximal functions, A_∞-measures and quasiconformal maps.*
Susan G. Staples, University of Texas, Austin (855-30-104)

9:00 a.m. (111) *The quasihyperbolic metric is exponentially integrable on Hölder domains in R^n.* Preliminary report.
Wayne Smith, University of Washington, and **David A. Stegenga***, University of Hawaii, Honolulu (855-30-110)

9:30 a.m. (112) *The boundary distributions of analytic functions on the disc.*
Carl Sundberg, University of Tennessee, Knoxville (855-30-135)

10:00 a.m. (113) *The BMOA-distance of a function from VMOA.* Preliminary report.
David Stegenga, University of Hawaii, Manoa, and **Kenneth Stephenson***, University of Tennessee, Knoxville (855-30-134)

10:30 a.m. (114) *The Cauchy integral operator and the eigenvalue problem for the Laplacian.*
Dmitry Khavinson*, University of Arkansas, Fayetteville, **J. M. Anderson**, University College, England, and **Victor Lomonosov**, Moscow, USSR (855-30-10)

Special Session on Partial Differential Equations, III

8:00 a.m.–10:20 a.m. Room 129, Cardwell Hall

8:00 a.m. (115) *Fully nonlinear parabolic boundary value problems in higher space dimensions, II.*
Chin-Yuan Lin, Texas A & M University, College Station (855-35-53)

8:30 a.m. (116) *Bifurcation turning points in combustion equations.* Preliminary report.
Karl Gustafson, University of Colorado, Boulder (855-35-06) (Sponsored by Albert T. Lundell)

9:00 a.m. (117) *Optimal control for elliptic Volterra-Lotka type equations.*
Anthony Leung* and **Srdjan Stojanovic**, University of Cincinnati (855-35-154)

9:30 a.m. (118) *Reaction-diffusion models and elliptic eigenvalue problems.* Preliminary report.
Chris Cosner, University of Miami (855-35-155)

10:00 a.m. (119) *The wave equation with nonlinear boundary conditions.*
Irena Lasiecka, University of Virginia, and **Andreas Stahel***, University of Utah (855-35-153)

Special Session on Graph Theory, III

8:00 a.m.–10:50 a.m. Room 146, Cardwell Hall

8:00 a.m. (120) *Edge-graceful cubic graphs.*
John Watkins, Colorado College (855-05-91)

8:30 a.m. (121) *Ramsey problems and their relation to Turan type extremal problems.*
R. J. Faudree*, Memphis State University, and **M. Simonovits**, Hungarian Academy of Sciences, Hungary (855-05-111)

9:00 a.m. (122) *On peripheral vertices in graphs.*
Gary Chartrand*, Western Michigan University, **Garry Johns**, Saginaw Valley State University, and **Ortrud R. Oellermann**, University of Natal, South Africa (855-05-92)

9:30 a.m. (123) *Some unconventional games on graphs.* Preliminary report.
Paul Erdös, Hungarian Academy of Sciences, Hungary (855-05-65)

10:00 a.m. (124) *Minimum Boolean factorization of tournament codes.*
Greg Bain, **J. Richard Lundgren***, University of Colorado, Denver, and **John S. Maybee**, University of Colorado, Boulder (855-05-71)

10:30 a.m. (125) *The dimension of a random partial order of height one.*
W. T. Trotter*, **H. Kierstead**, Arizona State University, and **P. Erdös**, Hungarian Academy of Sciences, Hungary (855-05-101)

Special Session on Groups and Geometries, III

8:00 a.m.–10:50 a.m. Room 145, Cardwell Hall

8:00 a.m. (126) *Affine Λ-buildings.*
Curtis Bennett, University of Chicago (855-51-66)

8:30 a.m. (127) *Extended generalized polygons.*
Richard Weiss, Tufts University (855-20-13)

9:00 a.m. (128) *The embeddings of flag-transitive classical locally polar geometries of rank* 3.
Satoshi Yoshiara, Tufts University (855-51-34)

9:30 a.m. (129) *Embeddings of polar spaces.* Preliminary report.
Peter M. Johnson, Wayne State University (855-51-172)

10:00 a.m. (130) *Locally polar spaces with affine planes.* Preliminary report.
Hans Cuypers*, Michigan State University, and **Antonio Pasini**, University of Naples, Italy (855-51-106) (Sponsored by Jonathan I. Hall)

10:30 a.m. (131) *Totally irregular collineation groups.* Preliminary report.
Chat Yin Ho, University of Florida (855-20-23) (Sponsored by Ernest E. Shult)

Special Session on Commutative Algebra, III

8:30 a.m.–10:50 a.m. Room 102, Cardwell Hall

8:30 a.m. (132) *Strongly regular ring.*
Budh Nashier, Florida State University (855-13-122)

9:00 a.m. (133) *Conormal bundle of determinantal curves.*
A. Prabhakar Rao, University of Missouri, St. Louis (855-14-178)

9:30 a.m. (134) *Rings with low dimensional formal fibres.* Preliminary report.
Christel Rotthaus, Michigan State University (855-13-16)

10:00 a.m. (135) *Space curves as complete intersection.* Preliminary report.
Avinash Sathaye* and **Jon Stenerson**, University of Kentucky (855-14-195)

10:30 a.m. (136) *Zero cycles and the number of generators of modules.*
M. P. Murthy, University of Chicago (855-13-123)

Special Session on Inverse Problems and Scattering Theory, III

8:30 a.m.–10:50 a.m. Room 143, Cardwell Hall

8:30 a.m. (137) *Inversion of the backscatter data in the 3D potential scattering problem.*
Reese T. Prosser, Dartmouth College (855-81-156)

9:20 a.m. (138) *Inverse spectral theory in one and two dimensions.*
Roger Knobel and **Joyce R. McLaughlin***, Rensselaer Polytechnic Institute (855-34-174)

10:10 a.m. (139) *On an inverse boundary value problem in two dimensions.*
Ziqi Sun, University of Washington (855-35-01)

Special Session on Harmonic Analysis and Probability Theory, III

9:00 a.m.–10:50 a.m. Room 131, Cardwell Hall

9:00 a.m. (140) *Another lacunarity property for Fourier series.*
Kenneth A. Ross, University of Oregon (855-43-55)

9:30 a.m. (141) *A homomorphism theorem for maximal multiplier transforms.*
Nakhle' Asmar*, University of Missouri, Columbia, **Earl Berkson**, University of Illinois, Urbana-Champaign, and **T. Alastair Gillespie**, University of Edinburgh, Scotland (855-43-17)

10:00 a.m. (142) *Theta function of a Riemannian manifold with boundary.* Preliminary report.
Pei Hsu, Northwestern University (855-58-64) (Sponsored by Andrew G. Bennett)

10:30 a.m. (143) *The angular part of Brownian motion on negatively curved Riemannian manifolds.* Preliminary report.
Anton Thalmaier, University of Texas, Austin (855-60-99)

Special Session on Orthostructures, III

9:00 a.m.–10:50 a.m. Room 121, Cardwell Hall

9:00 a.m. (144) *Constructible hypergraphs.*
Christian Schindler, University of Denver (855-05-186)

9:30 a.m. (145) *Generalized measure theory on orthostructures.*
Gottfried T. Rüttimann, University of Bern, Switzerland (855-28-167)

10:00 a.m. (146) *An undecidability result in lattice theory.*
Otmar Spinas, Mathematisches Institut Universität Zürich, Switzerland (855-06-169) (Sponsored by David J. Foulis)

10:30 a.m. (147) *Maximum likelihood estimation on quasimanuals.*
Matthias P. Kläy*, Sandoz AG, Switzerland, and **David J. Foulis**, University of Massachusetts, Amherst (855-60-165)

Special Session on Numerical Analysis, II

9:00 a.m.–10:50 a.m. Room 122, Cardwell Hall

9:00 a.m. (148) *Series expansions for solitary waves.*
Steve Pennell, University of Lowell (855-65-79)

9:30 a.m. (149) *Simulations of incompressible flows containing interfaces using front tracking methods.*
Gretar Tryggvason*, **Ozen Unverdi** and **Kahled Sbeih**, University of Michigan, Ann Arbor (855-65-82) (Sponsored by Qisu Zou)

Saturday, March 17 (cont'd)

10:00 a.m. (150) *A second-order accurate scheme for the incompressible Navier-Stokes equations.* **John Strikwerda**, University of Wisconsin, Madison (855-65-80)

10:30 a.m. (151) *A new class of nonoscillatory discontinuous Galerkin finite element methods for conservation laws in multidimensions.* **Bernardo Cockburn**, **Suchung Hou**, University of Minnesota, Minneapolis, and **Chi-Wang Shu***, Brown University (855-65-81)

Special Session on Ergodic Theory, III

9:00 a.m.–10:50 a.m. Room 130, Cardwell Hall

9:00 a.m. (152) *On the converse of the dominated ergodic theorem.* **Laszlo I. Szabo**, Ohio State University, Columbus (855-28-97) (Sponsored by Joseph M. Rosenblatt)

9:30 a.m. (153) *Measures with prescribed marginals, extreme points and measure preserving transformations.* Preliminary report. **M. B. Rao***, North Dakota State University, and **K. Subramanyam**, University of North Carolina, Wilmington (855-28-151) (Sponsored by Dogan Comez)

10:00 a.m. (154) *Almost everywhere divergence and the "strong sweeping out property".* **Alexandra Bellow**, Northwestern University (855-28-105)

10:30 a.m. (155) *Weak sequential compactness and a. e. convergence of Cesaro averages.* Preliminary report. **Dogan Comez**, North Dakota State University (855-47-150)

Special Session on Applications of Category Theory, III

9:00 a.m.–10:50 a.m. Room 103, Cardwell Hall

9:00 a.m. (156) *Topological Eilenberg-Moore algebras.* **Sergio Salbany***, University of Zimbabwe, Zimbabwe, and **D. Pumplün**, Fern Universität Hagen, Federal Republic of Germany (855-18-28) (Sponsored by George E. Strecker)

9:30 a.m. (157) *Regular closure operators and compactness.* **Gabriele Castellini**, University of Puerto Rico, Mayagüez (855-18-19)

10:00 a.m. (158) *Appropriate domains for infinite dimensional calculus.* Preliminary report. **L. D. Nel**, Carleton University (855-58-30)

10:30 a.m. (159) *Special objects in the category of Γ-convex spaces.* Preliminary report. **Helmut Rohrl**, La Jolla, California (855-18-20)

Invited Address

11:00 a.m.–noon Room 101, Cardwell Hall

(160) *Examples of Cauchy-Riemann structures.* **Jean-Pierre Rosay**, University of Wisconsin, Madison (855-32-202)

Invited Address

1:30 p.m.–2:30 p.m. Room 101, Cardwell Hall

(161) *Harmonic measure and applications.* **Jang-Mei Wu**, University of Illinois, Urbana-Champaign (855-30-90)

Special Session on Harmonic Analysis and Probability Theory, IV

3:00 p.m.–5:20 p.m. Room 131, Cardwell Hall

3:00 p.m. (162) *Nonexplosion of a stochastic partial differential equation.* Preliminary report. **Carl Mueller**, University of Rochester (855-60-189)

3:30 p.m. (163) *Gradient estimates using coupling.* **Michael Cranston**, University of Rochester (855-60-108)

4:00 p.m. (164) *Exponentially fast uniform convergence in one dimensinal stochastic Ising models.* **Richard Holley***, University of Colorado, Boulder, and **Dan Stroock**, Massachusetts Institute of Technology (855-60-44)

4:30 p.m. (165) *Lifetime distribution of h processes.* **Burgess Davis**, Purdue University, West Lafayette (855-60-67)

5:00 p.m. (166) *Sharp square-function inequalities for conditionally symmetric martingales.* **Gang Wang**, Purdue University, West Lafayette (855-60-09)

Special Session on Orthostructures, IV

3:00 p.m.–4:50 p.m. Room 121, Cardwell Hall

3:00 p.m. (167) *Profinite orthomodular lattices.* **Tae Ho Choe***, McMaster University, and **Richard J. Greechie**, Kansas State University (855-06-50)

3:30 p.m. (168) *Blocks and commutators in orthomodular lattices.* **Günter Bruns**, McMaster University, and **Richard Greechie***, Kansas State University (855-06-164)

4:00 p.m. (169) *Orthomodular structures from sesquilinear forms.* **Robert Piziak**, Baylor University (855-06-166)

4:30 p.m. (170) *A method of constructing orthomodular lattices.* **John R. Harding**, McMaster University (855-06-168)

Special Session on Numerical Analysis, III

3:00 p.m.–4:50 p.m. Room 122, Cardwell Hall

3:00 p.m. (171) *A least-squares finite element method for Helmholtz equation.*
Ching Lung Chang, Cleveland State University (855-35-83) (Sponsored by J. A. Chao)

3:30 p.m. (172) *Numerical simulation of gas-solid fluid flows.*
Yue-Kuen Kwok, San Jose State University (855-65-46) (Sponsored by Qisu Zou)

4:00 p.m. (173) *Lattice gas automata – a new method for solving the Navier-Stokes equations.*
Shiyi Chen* and **Gary D. Doolen**, Los Alamos National Laboratory (855-65-129) (Sponsored by Qisu Zou)

4:30 p.m. (174) *A comparison of some numerical conformal mapping methods for exterior regions.*
Thomas K. DeLillo* and **Alan R. Elcrat**, Wichita State University (855-65-130)

Special Session on Geometric Function Theory, IV

3:00 p.m.–6:20 p.m. Room 144, Cardwell Hall

3:00 p.m. (175) *Goluzin inequalities and minimum energy for mappings onto nonoverlapping regions.*
P. L. Duren*, University of Michigan, Ann Arbor, and **M. M. Schiffer**, Stanford University (855-30-58)

3:30 p.m. (176) *On a fixed area problem.* Preliminary report.
Y. J. Leung, University of Delaware (855-30-175) (Sponsored by Joseph S. Hemmeter)

4:00 p.m. (177) *Linear invariance and uniform local univalence.*
Wancang Ma and **David Minda***, University of Cincinnati (855-30-198)

4:30 p.m. (178) *Extremal distance and quasiconformal circle domains.* Preliminary report.
David A. Herron*, University of Cincinnati, and **Pekka Koskela**, University of Jyväskylä, Finland (855-30-117)

5:00 p.m. (179) *Some numerical calculations related to the Riemann Hypothesis.* Preliminary report.
Karl Barth, Syracuse University (855-30-120)

5:30 p.m. (180) *Iteration and zeros of the second derivative.*
A. Hinkkanen, University of Texas, Austin (855-30-103)

6:00 p.m. (181) *Real zeros of the second derivative of the reciprocal of an entire function.*
George Csordas, **Wayne Smith*** and **Jack Williamson**, University of Hawaii, Honolulu (855-30-133)

Special Session on Partial Differential Equations, IV

3:00 p.m.–4:50 p.m. Room 129, Cardwell Hall

3:00 p.m. (182) *Existence of travelling wave solutions for an evolutionary ecology model.*
Roger Lui, University of Utah (855-35-33)

3:30 p.m. (183) *Slow motion manifolds for the Cahn-Hilliard equation in 1 space dimension.*
Nicholas D. Alikakos, University of Tennessee, Knoxville (855-35-203)

4:00 p.m. Informal Discussion

Special Session on Commutative Algebra, IV

3:00 p.m.–5:50 p.m. Room 102, Cardwell Hall

3:00 p.m. (184) *Linear triangularization of homogeneous polynomial maps.* Preliminary report.
David Wright, Washington University (855-13-98)

3:30 p.m. (185) *Ranks of indecomposable modules over one-dimensional rings, II.* Preliminary report.
Leo Chouinard and **Sylvia Wiegand***, University of Nebraska, Lincoln (855-13-158)

4:00 p.m. (186) *On the structure of certain normal ideals.* Preliminary report.
Craig Huneke, Purdue University, West Lafayette, **Wolmer Vasconcelos**, Rutgers University, New Brunswick, and **Bernd Ulrich***, Michigan State University (855-13-119)

4:30 p.m. (187) *Rees algebras of two-dimensional Cohen-Macaulay local rings.* Preliminary report.
Jugal Verma, Louisiana State University, Baton Rouge (855-13-145) (Sponsored by Tomasz Przebinda)

5:00 p.m. (188) *Divisorial properties of the canonical module for invariant subrings.*
Dana T. Weston, University of Missouri, Columbia (855-13-32)

5:30 p.m. (189) *On the non-existence of a minimal algebra resolution despite vanishing of Avramov obstructions.*
Hema Srinivasan, University of Missouri, Columbia (855-13-121)

Special Session on Inverse Problems and Scattering Theory, IV

3:00 p.m.–5:20 p.m. Room 143, Cardwell Hall

3:00 p.m. Informal Discussion

Saturday, March 17 (cont'd)

Special Session on Ergodic Theory, IV

3:00 p.m.–4:50 p.m. Room 130, Cardwell Hall

3:00 p.m. (190) *Multiparameter and subsequence ergodic theorems.*
James H. Olsen, North Dakota State University (855-47-131)

3:30 p.m. (191) *Mixing examples in the class of piecewise continuous and expanding interval maps.*
Christopher Bose, University of Victoria (855-28-124)
(Sponsored by Joseph M. Rosenblatt)

4:00 p.m. (192) *Polynomial van der Waerden implies polynomial Szemeredi.*
Vitaly Bergelson, Ohio State University, Columbus (855-28-180)

4:30 p.m. (193) *Counterexamples from Gaussian automorphisms.*
Andrés del Junco, University of Toronto (855-28-190)

Special Session on Groups and Geometries, IV

3:00 p.m.–5:50 p.m. Room 145, Cardwell Hall

3:00 p.m. (194) *Generalized quadrangles with $s = t^2$: A survey of recent results.*
Stanley E. Payne, University of Colorado, Denver (855-51-126)

3:30 p.m. (195) *Skeletons of conical flocks.*
Norman L. Johnson, University of Iowa (855-51-26)
(Sponsored by Ernest E. Shult)

4:00 p.m. (196) *Generalized quadrangles in p-groups.*
Diane Herrmann, University of Chicago (855-20-132)

4:30 p.m. (197) *Restrictions on groups with a Kantor family.* Preliminary report.
Xu Ming Chen and **Daniel Frohardt***, Wayne State University (855-20-171)

5:00 p.m. (198) *Orthogonal resolutions of designs.*
Spyros S. Magliveras, University of Nebraska, Lincoln (855-05-61)

5:30 p.m. Informal Discussion

Special Session on Applications of Category Theory, IV

3:00 p.m.–5:20 p.m. Room 103, Cardwell Hall

3:00 p.m. (199) *An internal characterization of β.*
Guenther E. Richter, University of Bielefeld, Federal Republic of Germany (855-18-25)

3:30 p.m. (200) *Enriched category theory based on relations.* Preliminary report.
Jurgen Koslowski, Macalester College (855-18-47)

4:00 p.m. (201) *$\mathcal{A}$-epimorphisms, diagonal-separation, and disconnectedness.*
Harriet M. Lord, California State Polytechnic University (855-18-14)

4:30 p.m. (202) *Topological universe hulls inside the category of pseudotopological spaces.*
Friedhelm Schwarz, University of Toledo (855-18-85)

5:00 p.m. (203) *Completely regular spaces.* Preliminary report.
H. L. Bentley*, University of Toledo, and **E. Lowen-Colebunders**, Free University of Brussels, Belgium (855-54-59)

Andy Roy Magid
Associate Secretary
Norman, Oklahoma

GROUP ACTIONS AND INVARIANT THEORY

A. Bialynicki-Birula, J. Carrell, P. Russell, and D. Snow, Editors

(Conference Proceedings, Canadian Mathematical Society, Volume 10)

This volume contains the proceedings of a conference, sponsored by the Canadian Mathematical Society, on Group Actions and Invariant Theory, held in August, 1988 in Montreal. The conference was the third in a series bringing together researchers from North America and Europe (particularly Poland). The papers collected here will provide an overview of the state of the art of research in this area. The conference was primarily concerned with the geometric side of invariant theory, including explorations of the linearization problem for reductive group actions on affine spaces (with a counterexample given recently by J. Schwarz), spherical and complete symmetric varieties, reductive quotients, automorphisms of affine varieties, and homogeneous vector bundles.

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Fayetteville, Arkansas
University of Arkansas
March 23–24

Program

The eight-hundred-and-fifty-sixth meeting of the American Mathematical Society will be held at the University of Arkansas in Fayetteville, Arkansas on Friday, March 23, and Saturday, March 24, 1990. This meeting will be held in conjunction with the University of Arkansas' Fourteenth Annual Lecture Series in Mathematical Sciences, and in cooperation with the Society for Industrial and Applied Mathematics (SIAM). All sessions will be held in the Center for Continuing Education.

Invited Addresses

By invitation of the Southeastern Section Program Committee, there will be four invited one-hour addresses. The speakers, their affiliations, the titles of their talks, and the scheduled times of presentation are:

MARCEL F. NEUTS, University of Arizona, *Phase-type distributions: Basic properties*, 11:00 a.m. Friday. This talk is part of the University of Arkansas' Fourteenth Annual Lecture Series and is in cooperation with SIAM. The three remaining talks in the Lecture Series will occur in the Special Session on *Probability distributions of phase type and applications*, also being held in cooperation with SIAM.

VLADIMIR I. OLIKER, Emory University, *Selected nonlinear problems in geometry*, 1:00 p.m. Friday.

MARK A. STERN, Duke University and the Institute for Advanced Study, *A geometric trace formula for Hecke operators*, 11:00 a.m. Saturday.

JONATHAN M. WAHL, University of North Carolina, Chapel Hill, *Topology and geometry of isolated complex surface singularities*, 1:00 p.m. Saturday.

Special Sessions

By invitation of the same committee, there will be nine special sessions of selected twenty-minute papers. The topics, the names and affiliations of the organizers, and the speakers are as follows:

Singular integral operators and related areas, GERALDO SOARES DE SOUZA and GARY SAMPSON, Auburn University, Auburn. Kenneth F. Andersen, John Gilbert, Cristian E. Gutiérrez, Björn Jawerth, Peter M. Knopf, Dan Oberlin, Rodolfo H. Torres, Tavan T. Trent, James L. Wang, and J. Michael Wilson.

Banach algebras, JOHN DUNCAN, University of Arkansas. Bruce Barnes, David P. Blecher, Peter A. Detre, F. Ghahramani, Sandy Grabiner, N. J. Kalton, Herbert Kamowitz, Anthony To-Ming Lau, Michael M. Neumann, Theodore W. Palmer, and Marc P. Thomas.

Semigroups in geometry and analysis, KARL H. HOFMANN and JIMMIE D. LAWSON, Louisiana State University, Baton Rouge. Mitchell J. Anderson, Norbert Dörr, Anselm Eggert, Paul Ehrlich, Karl H. Hofmann, J. P. Holmes, Palle E. T. Jorgensen, Arunava Mukherjea, Karl-Hermann Neeb, Mohan S. Putcha, Wolfgang A. F. Ruppert, Boris M. Schein, James W. Stepp, Christian Terp, and Wolfgang Weiss.

On complex function theory of one and several variables, DIMA KHAVINSON, University of Arkansas, Fayetteville. John T. Anderson, Albert Baernstein II, Roger W. Barnard, P. L. Duren, A. Hinkkanen, Steven G. Krantz, Marius Overholt, Richard Rochberg, Zbigniew Slodkowski, Emil J. Straube, and John Wermer.

Phase-type distributions and some applications, ITREL E. MONROE and COLM A. O'CINNEIDE, University of Arkansas, Fayetteville. The three remaining talks of the Fourteenth Lecture Series will occur during this Special Session. Soren Asmussen, C. Blondia, Andrea Bobbio, S. Chakravarthy, Mary A. Johnson, Lester Lipsky, David M. Lucantoni, Marcel F. Neuts, Marcel F. Neuts, Marcel F. Neuts, Colm O'Cinneide, V. Ramaswami, Ushio Sumita, Kishor Trivedi, and Appie van de Liefvoort.

Algebraic geometry, DAVID R. MORRISON, Duke University, and JONATHAN M. WAHL. Paolo Aluffi, Donu Arapura, Bruce Crauder, Brian Harbourne, David B. Jaffe, Sheldon Katz, Rick Miranda, David R. Morrison, Kieran O'Grady, Mark Spivakovsky, and Jan Stevens.

Geometry, physics and nonlinear PDE's, VLADIMIR I. OLIKER and ANDREJS E. TREIBERGS, University of Utah. I. Bakelman, John K. Beem, Eugenio Calabi, Jaigyoung Choe, Dennis DeTurck, P. Ehrlich, José F. Escobar, Wm. J. Firey, Michael E. Gage, Samuel I. Goldberg, Carolyn Gordon, Robert Hardt, R. Howard, Gary R. Jensen,

Bernhard Kawohl, Nicholas J. Korevaar, Jeffrey Lee, G. Liao, Erwin Lutwak, Robert C. McOwen, Daniel Phillips, Ernst A. Ruh, Friedmar Schulz, Andrejs E. Treibergs, S. Walter Wei, Henry C. Wente, Frederico Xavier, and Paul C. Yang.

Combinatorics, JAMES G. OXLEY, Louisiana State University. Safwan Akkari, Nathaniel Dean, Bradley S. Gubser, Hugh Hind, Bogdan Oporowski, James G. Oxley, M. D. Plummer, Talmage James Reid, Neil Robertson, Gordon F. Royle, William Schmitt, W. D. Wallis, and James A. Wiseman.

Differential geometry, WILLIAM L. PARDON, Duke University, and MARK A. STERN. Joseph H. G. Fu, Peter Haskell, Werner Muller, Alan M. Nadel, William Pardon, Sai Kee Yeung, and Fangyang Zheng.

Abstracts for consideration for these sessions should have been submitted by the **November 21, 1989** deadline. This deadline was previously published in the Calendar of AMS Meetings and Conferences and in the Invited Speakers and Special Sessions section of the *Notices*.

Contributed Papers

There will also be a session for contributed ten-minute papers. Late papers will not be accommodated.

Registration

The meeting registration desk will be located on the second floor (street level) of the Center for Continuing Education located on the square in downtown Fayetteville at the corner of East Avenue and Center Street. The meeting registration desk will be open from 8:00 a.m. to 5:00 p.m. on Friday, March 23, and from 8:00 a.m. to noon on Saturday, March 24.

The registration fees are $30 for members of the AMS or SIAM, $45 for nonmembers, and $10 for students and unemployed mathematicians.

Petition Table

A petition table will be set up in the registration area. Additional information about petition tables can be found in a box in the Louisville meeting announcement in the October 1989 issue of *Notices*.

David II Report

There will be a special presentation and discussion Friday evening at 7:15 p.m. concerning the upcoming National Research Council David II Report. A written executive summary of David II will be available to participants. This report is to be issued this spring and could have a major impact on all mathematics departments. The focus will be on becoming familiar with the report and discussing its use in our work.

Accommodations

A block of rooms is being held in the Fayetteville Hilton adjacent to the Center for Continuing Education. Rates of $49 for a single room and $56 for a double room will be offered to participants making reservations **no later than March 8, 1990**. After that date the rates listed below will apply. Participants should make their own reservations directly with the Hilton and with the hotels listed below and identify themselves as participants of the AMS meeting in order to obtain the rates listed. All rates are subject to a nine percent tax. Distances given below are driving distances measured from the Center for Continuing Education. The AMS is not responsible for rate changes or accommodations offered by hotels/motels.

Fayetteville Hilton
70 North East Street, Fayetteville, AR 72701
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Single $58 Double $69
Above rates for reservations made after March 8, 1990.

Mountain Inn (one block)
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Single $27 Double $29

Best Western Motel (two-and-one-half miles)
1000 Hwy 71, Fayetteville, AR 72701
Telephone: 501-442-3041 or 800-528-1234

Single $35 Double $39

Motel 6 (three miles)
2980 North College, Fayetteville, AR 72701
Telephone: 317-741-7777

Single $19.95 Double $25.95

Park Inn (two-and-one-half miles)
1255 Shiloh Drive, Fayetteville, AR 72701
Telephone: 501-521-1166 or 800-437-7275

Single $44 Double $46

Food Service

There are a number of restaurants on the square and in the downtown area. Complete listings will be available at the meeting registration desk.

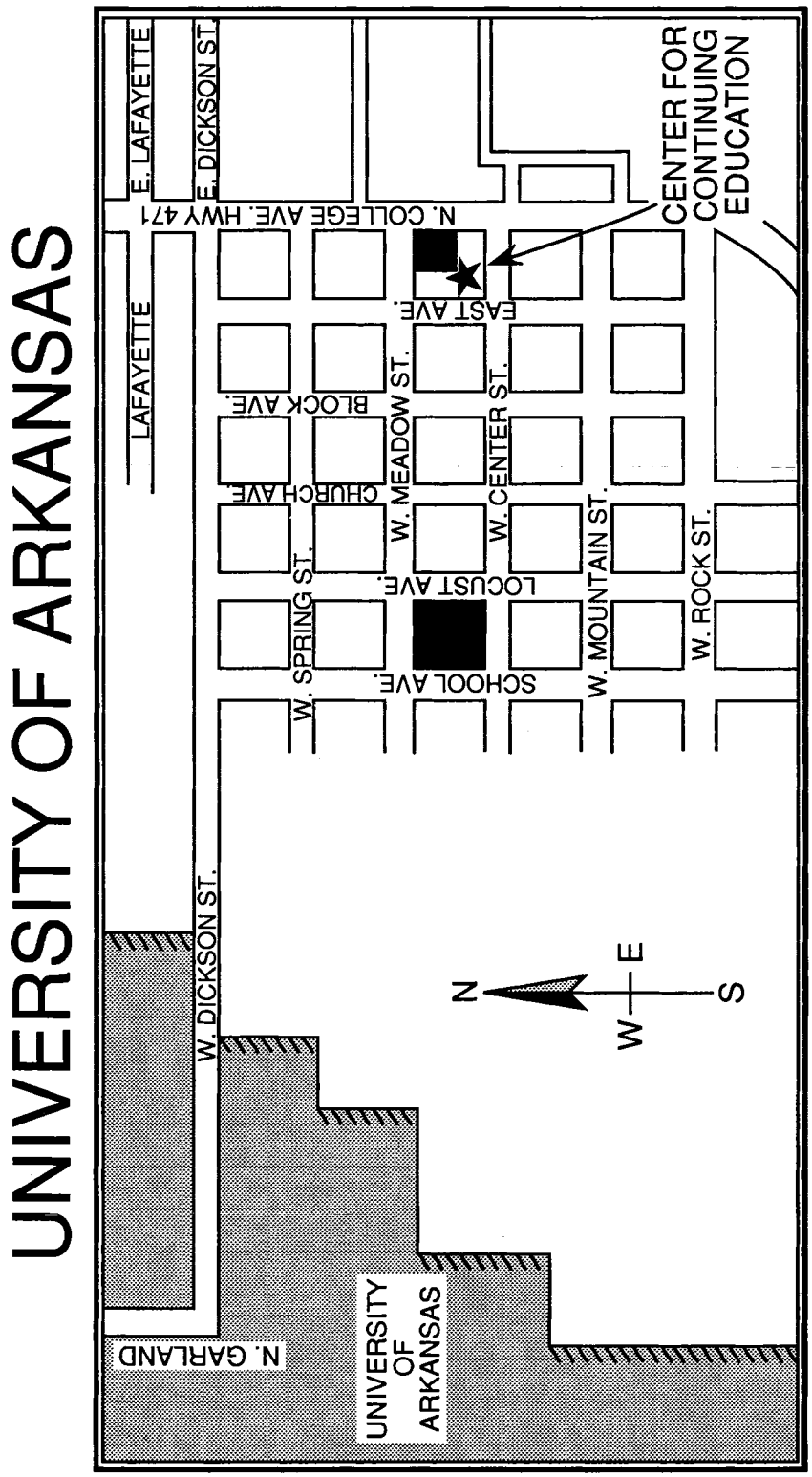
Travel

Fayetteville is served by commuter lines for several major airlines as follows: American Eagle, connecting in Dallas, Texas; Braniff Airlines, connecting in Kansas City, Kansas; Delta Connection, connecting in Dallas, Texas;

Northwest Airlink, connecting in Memphis, Tennessee; and Trans World Express, connecting in St. Louis, Missouri. The Best Western Inn, Fayetteville Hilton, and Mountain Inn have complimentary van service to and from the airport. Taxi service is also available. The Fayetteville Airport is approximately four miles from the center of town.

Weather

The weather in late March is usually mild though it is occasionally rainy.



Program of the Sessions

The time limit for each contributed paper in the sessions is ten minutes. In the special sessions, the time limit varies from session to session and within sessions. To maintain the schedule, time limits will be strictly enforced.

Abstracts of papers presented in the sessions at this meeting will be found in the March 1990 issue of *Abstracts of papers presented to the American Mathematical Society*, ordered according to the numbers in parentheses following the listings below.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Friday, March 23

Special Session on Banach Algebras, I

8:00 a.m.–10:55 a.m. Room 411, Center for Continuing Education

8:00 a.m. (1) *Spectral theory in F-algebras with applications to Laplace transforms.*
Bruce Barnes, University of Oregon (856-46-75)

8:30 a.m. (2) *A characterization of operator algebras and applications.*
David P. Blecher, University of Houston, Houston (856-46-82)

9:00 a.m. (3) *Standard homomorphisms and regulated weights on weighted convolution algebras.*
F. Ghahramani*, **J. P. McClure**, University of Manitoba, and **S. Grabiner**, Pomona College (856-46-10)

9:30 a.m. (4) *Convergent sequences and standard ideals in weighted convolution algebras.* Preliminary report.
Sandy Grabiner, Pomona College (856-46-11)

10:00 a.m. Informal Discussion

Special Session on Complex Function Theory of One and Several Variables, I

8:00 a.m.–10:30 a.m. Room 402, Center for Continuing Education

8:00 a.m. (5) *Removable singularities for L^1CR functions.* Preliminary report.
John T. Anderson*, College of the Holy Cross, and **Joseph A. Cima**, University of North Carolina, Chapel Hill (856-32-115)

8:40 a.m. (6) *Some results related to Landau's covering theorem.*
Albert Baernstein, II, Washington University (856-30-40)

9:20 a.m. (7) *Some open problems in one and several complex variables.*
Roger W. Barnard, Texas Tech University (856-30-84)

10:00 a.m. (8) *Sets lying over the sphere in $\mathbb{C}^2$.* Preliminary report.
John Wermer, Brown University (856-32-79)

Special Session on Phase-type Distributions and Some Applications, I

8:00 a.m.–10:30 a.m. Room 107, Center for Continuing Education

8:00 a.m. (9) *New results on the single server queue with a batch Markovian arrival process.*
David M. Lucantoni, AT&T Bell Laboratories, Holmdel, New Jersey (856-90-24) (Sponsored by Itrel E. Monroe)

8:40 a.m. (10) *Phase-type representation of waiting times.*
Soren Asmussen, Chalmers Institute of Technology, Sweden (856-90-26) (Sponsored by Itrel E. Monroe)

9:30 a.m. (11) *Phase-distribution selection methods: Recent developments.*
Mary A. Johnson, University of Arizona (856-90-25) (Sponsored by Itrel E. Monroe)

10:00 a.m. (12) *Implementation of matrix analytic methods for phase type queues using uniformization techniques.*
V. Ramaswami, Bell Communications Research, Morristown, New Jersey (856-90-21) (Sponsored by Itrel E. Monroe)

Special Session on Geometry, Physics and Nonlinear PDE's, I

8:00 a.m.–10:50 a.m. Room 204, Center for Continuing Education

8:00 a.m. (13) *Maximum principles and applications.* Preliminary report.
I. Bakelman, Texas A & M University, College Station (856-35-72)

8:35 a.m. (14) *A survey of some unusual harmonic maps from the 3-ball to the 2-sphere.* Preliminary report.
Robert Hardt, Rice University (856-49-67)

9:10 a.m. (15) *Spherical minimal immersions of spherical space forms.* Preliminary report.
Dennis DeTurck, University of Pennsylvania (856-53-77)

Friday, March 23 (cont'd)

9:45 a.m. (16) *The changing geometry of isospectral manifolds.* **Dennis DeTurck**, **Herman Gluck**, University of Pennsylvania, **Carolyn Gordon*** and **David Webb**, Washington University (856-53-30)

10:20 a.m. (17) *On the index of the Costa-Hoffan-Meeks minimal surface.* Preliminary report. **Peter Li**, University of Arizona, **Luen-Fai Tam**, The Chinese University of Hong Kong, Hong Kong, **Frank Stenger** and **Andrejs E. Treibergs***, University of Utah (856-53-52)

Special Session on Combinatorics, I

8:00 a.m.–9:50 a.m. Room 405, Center for Continuing Education

8:00 a.m. (18) *Finite descriptions of tree ideals.* Preliminary report. **Neil Robertson***, Ohio State University, Columbus, **P. D. Seymour**, Bell Communication Research, and **Robin Thomas**, Georgia Institute of Technology (856-05-125)

8:40 a.m. (19) *An included minor result for 3-connected graphs.* Preliminary report. **Bogdan Oporowski*** and **James Oxley**, Louisiana State University, Baton Rouge (856-05-32)

9:20 a.m. (20) *A characterization of the planar graphs with no 6-wheel minor.* Preliminary report. **Bradley S. Gubser**, Louisiana State University, Baton Rouge (856-05-98)

Session on Banach Lattices and Theory of Determinates

9:00 a.m.–9:30 a.m. Room 406, Center for Continuing Education

9:00 a.m. (21) *Sums of homomorphisms into Dedekind complete Banach lattices.* **David C. Carothers***, Hope College, and **William A. Feldman**, University of Arkansas, Fayetteville (856-47-127)

9:20 a.m. (22) *The value of certain determinants with elements* ± 1. Preliminary report. **Dale Woods*** and **D. J. Boyce**, Central State University (856-15-100)

Invited Address

11:00 a.m.– noon Room 107, Center for Continuing Education

(23) *Phase-type distributions: Basic properties.* **Marcel F. Neuts**, University of Arizona (856-90-16) (Sponsored by Itrel E. Monroe)

Invited Address

1:00 p.m.–2:00 p.m. Room 204, Center for Continuing Education

(24) *Selected nonlinear problems in geometry.* **Vladimir I. Oliker**, Emory University (856-53-50)

Special Session on Banach Algebras, II

2:10 p.m.–4:35 p.m. Room 411, Center for Continuing Education

2:10 p.m. (25) *Multipliers of weighted L^p spaces.* **Peter A. Detre**, Southwest Missouri State University (856-47-36)

2:40 p.m. (26) *Compact endomorphisms of Banach algebras.* **Herbert Kamowitz**, University of Massachusetts, Boston (856-46-112)

3:10 p.m. (27) *Semi-simple Banach algebras and super-decomposable operators.* Preliminary report. **Michael M. Neumann**, Mississippi State University (856-47-128)

3:40 p.m. Informal Discussion

Special Session on Semigroups in Geometry and Analysis, I

2:10 p.m.–6:00 p.m. Room 409, Center for Continuing Education

2:10 p.m. (28) *The duality between subsemigroups of Lie groups and monotone functions.* **Karl-Hermann Neeb**, Technische Hochschule Darmstadt, Federal Republic of Germany (856-22-07) (Sponsored by Karl H. Hofmann)

2:50 p.m. (29) *On the geometry of subsemigroups of Lie groups.* **Wolfgang A. F. Ruppert**, Universität für Bodenkultur, Austria and Technische Hochschule Darmstadt, Federal Republic of Germany (856-22-02) (Sponsored by Karl H. Hofmann)

3:30 p.m. (30) *On the set of compact subgroups of a locally compact group.* **Christian Terp**, Technische Hochschule Darmstadt, Federal Republic of Germany (856-22-03) (Sponsored by Karl H. Hofmann)

4:10 p.m. (31) *On topological semigroups of conal curves and connecting homotopy.*
Wolfgang Weiss, Technische Hochschule Darmstadt, Federal Republic of Germany (856-22-08)
(Sponsored by Karl H. Hofmann)

4:50 p.m. (32) *Causality and homothetic maps on space-time.*
Paul Ehrlich, University of Florida (856-53-15)

5:30 p.m. (33) *Applications of differentiable semigroups in operator theory.*
J. P. Holmes, Auburn University, Auburn (856-20-39)

Special Session on Complex Function Theory of One and Several Variables, II

2:10 p.m.–4:00 p.m. Room 402, Center for Continuing Education

2:10 p.m. (34) *Robin functions and energy functionals of multiply connected domains.*
P. L. Duren*, University of Michigan, Ann Arbor, and **M. M. Schiffer**, Stanford University (856-30-65)

2:50 p.m. (35) *Schwarzian derivatives and zeros of solutions of second order linear differential equations.*
A. Hinkkanen*, University of Texas, Austin, and **John Rossi**, Virginia Polytechnic Institute and State University (856-30-92)

3:30 p.m. (36) *Harmonic analysis on domains.*
Steven G. Krantz, Washington University (856-42-27)

Special Session on Phase-type Distributions and Some Applications, II

2:10 p.m.–5:10 p.m. Room 107, Center for Continuing Education

2:10 p.m. (37) *Phase-type distributions: Use in queuing models.*
Marcel F. Neuts, University of Arizona (856-90-17)
(Sponsored by Itrel E. Monroe)

3:10 p.m. (38) *A finite capacity polling system with non-exhaustive service and non-renewal input.*
C. Blondia, Philips Research Laboratory, Belgium (856-90-47) (Sponsored by Itrel E. Monroe)

3:50 p.m. (39) *ML estimation of the parameters of a PH-distribution in triangular canonical form.*
Andrea Bobbio* and **Aldo Cumani**, Istituto Elettrotecnico Nazionale Galileo Ferraris, Italy (856-90-48) (Sponsored by Itrel E. Monroe)

4:30 p.m. Informal Discussion

Special Session on Geometry, Physics and Nonlinear PDE's, II

2:10 p.m.–7:20 p.m. Room 204, Center for Continuing Education

2:10 p.m. (40) *Null directions and curvature.* Preliminary report.
John K. Beem*, University of Missouri, Columbia, and **Phillip E. Parker**, Wichita State University (856-53-53)

2:45 p.m. (41) *Index, vision number and stability of complete minimal surfaces.* Preliminary report.
Jaigyoung Choe, Rice University (856-53-56)
(Sponsored by Andrejs E. Treibergs)

3:20 p.m. (42) *Causal and geodesic behavior of gravitational plane waves.*
P. Ehrlich*, **G. Emch**, University of Florida, and **G. Galloway**, University of Miami (856-53-13)

3:55 p.m. (43) *Worn stones – a second look.* Preliminary report.
Wm. J. Firey, Oregon State University (856-52-45)

4:30 p.m. (44) *Contact Riemannian three-manifolds.* Preliminary report.
Samuel I. Goldberg, University of Illinois, Urbana-Champaign (856-53-71)

5:05 p.m. (45) *The inhomogeneous extremal metric problem for closed surfaces.*
Eugenio Calabi, University of Pennsylvania (856-53-68)

5:40 p.m. (46) *Almost umbilic submanifolds.* Preliminary report.
R. Howard, University of South Carolina, Columbia (856-53-58)

6:15 p.m. (47) *Domains in Riemannian manifolds and inverse spectral geometry.*
Harold Donnelly and **Jeffrey Lee***, Purdue University, West Lafayette (856-53-55)

6:50 p.m. (48) *On the size of the blowup set for a quasilinear parabolic equation.*
Michael E. Gage, University of Rochester (856-35-54)

Special Session on Combinatorics, II

2:10 p.m.–4:00 p.m. Room 405, Center for Continuing Education

2:10 p.m. (49) *Bounds for rectilinear crossing numbers.*
Daniel Bienstock and **Nathaniel Dean***, Bellcore, Morristown, New Jersey (856-05-44)

2:50 p.m. (50) *Generalized total colorings.*
Hugh Hind, University of Southern Mississippi (856-05-126)

3:30 p.m. (51) *Coclosure operators and chromatic polynomials.*
Nigel Ray, University of Manchester, England, and **William Schmitt***, Memphis State University (856-05-34)

Friday, March 23 (cont'd)

Special Session on Differential Geometry, I

2:10 p.m.–4:20 p.m. Room 404, Center for Continuing Education

2:10 p.m. (52) *$(-1/4)$-pinched Riemannian metrics on compact Kaehler manifolds.*
Fangyang Zheng, Massachusetts Institute of Technology (856-53-120)

2:55 p.m. (53) *L_2-$\overline{\partial}$-cohomology of projective varieties.*
William Pardon* and **Mark Stern**, Duke University (856-58-118)

3:40 p.m. (54) *Kähler-Einstein metrics of positive scalar curvature.*
Alan M. Nadel, Massachusetts Institute of Technology (856-32-86)

Special Session on Singular Integral Operators and Related Areas, I

2:10 p.m.–6:00 p.m. Room 403, Center for Continuing Education

2:10 p.m. (55) *Continuity properties of pseudodifferential operators and other operators with singular kernels.*
Rodolfo H. Torres, Washington University (856-35-89)

2:50 p.m. (56) *Weighted inequalities for averaging operators.*
Kenneth F. Andersen, University of Alberta (856-42-63)

3:30 p.m. (57) *Oscillatory integrals with polynomial phase.* Preliminary report.
Dan Oberlin, Florida State University (856-42-64)

4:10 p.m. (58) *On the approximation problem for $\overline{\partial}^2$.* Preliminary report.
James L. Wang, University of Alabama, Tuscaloosa (856-30-80)

4:50 p.m. (59) *Projection theorems for estimating harmonic measure.*
Peter M. Knopf, Pace University (856-32-123)

5:30 p.m. (60) *Estimates for the maximal operator of the Ornstein-Uhlenbeck semigroup.* Preliminary report.
Cristian E. Gutiérrez*, Temple University, Philadelphia, and **Wilfredo O. Urbina**, Universidad Central de Venezuela, Caracas (856-42-113)

Saturday, March 24

Special Session on Banach Algebras, III

8:00 a.m.–10:30 a.m. Room 411, Center for Continuing Education

8:00 a.m. (61) *Remarks on the approximation property.*
P. G. Casazza and **N. J. Kalton***, University of Missouri, Columbia (856-46-38)

8:40 a.m. (62) *The second conjugate algebra of $L_1(G)$ of a locally compact group.*
Anthony To-Ming Lau, University of Alberta (856-43-102)

9:20 a.m. (63) *Spectral algebras.*
Theodore W. Palmer, University of Oregon (856-46-91)

10:00 a.m. (64) *Decompositions of commutative Banach algebras as semi-direct products and other structure results.* Preliminary report.
Marc P. Thomas, California State University, Bakersfield (856-46-09)

Special Session on Semigroups in Geometry and Analysis, II

8:00 a.m.–10:30 a.m. Room 409, Center for Continuing Education

8:00 a.m. (65) *Positive definite and negative definite functions on the Heisenberg group.*
Palle E. T. Jorgensen, University of Iowa (856-47-01)

8:40 a.m. (66) *On the semigroup* $(\exp iW)G$. Preliminary report.
Norbert Dörr, Technische Hochschule Darmstadt, Federal Republic of Germany (856-22-06)
(Sponsored by Karl H. Hofmann)

9:20 a.m. (67) *Classification of Lie semialgebras.* Preliminary report.
Anselm Eggert, Technische Hochschule Darmstadt, Federal Republic of Germany (856-22-04)
(Sponsored by Karl H. Hofmann)

10:00 a.m. (68) *Classification of hyperplane subalgebras in real Lie algebras,* Geometriae Dedicata 1990, to appear.
Karl H. Hofmann, Technische Hochschule Darmstadt, Federal Republic of Germany (856-22-05)

Special Session on Complex Function Theory of One and Several Variables, III

8:00 a.m.–10:30 a.m. Room 402, Center for Continuing Education

8:00 a.m. (69) *The minimum points of the hyperbolic metric in plane domains.*
Marius Overholt, University of Tennessee, Knoxville (856-30-103)

8:40 a.m. *Calderon Toeplitz operators.* Preliminary report.
(70) **Krzysztof Nowak** and **Richard Rochberg***, Washington University (856-46-101)

9:20 a.m. *Polynomial hulls and analytic motions.*
(71) **Zbigniew Slodkowski**, University of Illinois, Chicago (856-32-85) (Sponsored by Dima Khavinson)

10:00 a.m. *Equivalence of regularity for the Bergman projection and the $\overline{\partial}$-Neumann operator.*
(72) **Harold P. Boas** and **Emil J. Straube***, Texas A & M University, College Station (856-32-94)

Special Session on Phase-type Distributions and Some Applications, III

8:00 a.m.–10:50 a.m. Room 107, Center for Continuing Education

8:00 a.m. *Observable and unobservable aspects of Markov models.*
(73) **Colm O'Cinneide**, Louisiana State University, Baton Rouge (856-90-23) (Sponsored by Itrel E. Monroe)

8:40 a.m. *On multivariate phase type distributions.*
(74) **Ushio Sumita**, University of Rochester (856-90-22) (Sponsored by Itrel E. Monroe)

9:20 a.m. *Computer solution of stochastic models.*
(75) **Kishor Trivedi**, Duke University (856-90-20) (Sponsored by Itrel E. Monroe)

10:00 a.m. *Phase-type distributions: In the construction of point processes.*
(76) **Marcel F. Neuts**, University of Arizona (856-90-18) (Sponsored by Itrel E. Monroe)

Special Session on Geometry, Physics and Nonlinear PDE's, III

8:00 a.m.–10:50 a.m. Room 204, Center for Continuing Education

8:00 a.m. *Conformal deformation of metrics to constant mean curvature.*
(77) **José F. Escobar**, University of Chicago (856-53-31)

8:35 a.m. *Riemannian metrics on fiber bundles.* Preliminary report.
(78) **Gary R. Jensen***, Washington University, and **Marco Rigoli**, Citta Universitaria, Italy (856-53-33)

9:10 a.m. *On the structure of complete embedded constant mean curvature surfaces in Euclidean space.* Preliminary report.
(79) **Nicholas J. Korevaar**, University of Utah (856-53-57)

9:45 a.m. *Conformal deformation equation and isospectral set of conformal metrics.* Preliminary report.
(80) **Sun-Yung A. Chang**, University of California, Los Angeles, and **Paul C. Yang***, University of Southern California (856-53-59)

10:20 a.m. *Rotational mean curvature flow, quenching and blow up.*
(81) **Bernhard Kawohl**, Universität Heidelberg, Federal Republic of Germany (856-35-35)

Special Session on Combinatorics, III

8:00 a.m.–9:50 a.m. Room 405, Center for Continuing Education

8:00 a.m. *Matchings in regular graphs.*
(82) **M. D. Plummer**, Vanderbilt University (856-05-62)

8:40 a.m. *The maximum value of the principal eigenvalue of a planar graph.* Preliminary report.
(83) **B. N. Boots**, Wilfrid Laurier University, and **Gordon F. Royle***, Vanderbilt University (856-05-88)

9:20 a.m. *On quasi-threshold graphs.*
(84) **W. D. Wallis**, Southern Illinois University, Carbondale (856-05-42)

Special Session on Singular Integral Operators and Related Areas, II

8:00 a.m.–10:30 a.m. Room 403, Center for Continuing Education

8:00 a.m. *Bounded point evaluations.* Preliminary report.
(85) **Tavan T. Trent**, University of Alabama, Tuscaloosa (856-47-81)

8:40 a.m. *Cauchy integrals on terrible curves.*
(86) **J. Michael Wilson**, University of Vermont (856-42-74)

9:20 a.m. *Littlewood-Paley theory on spaces of homogenous type.*
(87) **Björn Jawerth**, University of South Carolina, Columbia (856-46-121)

10:00 a.m. *Singular integral operators and Hardy spaces.*
(88) **John Gilbert**, University of Texas, Austin (856-42-46) (Sponsored by R. E. Showalter)

Special Session on Algebraic Geometry, I

8:30 a.m.–10:50 a.m. Room 410, Center for Continuing Education

8:30 a.m. *The Hodge decomposition for smooth quasi-projective varieties.*
(89) **Donu Arapura**, Purdue University, West Lafayette (856-14-105)

9:00 a.m. *Obstructions for deformations of singularities.* Preliminary report.
(90) **Jan Stevens**, University of Utah (856-32-97)

9:30 a.m. *The Artin smoothing problem and the approximation theorems.* Preliminary report.
(91) **Mark Spivakovsky**, Harvard University (856-13-119)

10:00 a.m. *The structure of small resolutions.* Preliminary report.
(92) **Sheldon Katz**, Oklahoma State University, Stillwater, and **David R. Morrison***, Duke University (856-14-90)

10:30 a.m. *Donaldson's polynomials of surfaces in P^3.* Preliminary report.
(93) **Kieran O'Grady**, Columbia University (856-14-95)

Saturday, March 24 (cont'd)

Invited Address

11:00 a.m.– noon Room 204, Center for Continuing Education

(94) *A geometric trace formula for Hecke operators.*
Mark A. Stern, Institute for Advanced Study (856-58-51)

Invited Address

1:00 p.m.–2:00 p.m. Room 204, Center for Continuing Education

(95) *Topology and geometry of isolated complex surface singularities.*
Jonathan Wahl, University of North Carolina, Chapel Hill (856-14-122)

Special Session on Semigroups in Geometry and Analysis, III

2:10 p.m.–5:20 p.m. Room 409, Center for Continuing Education

2:10 p.m. (96) *Product integrals in differentiable groupoids with multiplication strongly differentiable at the identity.* Preliminary report.
Mitchell J. Anderson, University of Hawaii, Hilo (856-22-106)

2:50 p.m. (97) *Compact uniquely divisible matrix semigroups.*
Dennison R. Brown and **James W. Stepp***, University of Houston, Houston (856-22-99)

3:30 p.m. (98) *The lattice of principal ideals of a linear algebraic monoid.*
Mohan S. Putcha, North Carolina State University (856-20-87) (Sponsored by Jimmie D. Lawson)

4:10 p.m. (99) *Infinitesimal bisimple bases and transitive representations of inverse semigroups.* Preliminary report.
Boris M. Schein, University of Arkansas, Fayetteville (856-20-107)

4:50 p.m. (100) *Multiplicative semigroups of infinite dimensional matrices.* Preliminary report.
Arunava Mukherjea, University of South Florida (856-15-73)

Special Session on Phase-type Distributions and Some Applications, IV

2:10 p.m.–5:00 p.m. Room 107, Center for Continuing Education

2:10 p.m. (101) *A finite capacity dynamic priority queueing model with phase type services.*
S. Chakravarthy, GMI Engineering and Management Institute, Flint, Michigan (856-90-49) (Sponsored by Itrel E. Monroe)

2:50 p.m. (102) *Must matrix representations of distributions be restricted to phase type?*
Lester Lipsky, University of Connecticut, Storrs (856-90-108) (Sponsored by Itrel E. Monroe)

3:30 p.m. (103) *The moment problem for continuous distributions.* Preliminary report.
Appie van de Liefvoort, University of Missouri, Kansas City (856-90-109) (Sponsored by Thomas P. Kezlan)

4:10 p.m. (104) *Phase-type distributions: Asymptotic results.*
Marcel F. Neuts, University of Arizona (856-90-19) (Sponsored by Itrel E. Monroe)

Special Session on Geometry, Physics and Nonlinear PDE's, IV

2:10 p.m.–7:20 p.m. Room 204, Center for Continuing Education

2:10 p.m. (105) *On the parabolic harmonic map equation from non-compact manifolds.*
G. Liao*, University of Texas, Arlington, and **L. F. Tam**, The Chinese University of Hong Kong, Hong Kong (856-53-78)

2:45 p.m. (106) *Generalized convex hypersurfaces.*
Erwin Lutwak, Polytechnic University of New York (856-52-60)

3:20 p.m. (107) *Prescribed curvature and singularities of conformal metrics on Riemann surfaces.* Preliminary report.
Robert C. McOwen, Northeastern University (856-35-61)

3:55 p.m. (108) *A priori estimates for a class of problems from nonlinear elasticity.* Preliminary report.
Patricia Bauman, Purdue University, West Lafayette, **Nicholas Owen**, University of Bath, United Kingdom, and **Daniel Phillips***, Purdue University, West Lafayette (856-35-28)

4:30 p.m. (109) *The local structure of Riemannian manifolds.* Preliminary report.
Patrick Ghanaat, Swiss Federal Institute of Technology, Switzerland, **Maung Min-oo**, McMaster University, and **Ernst A. Ruh***, Ohio State University, Columbus (856-53-37)

5:05 p.m. (110) *Darboux mappings and locally convex surfaces.* Preliminary report.
Friedmar Schulz, University of Iowa (856-35-12)

5:40 p.m. (111) *A class of nonlinear partial differential systems with geometric applications.*
S. Walter Wei, University of Oklahoma (856-53-69)

6:15 p.m. (112) *Surfaces of constant mean curvature of Enneper type.*
Henry C. Wente, University of Toledo (856-53-76)

6:50 p.m. (113) *A geometric estimate for the index of an umbilic on a smooth surface.*
Frederico Xavier, University of Notre Dame (856-53-14)

Special Session on Combinatorics, IV

2:10 p.m.–4:40 p.m. Room 405, Center for Continuing Education

2:10 p.m. (114) *On integrity of matroids.* Preliminary report.
Safwan Akkari, Indiana University-Purdue University, Fort Wayne (856-05-43)

2:50 p.m. (115) *The binary matroids having an element in every 4-wheel minor.* Preliminary report.
Talmage James Reid, University of Mississippi (856-05-111)

3:30 p.m. (116) *On minors avoiding elements in matroids.*
James G. Oxley, Louisiana State University, Baton Rouge (856-05-83)

4:10 p.m. (117) *On the intersection rank of strongly regular graphs.*
James A. Wiseman, Southern Illinois University, Carbondale (856-05-124) (Sponsored by Walter D. Wallis)

Special Session on Algebraic Geometry, II

2:15 p.m.–5:05 p.m. Room 410, Center for Continuing Education

2:15 p.m. (118) *Orbits of the action of $\mathbb{P}GL(3)$ on spaces of plane curves.*
Paolo Aluffi, Oklahoma State University, Stillwater (856-14-104)

2:45 p.m. (119) *Birational mappings between hypersurfaces of degree M in $\mathbb{P}^M$.*
Bruce Crauder, Oklahoma State University, Stillwater (856-14-93)

3:15 p.m. (120) *Cremona transformations and syzygies.*
Sheldon Katz*, Oklahoma State University, Stillwater, **Klaus Hulek** and **Frank Schreyer**, Universitaet Bayreuth, Federal Republic of Germany (856-14-96)

3:45 p.m. (121) *Hilbert functions of points in good position in $\mathbf{P}^2$.*
Brian Harbourne, University of Nebraska, Lincoln (856-14-110)

4:15 p.m. (122) *On set-theoretic complete intersections in complex projective space.*
David B. Jaffe, University of Nebraska, Lincoln (856-14-66)

4:45 p.m. (123) *Some recent results on the Gaussian map for curves.* Preliminary report.
Rick Miranda, Colorado State University (856-14-116)

Special Session on Differential Geometry, II

2:15 p.m.–5:10 p.m. Room 404, Center for Continuing Education

2:15 p.m. (124) *Index theory on homogeneous spaces.*
Jeffrey Fox, University of Colorado, Boulder, and **Peter Haskell***, Virginia Polytechnic Institute and State University (856-46-41)

3:00 p.m. (125) *Curvature measures of subanalytic sets.*
Joseph H. G. Fu, Indiana University, Bloomington (856-32-29)

3:45 p.m. (126) *Some aspects of analysis on locally symmetric spaces of finite volume.*
Werner Muller, Institute for Advanced Study (856-53-114) (Sponsored by Mark A. Stern)

4:30 p.m. (127) *Results of integrality of characteristic numbers.*
Sai Kee Yeung, Massachusetts Institute of Technology (856-53-117)

Joseph A. Cima
Associate Secretary
Chapel Hill, North Carolina

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University Park Pennsylvania State University April 7–8

Second Announcement

The eight-hundred-and-fifty-seventh meeting of the American Mathematical Society will be held at the Pennsylvania State University in University Park, Pennsylvania, on Saturday, April 7, and Sunday, April 8, 1990. This meeting will be held in conjunction with a meeting of the Association for Symbolic Logic (ASL).

Invited Addresses

By invitation of the Eastern Section Program Committee, there will be four invited one-hour addresses. The speakers, their affiliations, the titles of their talks where available, and the scheduled times of presentation are:

ROBERT T. GLASSEY, Indiana University, *Collisionless plasmas and the Vlasov-Maxwell equations*, 11:00 a.m. Sunday.

KARSTEN GROVE, University of Maryland, College Park, *Geometry and topology of manifolds curved from below*, 1:30 p.m. Sunday.

LOWELL EDWIN JONES, State University of New York at Stony Brook, *Topological rigidity for manifolds of non-positive curvature*, 11:00 a.m. Saturday.

GANG TIAN, Princeton University, *Einstein metrics on algebraic manifolds*, 1:30 p.m. Saturday.

Special Sessions

By invitation of the same committee, there will be four special sessions of selected twenty-minute papers. The topics, and the names and affiliations of the organizers, are as follows:

Classical and quantum groups, RANEE KATHRYN BRYLINSKI, Pennsylvania State University.

Algebraic topology, DONALD M. DAVIS, Lehigh University.

Geometric topology, THOMAS FARRELL, Columbia University.

Recent progress on Einstein manifolds and related topics, GANG TIAN.

Abstracts for consideration for these sessions should have been submitted by the **January 4, 1990** deadline. This deadline was previously published in the Calendar of AMS Meetings and Conferences and in the Invited Speakers and Special Sessions section of the *Notices*.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Late papers will not be accommodated.

Registration

The meeting registration desk will be located in the lobby of the Keller Conference Center. The registration fees are $30 for members of the AMS or ASL, $45 for nonmembers, and $10 for students and unemployed mathematicians.

Petition Table

A petition table will be set up in the registration area. Additional information about petition tables can be found in a box in the Louisville meeting announcement in the October 1989 issue of *Notices*.

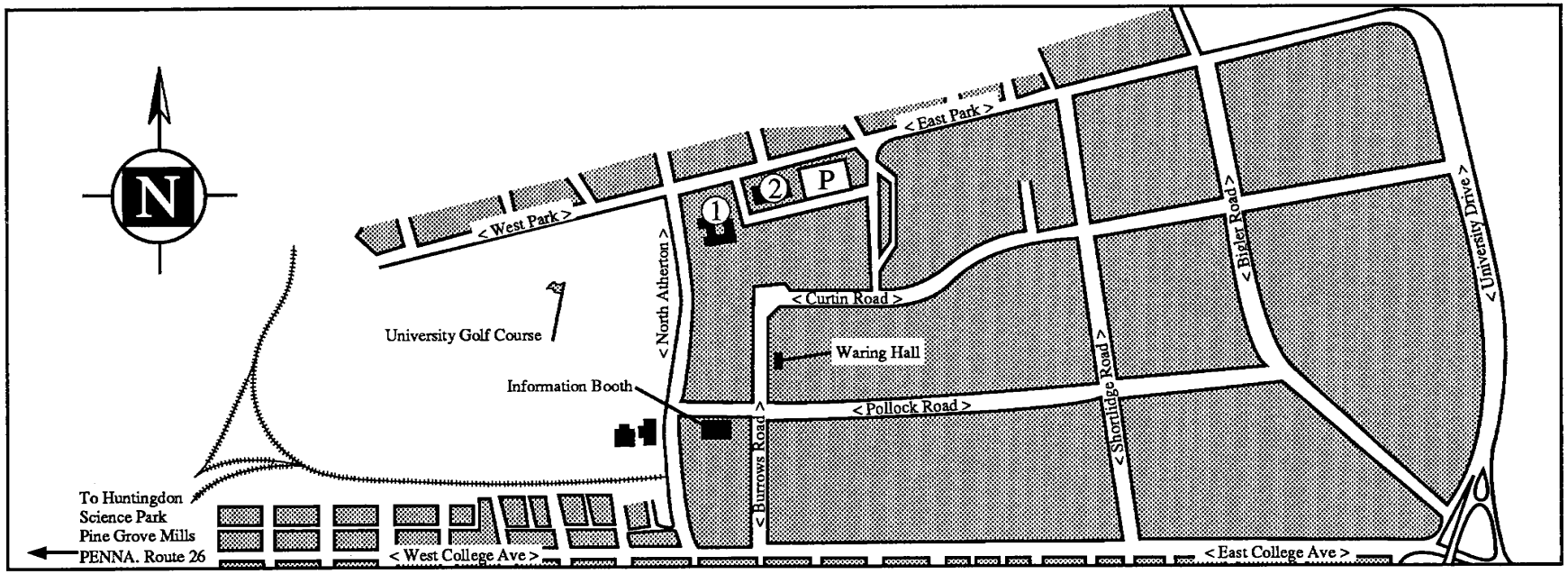
Activities of Other Organizations

The Pennsylvania Prognostic Testing Conference will be held on Friday, April 6, from 1:30 p.m. to 4:30 p.m. BERT K. WAITS, Ohio State University, will discuss the *Ohio Early Mathematics Placement Testing Program*. JOHN G. HARVEY, the University of Wisconsin, Madison, will briefly describe prognostic testing programs in the United States and discuss the effects of calculators on mathematics testing.

The **ASL** will have three invited one-hour addresses. The speakers are HARVEY M. FRIEDMAN, Ohio State University, Columbus; LEONARD LIPSCHITZ, Purdue University; and ATHANASIOS C. PHEIDAS, the University of Illinois at Urbana-Champaign.

The ASL and the Society will co-sponsor a symposium on *Number theory and decidability* to be moderated by BARRY MAZUR, Harvard University, and STEPHEN G. SIMPSON, Pennsylvania State University. The panelists will be SERGE LANG, Yale University, ANGUS MACINTYRE, Oxford University, and LOU VAN DEN DRIES, the University of Illinois, Urbana.

PENNSYLVANIA STATE UNIVERSITY



1 – Nittany Lion Inn 2 – Conference Center P – Parking

Social Event

A wine and beer reception will be held Saturday evening, April 7, from 5:00 p.m. to 7:30 p.m. in the Fireside Lounge at the Nittany Lion Inn. The admisssion price is $5 per person.

Accommodations

A block of rooms has been reserved at each of the following hotels/motels. The American Mathematical Society is not responsible for rate changes or accommodations offered by hotels/motels.

Nittany Lion Inn
North Atherton Street,
University Park, PA 16802
Telephone: 814-231-7500

Single $58 Double $68

Hampton Inn
East College Avenue,
University Park, PA 16802
Telephone: 814-231-1590

Single $46 Double $50

Sheraton/Days Inn
South Street,
University Park, PA 16802
Telephone: 814-238-8454

Single $53 Double $63

Food Service

The Nittany Lion Inn, adjacent to the Keller Conference Center, has a full service restaurant offering breakfast, lunch, and dinner. Complete listings will be available at the meeting registration desk.

Travel

US Air/Allegheny Commuter Airlines serve the State College area through the University Park Airport located five miles from campus. Limousine or taxi service is available for all flights. For reservations and information on US Air/Allegheny Commuter, please call 814-238-8414 or 800-428-4253. By bus, Trailways and Greyhound Lines connections are available to and from State College. For Trailways information please call 814-238-7362; for Greyhound information please call 814-237-5865. If traveling by car, University Park is readily accessible from both ends of the state via Interstate 80 (I-80).

Parking

Parking is available on campus for a fee of $3 per day.

W. Wistar Comfort
Associate Secretary
Middletown, Connecticut

UNIMODAL LOG-CONCAVE AND PÓLYA FREQUENCY SEQUENCES IN COMBINATORICS

Francesco Brenti

(Memoirs of the AMS, Number 413)

In recent years, considerable research has focused on unimodal or log-concave sequences that are of combinatorial interest. Although these two properties have simple definitions, proving that a sequence is unimodal or log-concave is often a difficult task requiring refined and sophisticated mathematical tools from such areas as representation theory, algebraic geometry, or classical analysis.

The main purpose of this book is to show the theory of total positivity can be very useful in studying this area. In the first part of the book, after discussing some combinatorial motivations, the author studies some of the fundamental linear transformations that preserve the log-concavity or Pólya frequency properties of a sequence. This part forms the theoretical core of the work and may be read independently from the rest. In fact, this rich and powerful theory can be applied to any situation in which log-concavity and unimodality questions arise. The second part of the book is devoted to applications to several combinatorial situations, yielding many new results and solutions to some problems that had resisted attack with other techniques. Both parts of the book point to many conjectures, open problems, and directions for further study.

1980 *Mathematics Subject Classifications*: 05A20; 05A15, 05A10, 05C20, 06A10, 11B73, 15A04, 26C10, 30C15
ISBN 0-8218-2476-7, LC 89-15137
ISSN 0065-9266
106 pages (softcover), September 1989
Individual member $10, List price $17,
Institutional member $14
To order, please specify MEMO/413NA

All prices subject to change. Shipment will be made by surface. For air delivery add, 1st book $5, each additional book $3, maximum $100. *Prepayment required.* **Order from** American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-321-4AMS (321-4267) in the U.S. and Canada to charge with VISA or MasterCard.

Albuquerque, New Mexico
University of New Mexico
April 19–21

Second Announcement

The eight-hundred-and-fifty-eighth meeting of the American Mathematical Society will be held at the Sheraton Old Town Hotel in Albuquerque, New Mexico, on Thursday, April 19, Friday, April 20, and Saturday, April 21, 1990. This meeting is being held in cooperation with the Society for Industrial and Applied Mathematics (SIAM) and being hosted by the University of New Mexico.

Invited Addresses

By invitation of the Far Western Section Program Committee, and in cooperation with SIAM, there will be six invited one-hour addresses. The speakers, their affiliations, and the titles of their talks where available are:

DAVID CAMPBELL, Los Alamos National Laboratory, *Solitary waves and their interactions in non-integrable nonlinear partial differential equations.*

PETER B. GILKEY, University of Oregon, *Can one hear the shape of a drum?*

GUNDORPH K. KRISTIANSEN, Lund University, *Recent developments in time-domain inverse scattering theory using invariant embedding techniques.*

ROBERT MAY, Oxford University, *title to be announced.*

ALAN NEWELL, University of Arizona, *Convection patterns in large containers.*

MARC A. RIEFFEL, University of California, Berkeley, *Quantum groups and operator algebras.*

Special Sessions

By invitation of the same committee, and in cooperation with SIAM, there will be seven special sessions of selected twenty-minute papers. The topics, and the names and affiliations of the organizers, are as follows:

Numerical solution of partial differential equations, RICHARD C. ALLEN, Sandia National Laboratory, JOSÉ CASTILLO, San Diego State University, and STANLY STEINBERG, University of New Mexico.

Geometry and topology of moduli spaces, CHARLES P. BOYER, and BENJAMIN M. MANN, University of New Mexico.

Real algebraic geometry, MICHAEL A. BUCHNER, University of New Mexico, and WOJCIECH KUCHARZ, University of Hawaii and University of New Mexico.

Dynamical systems: low dimensional behavior in partial differential equations, DAVID CAMPBELL, and JAMES M. HYMAN, Los Alamos National Laboratory.

Invariant embedding and inverse problems, JAMES CORONES, Ames Laboratory, PAUL NELSON, Texas A&M, and DANIEL SETH, Ames Laboratory.

Differential geometry, HOWARD FEGAN and ALEXANDER P. STONE, University of New Mexico.

Mathematical Biology, JAMES M. HYMAN, Los Alamos National Laboratory, W. T. KYNER, University of New Mexico, ANN STANLEY, Los Alamos National Laboratory, DEBORAH SULSKY, University of New Mexico, and CARLA WOFSY, University of New Mexico.

Abstracts for consideration for these sessions should have been submitted by the **January 4, 1990** deadline. This deadline was previously published in the Invited Speakers and Special Sessions section of the *Notices.*

Contributed Papers

There will also be sessions for contributed ten-minute papers. Late papers will not be accommodated.

Council

The Council of the AMS will meet at 7:00 p.m. on Thursday, April 19, 1990, in the Fireplace Room at the Sheraton Old Town Hotel.

Poster Session

A poster session of contributed papers will be organized.

Activities of Other Organizations

The Great Plains Operator Theory Seminar will also be held at the Sheraton Old Town Hotel, April 19-21, 1990.

Registration

The meeting registration desk will be located in the lobby of the Sheraton Old Town Hotel. The meeting registration desk will be open from 6:00 p.m. to 9:00 p.m. on Wednesday, April 18, and from 8:00 a.m. to noon on Thursday, April 19, Friday, April 20, and Saturday, April 21.

The registration fee is $45, with a special $25 fee for graduate students and unemployed mathematicians, and a one day fee of $25.

Social Event

On Friday evening, April 20, there will be a reception and a no-host bar at the New Mexico Museum of Natural History. During the evening participants will have exclusive access to most of the exhibits at this outstanding museum. Further information will appear in the March issue of the *Notices*.

Petition Table

A petition table will be set up in the registration area. Additional information about petition tables can be found in a box in the Louisville meeting announcement in the October 1989 issue of *Notices*.

David II Report

There will be a special presentation and discussion at the reception Friday evening concerning the upcoming National Research Council David II Report. This report is to be issued this spring and could have a major impact on all mathematics departments. The focus will be on becoming familiar with the report and discussing its use in our work.

Accommodations

A block of rooms is being held at the Sheraton Old Town Hotel, and at the Rio Grande Inn, which is within walking distance. Participants should make their own reservations directly with the hotels listed below and identify themselves as participants of the AMS and SIAM meeting in order to obtain the rates listed. Participants must make reservations 45 days in advance of the meeting to be assured of the quoted rates. The American Mathematical Society is not responsible for rate changes or accommodations offered by hotels/motels in the following list.

Sheraton Old Town Hotel
800 Rio Grande Boulevard NW
Albuquerque, NM 87104
Telephone: 505-843-6300 or 800-237-2133

Single or Double $53

Rio Grande Inn
1015 Rio Grande Boulevard NW
Albuquerque, NM 87104
Telephone: 505-843-9500

Single $29 Double $32

Travel

The Albuquerque Airport is served by most airlines. Both the Sheraton Old Town Hotel and the Rio Grande Inn provide free airport shuttle service. The Albuquerque City Bus (Sun-Tran) runs from the airport through the downtown area at seven minutes after the hour, and at thirty-seven minutes after the hour. The Sun-Tran Bus number is #50. Participants may board the bus on the west side of the airport on the lower level and the fare is sixty cents one-way. Cab service is also available for approximately seven dollars one-way.

Weather and Local Attractions

April temperatures in Albuquerque are mild, although participants are advised to bring a sweater or light jacket. Nearby ski areas may still be open at the time of the meeting. Old Town, in Albuquerque, has a historic plaza, Museum of Art, Museum of Natural History, and many restaurants, shops, and galleries. Albuquerque is also home to the world's longest tramway, the Sandia Peak Tramway.

Lance W. Small
Associate Secretary
La Jolla, California

MAA Contributed Paper Sessions at Columbus

The Joint Mathematics Meetings in Columbus, Ohio, will be held August 8 – 11 (Wednesday – Saturday), 1990. The first full announcement of the meeting will appear in the April 1990 isssue of *Notices* and the March/April issue of *Focus*. This early preliminary announcement of the Columbus meeting is made to encourage MAA members' participation and to provide lead-time for organizing the MAA sessions on contributed papers. For more detailed information on the MAA's 75th anniversary celebration in Columbus, see Gerald Alexanderson's related article in January/February issue of *Focus*.

Contributed papers are being accepted on several topics in collegiate mathematics. The topics, organizers, their affiliations, and the days they will meet are:

- *Liberal arts mathematics courses*, SOLOMON A. GARFUNKEL, Consortium for Mathematics and its Applications (COMAP), Friday August 11 (and possibly Thursday, August 10).

This session will be devoted to the mathematical content and course design for liberal arts students. We are soliciting papers which address these themes in the context of long-term literacy goals as well as core undergraduate curriculum issues.

- *Toward equity and excellence: Efforts to increase the number of minorities and women in the profession*, CAROLYN R. MAHONEY, California State University at San Marcos, Friday, August 11 (and possibly Thursday, August 10).

Papers are welcome discussing precollege interventions, college and graduate school seminar workshops, and mentor programs, institutional initiatives as well as state and national efforts aimed at increasing participation of underrepresented groups.

- *The interface between mathematics and operations research*, LINN I. SENNOTT, Illinois State University, Normal, Wednesday, August 9 (and possibly Thursday, August 10).

The session has two purposes: 1) to illustrate the contributions of mathematics to the development of operations research via such topics as linear programming, queueing theory, etc., and 2) to acquaint mathematicians with the application of operations research models. Papers are solicited in either (or both) of these areas.

Presentations are normally limited to ten minutes, although selected contributors may be given up to twenty minutes. Individuals wishing to submit papers for any of these sessions should send the following information to the MAA Washington office at 1529 Eighteenth Street, NW, Washington, DC 20036 **by May 18**:

1. Title
2. Intended session
3. A one-paragraph abstract (for distribution at the meeting)
4. A one-page outline of the presentation

Rooms where sessions of contributed papers will be held are equipped with overhead projector and screen. Blackboards are not normally available. Persons having other equipment needs should contact the MAA Associate Secretary (Kenneth A. Ross, Department of Mathematics, University of Oregon, Eugene, OR 97403) as soon as possible, but in any case prior to **June 1**. Upon request, the following will be made available: one additional overhead projector/screen, 35mm carousel slide projector, 16mm film projector, or VHS video cassette recorder with one color monitor.

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.

University Park, PA, April 1990

Robert T. Glassey
Karsten Grove
Lowell Edwin Jones
Gang Tian

Albuquerque, NM, April 1990

David Campbell
Peter B. Gilkey
Gundorph K. Kristiansen
Robert May
Alan Newell
Marc A. Rieffel

Columbus, OH, August 1990

Joseph G. Conlon
Michael G. Crandall (Progress in Mathematics Lecture)
Saunders Mac Lane (AMS-MAA)
John Morgan (Progress in Mathematics Lecture)
Michael E. Taylor

Denton, TX, November 1990

Avner D. Ash
Peter S. Constantin
John Leucke
Clarence W. Wilkerson

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 *Notices* went to the printer. The section below entitled **Information for Organizers** describes the timetable for announcing the existence of Special Sessions.

April 1990 Meeting in University Park, Pennsylvania
Eastern Section
Associate Secretary: W. Wistar Comfort
Deadline for organizers: Expired
Deadline for consideration: Expired

Ranee Kathryn Brylinski, *Classical and quantum groups*
Donald M. Davis, *Algebraic topology*
Thomas Farrell, *Geometric topology*
Gang Tian, *Recent progress on Einstein manifolds and related topics*

April 1990 Meeting in Albuquerque, New Mexico
Far Western Section
Associate Secretary: Lance W. Small
Deadline for organizers: Expired
Deadline for consideration: Expired

Richard C. Allen, José Castillo and Stanly Steinberg, *Numerical solution of partial differential equations*
Charles P. Boyer and Benjamin M. Mann, *Geometry and topology of moduli spaces*
Michael A. Buchner and Wojciech Kucharz, *Real algebraic geometry*
David Campbell and James M. Hyman, *Dynamical systems: low dimensional behavior in partial differential equations*
James Corones, Paul Nelson and Daniel Seth, *Invariant embedding and inverse problems*
Howard Fegan and Alexander P. Stone, *Differential geometry*
James M. Hyman, W. T. Kyner, Ann Stanley, Deborah Sulsky and Carla Wofsy, *Mathematical biology*

August 1990 Meeting in Columbus, Ohio
Associate Secretary: W. Wistar Comfort
Deadline for organizers: Expired
Deadline for consideration: April 27, 1990

Eiichi Bannai, Thomas A. Dowling, Dijen Ray-Chaudhuri and Neil Robertson, *Combinatorics*
Susan Jane Colley and Gary Kennedy, *Algebraic geometry*
Zita M. Divis and David Terman, *Dynamics of biological systems*
S. K. Jain and S. Tariq Rizvi, *Ring theory*
Richard J. Nowakowski, *Combinatorial games*
Surinder K. Sehgal and Ronald Solomon, *Group theory*

October 1990 Meeting in Amherst, Massachusetts
Eastern Section
Associate Secretary: W. Wistar Comfort
Deadline for organizers: Expired
Deadline for consideration: July 16, 1990

November 1990 Meeting in Denton, Texas
Central Section
Associate Secretary: Andy Roy Magid
Deadline for organizers: February 15, 1990
Deadline for consideration: July 16, 1990
Ilya Bakelman, *Geometric inequalities and convex bodies*
Scott T. Chapman and Nick H. Vaughan, *Commutative algebra*
Lisa Mantini and Roger C. Zierau, *Representation theory of Lie groups*
Mark S. Reeder, *Arithmetic groups*
Peter F. Stiller, *Algebraic geometry*

January 1991 Meeting in San Francisco, California
Associate Secretary: Andy Roy Magid
Deadline for organizers: April 16, 1990
Deadline for consideration: September 19, 1990

March 1991 Meeting in South Bend, Indiana
Central Section
Associate Secretary: Andy Roy Magid
Deadline for organizers: June 16, 1990
Deadline for consideration: To be announced

March 1991 Meeting in Tampa, Florida
Southeastern Section
Associate Secretary: Joseph A. Cima
Deadline for organizers: June 22, 1990
Deadline for consideration: To be announced

Information for Organizers

Special Sessions at Annual and Summer Meetings are held under the supervision of the Program Committee for National Meetings (PCNM). They are administered by the Associate Secretary in charge of that meeting with staff assistance from the Meetings and Editorial Departments in the Society office in Providence.

According to the "Rules for Special Sessions" of the Society, Special Sessions are selected by the PCNM from a list of proposed Special Sessions in essentially the same manner as Invited Speakers are selected. The number of Special Sessions at a Summer or Annual Meeting is limited. The algorithm that determines the number of Special Sessions allowed at a given meeting, while simple, is not repeated here, but can be found in "Rules for Special Sessions" on page 614 in the April 1988 issue of *Notices*.

Each Invited Speaker is invited to generate a Special Session, either by personally organizing one or by having a Special Session organized by others. Proposals to organize a Special Session are sometimes requested either by the PCNM or by the Associate Secretary. Other proposals to organize a Special Session may be submitted to the Associate Secretary in charge of that meeting (who is an *ex-officio* member of the committee and whose address may be found below). These proposals must be in the hands of the PCNM well in advance of the meeting and, in any case, at least nine (9) months prior to the meeting at which the Special Session is to be held in order that the committee may consider all the proposals for Special Sessions simultaneously. Proposals that are sent to the Providence office of the Society, to *Notices*, or directed to anyone other than the Associate Secretary will have to be forwarded and may not be received in time to be considered for acceptance.

It should be noted that Special Sessions must be announced in *Notices* in such a timely fashion that any member of the Society who so wishes may submit an abstract for consideration for presentation in the Special Session before the deadline for such consideration. This deadline is usually three (3) weeks before the Deadline for Abstracts for the meeting in question.

Special Sessions are very effective at Sectional Meetings and can usually be accommodated. They are selected by the Section Program Committee. The processing of proposals for Special Sessions for Sectional Meetings is handled by the Associate Secretary for the Section, who then forwards the proposals to the Section Program Committee, which makes the final selection of the proposals. Each Invited Speaker at a Sectional Meeting is invited to organize a Special Session. Just as for national meetings, no Special Session at a Sectional Meeting may be approved so late that its announcement appears past the deadline after which members can no longer send abstracts for consideration for presentation in that Special Session.

The Society reserves the right of first refusal for the publication of proceedings of any Special Session. These proceedings appear in the book series Contemporary Mathematics.

More precise details concerning proposals for and organizing of Special Sessions may be found in the "Rules for Special Sessions" or may be obtained from any Associate Secretary.

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)

Lance W. Small, Associate Secretary
Department of Mathematics
University of California, San Diego
La Jolla, CA 92093
e-mail: g_small@math.ams.com
(Telephone 619 - 534 - 3590)

Central Section

Andy Roy Magid, Associate Secretary
Department of Mathematics
University of Oklahoma
601 Elm PHSC 423
Norman, OK 73019
e-mail: g_magid@math.ams.com
(Telephone 405-325-2052)

Eastern Section

W. Wistar Comfort, Associate Secretary
Department of Mathematics
Wesleyan University
Middletown, CT 06457
e-mail: g_comfort@math.ams.com
(Telephone 203-347-9411)

Southeastern Section

Joseph A. Cima, Associate Secretary
Department of Mathematics
University of North Carolina, Chapel Hill
Chapel Hill, NC 27599-3902
e-mail: g_cima@math.ams.com
(Telephone 919-962-1050)

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 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. Contributors should know that there is a limitation in size of a single Special Session, so that it is sometimes true that all places are filled by invitation. Papers not accepted for a Special Session are considered as ten-minute contributed papers.

Abstracts of papers submitted for consideration for presentation at a Special Session must be received by the Providence office (Editorial Department, American Mathematical Society, P. O. 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.

Electronic submission of abstracts is now available to those who use the TEX typesetting system. Requests to obtain the package of files may be sent electronically via the Internet to **abs-request@math.ams.com.** Requesting the files electronically will likely be the fastest and most convenient way, but users may also obtain the package on IBM or Macintosh diskettes, available free of charge by writing to: Electronic Abstracts, American Mathematical Society, Publications Division, P.O. Box 6248, Providence, RI 02940, USA. When requesting the Abstracts package, users should be sure to specify whether they want the plain TEX, $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX, or the LATEX package.

Number of Papers Presented
Joint Authorship

Although an individual may present only one ten-minute contributed paper at a meeting, any combination of joint authorship may be accepted, provided no individual speaks more than once. An author can speak by invitation in more than one Special Session at the same meeting.

An individual may contribute only one abstract by title in any one issue of *Abstracts*, but joint authors are treated as a separate category. Thus, in addition to abstracts from two individual authors, one joint abstract by them may also be accepted for an issue.

Joint Summer Research Conferences in the Mathematical Sciences

University of Massachusetts at Amherst, MA, June 7 to July 4, 1990

The 1990 Joint Summer Research Conferences in the Mathematical Sciences will be held at the University of Massachusetts at Amherst from June 7 to July 4. It is anticipated that the conferences will be supported by grants from the National Science Foundation and other agencies.

There will be six conferences in six different areas of mathematics. The topics and organizers for the 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 and individuals submitting proposals. 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 are similiar in scientific 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 a 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 a limited number of participants in each conference. Others, in addition to those funded, will be welcome, within the limitations of the facilities of the campus. In the spring a brochure will be mailed to all who are invited to attend the conferences. The brochure will include information on room and board rates, the residence and dining hall facilities, travel and local information and a housing form to use to request on-campus accommodations. Information on off-campus housing will also be included in the brochure. Participants should make their own housing and travel arrangements. Each participant will be required to pay nominal registration and social fees.

Those interested in attending one of the conferences should send the following information to the Summer Research Conference Coordinator, Meetings Department, American Mathematical Society, Post Office Box 6248, Providence, RI 02940, through electronic mail: CAK@MATH.AMS.COM on the Internet, or by FAX: 401-331-3842.

Please type or print the following:

1. Title and dates of conference desired;
2. Full name;
3. Mailing address;
4. Telephone number and area code for office and home;
5. Member of AMS, IMS, or SIAM? If AMS, please give member code;
6. Your scientific background relevant to the topic of the conference;
7. Financial assistance requested; please estimate cost of travel;
8. Indicate if interested in attending if support is not offered. Indicate if support is not required.

Funds may also be available for foreign graduate students under the Short Term Enrichment Program (STEP) of the United States Information Agency (USIA). Students must meet the following eligibility requirements: 1. must be enrolled in full-time graduate studies at a U.S. institution of higher education; 2. are not receiving any U.S. government funds for academic support; 3. are not on refugee, immigrant, or tourist visa status; and 4. have not been awarded STEP grants previously. Those eligible should include the following information when supplying the above eight items: 1. home country; 2. student status; 3. name of institution enrolled; 4. name of an official at the institution who can verify status and financial situation.

The deadline for receipt of applications is February 23, 1990. Requests for invitations will be forwarded to the Organizing Committee for each conference for consideration after February 23. Applicants selected will receive formal invitations and notification of financial assistance from the AMS. **Requests received past the deadline will be returned.** Funds available for these conferences are limited and individuals who can obtain support from other sources should do so. Women and members of minority groups are encouraged to apply and participate in these conferences.

Any questions concerning the scientific portion of the conference should be directed to the chair or any member of the Organizing Committee.

The Joint Summer Research Conferences in the

Mathematical Sciences are under the direction of the AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences. The following committee members chose the topics for the 1990 conferences: William B. Arveson, John A. Burns, Martin Golubitsky, Daniel J. Kleitman, Anthony W. Knapp, Ingram Olkin, Mary Ellen Rudin, Stephen Simpson and Gregg J. Zuckerman.

Descriptions of the subject matter of each of the 1990 conferences appeared in the October and November *Notices*, pages 1087–1089 and 1242–1243 respectively; they were accompanied by lists of members of the respective Organizing Committees.

Thursday, June 7 to Wednesday, June 13

Probability models and statistical analysis for ranking data

MICHAEL A. FLIGNER (The Ohio State University), Co-Chair,

JOSEPH S. VERDUCCI (The Ohio State University), Co-Chair

Thursday, June 7 to Wednesday, June 13

Inverse scattering on the line

DAVID SATTINGER (University of Minnesota, Minneapolis), Chair

Thursday, June 14 to Wednesday, June 20

Deformation theory of algebras and quantization with applications to physics

MURRAY H. GERSTENHABER (University of Pennsylvania), Co-Chair

JAMES D. STASHEFF (University of North Carolina at Chapel Hill), Co-Chair

Thursday, June 21 to Wednesday, June 27

Strategies for sequential search and selection in real time

THOMAS S. FERGUSON (University of California, Los Angeles), Co-Chair

STEPHEN M. SAMUELS (Purdue University), Co-Chair

Thursday, June 21 to Wednesday, June 27

Schottky Problems

LEON EHRENPREIS (Temple University), Co-Chair

ROBERT C. GUNNING (Princeton University), Co-Chair

Thursday, June 28 to Wednesday, July 4

Logic, local fields, and subanalytic sets

LOU VAN DEN DRIES (University of Illinois at Urbana-Champaign), Chair

UNFOLDINGS AND BIFURCATIONS OF QUASI-PERIODIC TORI

H. W. Broer, B. Huitema, F. Takens, and B. L. J. Braaksma
(Memoirs of the AMS, Number 421)

In the theory of dynamical systems, the occurrence of equilibria and periodic motions, as well as their general persistence and stability properties, are now fairly well understood. Researchers also have some systematic insight into the role of external parameters. This book aims to mimic this classical theory in the case of quasi-periodic motions. These motions are most familiar in the context of the conservative dynamics of classical mechanics, but they also occur with dissipative dynamics–for example, quasi-periodic attractors play a role in the onset of turbulence.

In the first part of the book, the authors present a general treatment of the use of external parameters in various contexts, employing notions such as integrability and transversality. The second part, dealing only with dissipative cases, studies bifurcations when the hyperbolicity is mildly violated. Readers will appreciate the way the book systematically ties together a number of cases fo quasi-periodicity and the resulting improvement of accuracy. In addition, a number of new applications are presented.

1980 *Mathematics Subject Classifications*: 58, 34
ISBN 0-8218-2483-X, LC 89-18093
ISSN 0065-9266
188 pages (softcover), January 1990
Individual member $13, List price $22,
Institutional member $18
To order, please specify MEMO/421NA

All prices subject to change. Shipment will be made by surface. For air delivery add, 1st book $5, each additional book $3, maximum $100. *Prepayment required.* **Order from** American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-321-4AMS (321-4267) in the U. S. and Canada to charge with VISA or MasterCard.

1990 Summer Seminar in Applied Mathematics

Vortex dynamics and vortex methods

University of Washington, Seattle, June 18 – 29

The twenty-first AMS-SIAM Summer Seminar in Applied Mathematics will be held June 18 – 29, 1990, at the University of Washington, Seattle. The seminar will be sponsored jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics. It is anticipated that the seminar will be supported by a grant from federal agencies. The proceedings of the seminar will be published by the AMS in the *Lectures in Applied Mathematics* series.

The subject of this seminar will be the study of vorticity-dominated fluid motion. Numerical techniques and their applications will be discussed (in particular, there will be several talks about discrete vortex methods). Applied mathematical analysis and laboratory experiments will be additional lecture subjects. A combination of introductory exposition and recent research results will be presented in the lectures. A goal of the seminar is to bring together researchers with different viewpoints in order to suggest new approaches and to facilitate critical evaluations of existing techniques for the study of vorticity-dominated flows.

A partial list of invited speakers includes J. BELL, Lawrence Livermore National Laboratories; T. BUTTKE, Courant Institute of Mathematical Sciences, NYU; R. CAFLISCH, University of California, Los Angeles; A. J. CHORIN, University of California, Berkeley; W. DAHM, University of Michigan; J. FERZIGER, Stanford University; A. GHONIEM, Massachusetts Institute of Technology; R. GLOWINSKY, University of Houston; W. HENSHAW, IBM T.J. Watson Research Center; T. HOU, Courant Institute of Mathematical Sciences, NYU; A.K.M.F. HUSSAIN, University of Houston; R. KRASNY, University of Michigan; H.-O. KREISS, University of California, Los Angeles; A. MAJDA, Princeton University; P. MARCUS, University of California, Berkeley; E. MEIBURG, Brown University; J. NEU, University of California, Berkeley; S. ORSZAG, Princeton University; J. SETHIAN, University of California, Berkeley; M. SHELLEY, University of Chicago; and G. TRYGGVASON, University of Michigan.

The Organizing Committee consists of CHRISTOPHER R. ANDERSON, University of California, Los Angeles, co-chair; STEPHEN CHILDRESS, Courant Institute of Mathematical Sciences, NYU; GEORGES-HENRI COTTET, University of California, Los Angeles and Ecole Polytechnique, Paris; CLAUDE GREENGARD, IBM T.J. Watson Research Center, co-chair; and ANTHONY LEONARD, California Institute of Technology.

A brochure will be available from the AMS office which will include information on accommodations and local information. Participants will be required to pay a $20 registration fee and a $25 social fee.

Those interested in attending the seminar should send the following information to the Summer Seminar Conference Coordinator, American Mathematical Society, P.O. Box 6248, Providence, RI 02940, by electronic mail: BAV@MATH.AMS.COM, or by FAX: 401-331-3842 **before March 23, 1990.**

1. Full name;
2. Mailing address;
3. Telephone number and area code for office and home. E-mail address (if applicable);
4. Member of AMS or SIAM? Include customer code if an AMS member;
5. Anticipated arrival and departure dates;
6. Your scientific background relevant to the topic;
7. Financial assistance requested (estimate cost of travel);
8. Indicate if interested in attending if support is not offered. Indicate if support is not required.

Participants who wish to apply for a grant-in-aid should so indicate; however, funds available for the seminar are very limited and individuals who can obtain support from other sources should do so. Graduate students who have completed at least one year of graduate school are encouraged to participate.

Funds may also be available for foreign graduate students under the Short Term Enrichment Program (STEP) of the United States Information Agency (USIA). Students must meet the following eligibility requirements: 1. must be enrolled in full-time graduate studies at a U.S. institution of higher education; 2. are not receiving any U.S. government funds for academic support; 3. are not on refugee, immigrant, or tourist visa status; and 4. have not been awarded STEP grants previously. Those eligible should include the following information when supplying the above eight items: 1. home country; 2. student status; 3. name of institution enrolled; 4. name of an official at the institution who can verify status and financial situation.

1990 Summer Research Institute

Differential Geometry

University of California, Los Angeles, July 8 – 28

The thirty-eighth Summer Research Institute sponsored by the American Mathematical Society will be devoted to *Differential Geometry* and will take place at the University of California, Los Angeles. Members of the Organizing Committee are: ROBERT BRYANT, Duke University; EUGENIO CALABI, University of Pennsylvania, S. Y. CHENG, University of California, Los Angeles; H. BLAINE LAWSON, State University of New York, Stony Brook; H. WU, University of California, Berkeley; ROBERT E. GREENE, University of California, Los Angeles (co-chair); and S. T. YAU, Harvard University (co-chair).

It is anticipated that the institute will be partially supported by a grant from the National Science Foundation. Proceedings of the institute will be published in the AMS series *Proceedings of Symposia in Pure Mathematics.*

This topic was selected by the 1988 AMS Committee on Summer Institutes and Special Symposia whose members at the time were: STEVEN L. KLEIMAN (chair), HAYNES R. MILLER, RAGHAVAN NARASIMHAN, PAUL H. RABINOWITZ, THOMAS C. SPENCER, and ROBERT B. WARFIELD, JR..

The years since the last AMS Summer Institute on differential geometry, held in 1973, have been a period of explosive growth and exciting research in this subject. Seen in retrospect, the 1973 institute both recounted the accomplishments in geometry in the 1960's and early 1970's and at the same time marked some new directions for the field. Riemannian geometry in the purest sense along with the theory of characteristic classes in geometry were enjoying a triumphant period. The previous decade had seen the quarter-pinching Sphere Theorem results, on complete open manifolds of nonnegative curvature, the use of heat kernel asymptotics in invariant theory, the discovery of new invariants, and the rapid growth of the theory of foliations. The 1973 institute also heralded a new era just beginning: work on prescribed curvature, the renewed interest in the spectrum of the Laplacian, and the beginning of the study of complex manifolds using analytic $\bar{\partial}$ methods. These were all portents of a new growth period which would involve a vast increase in the use of partial differential equations in geometry.

Partial differential equations arise naturally in geometry. The association of curvature tensor to metric is itself a partial differential operator, which could be thought of as the central object of the whole subject. Many other operators also arise naturally, as the Euler-Lagrange equations for variational problems. Naturally arising variational problems yield the minimal submanifold equations, the equations for harmonic maps, the complex Monge-Ampere equation for the Ricci curvature of a Kähler manifold, and the Yang-Mills equations. Since the early 1970's, significant progress has been made in understanding all these partial differential equations and many others on manifolds. In a virtually unprecedented way, it has become possible to approach the problems of geometry by direct study of the relevant partial differential equations. The results have transformed the subject of differential geometry.

Any reasonably short list of specific theorems will be necessarily partial, so numerous are the results, but some highlights will help to indicate the magnitude of the progress made: the solution of the Calabi Conjecture on the existence of canonical Einstein-Kähler metrics; the related constructions of a canonical complete Einstein-Kähler metric on pseudoconvex domains in C^n; the solution of the positive mass conjecture of relativity; the classification of manifolds of positive scalar curvature; results on minimal surfaces in 3-manifolds which were instrumental in the proof of the Smith Conjecture; the use of harmonic maps to prove rigidity theorems for complex manifolds; the characterization of C^n by curvature and related results on gap phenomena for Riemannian manifolds; the development of harmonic function theory on manifolds; the construction of surfaces of constant mean curvature; new results on differential systems; the determination of the possible holonomy groups; the solution of the Frankel conjecture on compact Kähler manifolds of nonnegative bisectional curvature; the solution of the Yamabe problem; the deformation of manifolds of positive Ricci curvature to constant positive; and the existence of canonical metrics on stable vector bundles.

Special mention should be made of the spectacular geometric results arising from Yang-Mills theory. Yang-Mills theory is again an example of an extremal problem, in this case in effect the minimization of the square integral of the curvature of a connection on a principal bundle. When the bundle lies over a 4-dimensional manifold, an additional structural feature arises in that the Hodge star takes the curvature 2-form again to a 2-form, so that 2-forms can be symmetrized and an-

tisymmetrized relative to this operation. Out of this rich geometric structure arises the possibility of proving profound differential topological results on 4-manifolds by geometric methods. The most spectacular of these is perhaps the existence of "exotic" (nonstandard) differentiable structures on topological R^4.

There have also been revolutionary developments in Riemannian geometry outside the partial differential equations methods. New concepts and methods involving the limiting behavior of metrics and the structure of the space of Riemannian manifolds as a whole have given new life to manifold geometry. Highlights include: the characterization of almost flat manifolds; the bounds on the Betti numbers of manifolds of nonnegative curvature; finiteness and convergence theorems for manifolds satisfying curvature bounds; and a comprehensive theory of manifolds of negative curvature.

The general intention for the 1990 Summer Institute is to cover not only developments in differential geometry itself, but also related topics in other parts of mathematics and in physics. The planned format is to have a number of one hour survey lectures in the morning sessions offering more broadly sketched viewpoints, followed in the afternoons by shorter, more specialized seminar lectures in parallel sessions. For organizational purposes the subject will be divided into eight subdivisions: 1. Riemannian geometry; 2. Minimal submanifolds; 3. Complex geometry and L^2 cohomology; 4. General theory of partial differential equations on manifolds: harmonic functions and mappings, Monge-Ampere equation, differential systems, and isometric embedding; 5. Eigenvalues, heat flow, and index theory; 6. Gauge theory and geometry in mathematical physics; 7. Groups and manifolds, and dynamical systems; 8. Symplectic geometry.

While it is anticipated that seminar activity on all these topics will continue throughout the three weeks of the institute, each week will have a different specific emphasis on two or more of the eight topics. A tentative list of the topics to be addressed follows. Please note, however, that the program is subject to change:

Week One: July 8 - 14: Minimal submanifolds; general theory of partial differential equations on manifolds (harmonic functions and mappings, Monge-Ampere equation, differential systems, isometric embedding); eigenvalues, heat flow and index theory.

Week Two: July 15 - 21: Gauge theory and geometry in mathematical physics; symplectic geometry; complex geometry and L^2 cohomology.

Week Three: July 22 - 28: Riemannian geometry; groups and manifolds, and dynamical systems.

The names of the survey lecturers will be provided in a future announcement.

Accommodations will be available in the campus residence halls for participants; cafeteria style meals will be available. All facilities will be accessible to the handicapped.

Information on housing, dining, travel and the local area will be sent to invited participants in the spring. Each participant will pay a registration fee and a social fee to cover the costs of social events scheduled during the institute.

Those interested in receiving an invitation to participate in the institute should send the following information to the Summer Institute Conference Coordinator, American Mathematical Society, Post Office Box 6248, Providence, RI 02940, **prior to April 1, 1990** or through electronic mail: WSD@MATH.AMS.COM, or by FAX: 401-331-3842.

Please type or print the following:

1. Full name;
2. Mailing address;
3. Telephone number and area code for office and home;
4. Which week or weeks you wish to attend;
5. Your scientific background relevant to the institute topic;
6. Financial assistance requested;
7. Indicate if interested in attending if support is not offered. Indicate if support is not required.
8. If member of AMS, give AMS member code.

Funds may also be available for foreign graduate students under the Short Term Enrichment Program (STEP) of the United States Information Agency (USIA). Students must meet the following eligibility requirements: 1. must be enrolled in full-time graduate studies at a U.S. institution of higher education; 2. are not receiving any U.S. government funds for academic support; 3. are not on refugee, immigrant, or tourist visa status; and 4. have not been awarded STEP grants previously. Those eligible should include the following information when supplying the above eight items: 1. home country; 2. student status; 3. name of institution enrolled; 4. name of an official at the institution who can verify status and financial situation.

Requests for invitations will be forwarded to the Organizing Committee for consideration up to the **deadline of April 1**, and applicants selected will receive formal invitations and notification of financial assistance beginning in mid-May.

Mathematics Sessions at the AAAS Annual Meeting

New Orleans, Louisiana, February 15–20, 1990

The 1990 Annual Meeting of the AAAS, February 15–20 in New Orleans, will feature many outstanding expository talks by prominent mathematicians. These include the following symposia (three-hour sessions) and invited talks cosponsored by Section A (Mathematics) of the AAAS and the Society. The names and affiliations of the organizers follow (speakers' names are given in parentheses):

- *Radon and Penrose transforms: Medical imaging to supersymmetry*, organized by JAMES V. PETERS, Long Island University, C.W. Post Center, and TODD QUINTO, Tufts University. (Allan Cormack, Gabor Herman, Larry Shepp, Ron O. Wells)
- *New directions in the philosophy of mathematics*, organized by REUBEN HERSH, University of New Mexico. (Gian-Carlo Rota, Thomas Tymoczko, Nicholas Goodman, Hao Wang, Martin Krieger, Michael Resnik)
- *Computational and mathematical modeling: A study of oil production and water resources*, organized by JAMES G. GLIMM, New York University. (James Glimm, Richard Ewing, Brent Lindquist, Larry Lake, David Wilkinson)
- *Geometry today*, organized by ERWIN LUTWAK, Polytechnic University of New York, and RALPH ALEXANDER, University of Illinois at Urbana. (George Francis, Vladimir Oliker, Herman Gluck, Gian-Carlo Rota)
- *Zero knowledge proofs and their applications*, organized by SILVIO MICALI, Massachusetts Institute of Technology. (Shafi Goldwasser, Manuel Blum, Silvio Micali)
- Frontiers of physical sciences: A mathematics lecture by FRANK MORGAN, Williams College.
- One day short course on *Chaotic dynamical systems* by ROBERT L. DEVANEY, Boston University.

Section A of the AAAS is also cosponsoring various symposia that will be of interest to mathematicians and mathematics educators. These include:

- *Chaos in the balance of nature*
- *Symmetry: Its theory and application through science*
- *Mathematical models in the social sciences*
- *The contributions of R.A. Fisher to science* (symposium commemorating the centennial of R.A. Fisher's birthday)
- *Revitalizing science and mathematics education through the use of technology*
- *Project approaches in developing new introductory physics, chemistry, and mathematics curricula*
- *The development of pre-adult attitudes toward science and mathematics in Japan and the United States.*

A meeting of the Section A Committee will take place from 4:00 p.m. to 6:00 p.m. on February 15 in Marlborough B Room of the New Orleans Hilton. The committee meeting is open to all who wish to stimulate interest and activities of the mathematical sciences within the AAAS.

For details see the November 10, 1989, issue of *Science*. Additional information on Section A activities can be found in the *News and Announcements* section of the November 1989 issue of *Notices*.

International Congress of Mathematicians

Kyoto, JAPAN

August 21–29, 1990

Second Announcement

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Important Deadlines

Preregistration at reduced rate, **May 15, 1990**
Preregistration in U.S. dollars, **May 15, 1990**
Short Communications, **April 15, 1990**
These should be accompanied by preregistration document and fee
Accommodation and Excursions, **June 30, 1990**
Cancellation of Preregistration with refund, **June 30, 1990**

The logo, designed by K. Aoki and Y. Komai, has three meanings: a Japanese stone lantern, the first character of Kyoto, and the character for 10^{16}.

ICM-90 Address, Telephone, Fax, Telex and Email

Secretariat ICM-90
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icm90%kurims.kyoto-u,ac.jp@relay.cs.net

In Telephone and Fax numbers, 075 is for the Kyoto area, not needed when calling from inside Kyoto, and 0 is to be omitted when calling from outside of Japan.

Preamble

The Organizing Committee is pleased to invite you to attend the International Congress of Mathematicians in Kyoto, JAPAN, August 21–29, 1990.

This announcement describes the Congress, gives related information and explains how to register. The detachable page 35 is the registration form.

ICM-90 will be held under the auspices of the International Mathematical Union and under the sponsorship of the Science Council of Japan, the Mathematical Society of Japan, the Japan Society of Mathematical Education, The History of Science Society of Japan, The Institute of Actuaries of Japan, the Japan Society for Software Science and Technology, The Japan Statistical Society, and The Operations Research Society of Japan.

1. Location of the Congress

The Congress will be held at the Kyoto International Conference Hall (KICH) located in the northern part of Kyoto City.

Kyoto International Conference Hall
(Abbreviated as KICH in the following.)
Address: Takaraga-ike, Sakyo-ku, Kyoto 606, JAPAN
Telephone: (075)791-3111

Telex: 5422353 INTHAL J
Fax: (075) 711-1100
Cable: INTHALL KYOTO
For details, see 5. Travel (pages 191-193). The maps showing important locations are on pages 201-202.

2. Outline of the Program

The tentative program of the Congress is summarized in the following table. Some changes in the program may become necessary depending on the number of speakers.

A more definitive and detailed program will appear in the Third Announcement, which will be mailed to those who preregister for **ICM-90**.

The KICH building will open at 9 and will close 30 minutes after the close of the official program. It will not be available on **Sunday, August 26**.

<table>
<tr><th></th><th>Morning</th><th></th><th>Afternoon</th><th>Evening</th></tr>
<tr><td>Tue., Aug. 21</td><td>Opening Ceremony</td><td rowspan="5">L U N C H</td><td>Works of Prize Winners</td><td>Reception Party</td></tr>
<tr><td>Wed., Aug. 22</td><td rowspan="3">(A) Plenary Addresses</td><td rowspan="3">(B) Parallel Sessions</td><td rowspan="3">Concert</td></tr>
<tr><td>Thu., Aug. 23</td></tr>
<tr><td>Fri., Aug. 24</td></tr>
<tr><td>Sat., Aug. 25</td><td></td><td>Musical Performances</td><td></td></tr>
<tr><td>Sun., Aug. 26</td><td colspan="4">Optional Excursions</td></tr>
<tr><td>Mon., Aug. 27</td><td rowspan="2">(A) Plenary Addresses</td><td rowspan="2">Lunch</td><td rowspan="2">(B) Parallel Sessions</td><td rowspan="2"></td></tr>
<tr><td>Tue., Aug. 28</td></tr>
<tr><td>Wed., Aug. 29</td><td>(C) Plenary Addresses</td><td>Closing Ceremony</td><td>Banquet</td><td></td></tr>
</table>

(A) One hour Plenary Addresses: 9:30–10:30 & 11:00–12:00.

(B) 45-minute invited Section Lectures in 6 Parallel Sessions: 13:30–, 14:30–, 16:00–, 17:00–, 18:00–; 10-minute short communications in 8 Parallel Sessions; Coffee break 15:15–16:00.

(C) One hour Plenary Addresses: 9:30–10:30, 10:45–11:45, 12:00–13:00.

3. Mathematical Activities

(a) Works of Prize Winners

The Fields Medals and the Rolf Nevanlinna Prize will be presented at the Opening Ceremony, and presentation of works of the winners will be given in the afternoon between 14:00–16:00.

(b) Plenary Addresses

At the recommendation of the Program Committee, appointed by the International Mathematical Union (IMU), the Organizing Committee has invited 15 mathematicians to give one-hour Plenary Addresses. These addresses are intended to inform participants of major concepts, problems and trends in mathematics, and should be comprehensible to a wide audience.

We plan to show videotapes of the Plenary Addresses in the afternoon (except Saturday, Sunday and the last day) for the benefit of participants who either missed a talk or who would like to see it again.

(c) Invited Section Lectures

Also at the recommendation of the IMU Program Committee, about 140 mathematicians have been invited to give 45-minute lectures in specified sections. These lectures are intended to be surveys of significant topics related to the area of the sponsoring section, and are also accessible to nonspecialists who have closely related interests.

The list of sections is as follows. The number in parentheses indicates the approximate number of invited 45-minute lectures in that section.

1. Mathematical logic and foundations (4)
2. Algebra (8)
3. Number theory (8)
4. Geometry (10)
5. Topology (9)
6. Algebraic geometry (7)
7. Lie groups and representations (7)
8. Real and complex analysis (10)
9. Operator algebras and function analysis (7)
10. Probability theory and mathematical statistics (9)
11. Partial differential equations (10)
12. Ordinary differential equations and dynamical systems (8)
13. Mathematical physics (11)
14. Combinatorics (7)
15. Mathematical aspects of computer science (6)
16. Computational methods (7)
17. Applications of mathematics to the sciences (5)
18. History, teaching and the nature of mathematics (4)

(d) ICMI Lectures

The International Commission on Mathematical Instruction is planning five 45-minute invited talks during **ICM-90**. They will be scheduled using some spots in the last part of the Parallel Sessions for invited speakers each day.

(e) Short Communications

Ordinary members of ICM-90 will have the privilege of presenting a 10-minute oral communication of their

mathematical work (as long as capacity permits), provided that they have preregistered by **April 15, 1990**, and have also submitted an abstract, including the title of their talk and the number of the appropriate section (as listed above) by that date. After screening by the Science Committee, the acceptance/rejection of the paper (along with the section in which the paper is accepted) will be notified by the Acceptance/Rejection Card on page 205.

Abstracts may be submitted in English, French, German, and Russian. Abstracts of accepted short communications which are properly prepared and received by the deadline, will be reproduced and distributed to all Ordinary Members when they pick up their Registration Packet in Kyoto. Late papers will not be accepted. Only one short communication is allowed for each Ordinary Member.

Instructions on how to prepare an abstract are on page 207. An Abstract Form is on page 209.

Important Points

*Preregistration of the speaker is a requirement for the acceptance of the short communication.

*Be sure that your name appears on the abstract in exactly the same form as it appears on the Preregistration Form.

*Abstracts of short communications should be submitted in the same envelope as the Preregistration Form of the speaker.

*The deadline is **April 15, 1990**. The abstract together with the preregistration document must reach us by that date.

*Reply Postcards

Please enclose the two postcards on page 206. Do not forget to write the title of the paper on one side of the Acceptance-Rejection Card and the author's address on the other side of both cards. The Acknowledgment card will be returned upon receipt of the preregistration and abstract (after confirmation of payment of the registration fee); the Acceptance-Rejection card will be returned later regarding the acceptance of the abstract.

(f) Informal Seminars

Ordinary Members who wish to organize spontaneous seminars are asked to make all arrangements among themselves, either in advance or during **ICM-90**, and to request a room for a specified time from the **ICM-90** Secretariat. Such seminars cannot be scheduled at the same time as the Plenary Addresses, but may take place during the afternoons as long as rooms are available. If the **ICM-90** Secretariat is notified of a seminar by 15:00 the day before, an announcement of the seminar will be included in the Daily Newsletter which will be distributed to all participants the following day.

(g) Chalk-Talk Rooms

Several small rooms equipped with blackboards will be set aside for informal mathematical discussions among participants. Participants are asked to limit their use of these rooms to one hour as a courtesy to other participants. The room numbers and locations will be made available at the Registration Desk of the Congress. The rooms will be closed after the scheduled closing hours of official programs. They are also closed during the Reception and the Banquet.

(h) Other Mathematics Conferences

Several independent international mathematics conferences are being planned in Japan just prior to or after the Congress. The latest list of such conferences is enclosed for those who are interested. Conferences of the same kind taking place near Japan are also included in the list to the extent known to us. Inquiries about all these conferences should be directed to the respective organizers. (See Mathematical Sciences Meetings & Conferences this issue p. 223 under August & September 1990.)

4. Social Programs

(a) Opening and Closing Ceremonies

The Opening Ceremony will be held at the Kyoto International Conference Hall (KICH) at 9:30 on **Tuesday, August 21**, accompanied by traditional court music and dance (Gagaku and Bugaku). Participants should arrive at the main entrance of KICH well in advance so as to have ample time to complete registration.

As part of the Opening Ceremony program, the Fields Medals and the Nevanlinna Prize will be awarded.

Presentation of the works of the medalists and the prize winner will be given in the afternoon at the Main Hall from 14:00.

The Closing Ceremony will be held at the Main Hall on **Wednesday, August 29** at 13:15.

(b) Reception

All members of the Congress are invited to the reception party to be given at the Event Hall of KICH on **Tuesday, August 21** at 17:00. This program is complimentary.

(c) Traditional Musical Performances

All members of the Congress are invited to attend Japanese traditional musical performances to be held at the Event Hall of KICH on **Saturday, August 25**, 15:00–17:20. This event will include traditional Japanese instrument and dance presentations such as flute, drum, samisen (a string instrument), the lion dance, Kyomai (dance), and Iwami Kagura (Shinto sacred music and dancing). This program is complimentary.

(d) Concert
A Cello recital by Takuro Mori is scheduled in the evening on **Thursday, August 23**. Admission is free for registered members. Interested persons are requested to pick up tickets/programs at the registration desk.

(e) Banquet
All Members of the Congress are invited to the Farewell Banquet to be held in the Event Hall of KICH on **Wednesday, August 29**, from 14:00 to 16:00. This program is complimentary.

(f) Excursions
Sunday, August 26 will be set aside for optional excursions and no lectures will be scheduled on this day. The Japan Travel Bureau offers bus tours Ex1–Ex4 in List B on page 197.

Bookings for these tours can be made by sending in the enclosed Form C on page 211. Payment of the fee is to be made to the Japan Travel Bureau. The method of payment is described in the Form C. The Organizing Committee will subsidize ¥3,000 for each Ordinary/Accompanying Member. Please note that the subsidy is not available for on-site application. Those Ordinary and Accompanying Members who are not participating in tours Ex1–Ex4 can receive a one-day pass for buses & subways of Kyoto city by application in Form C. This pass can be used an unlimited number of times on **August 26**.

(g) Program for Accompanying Members
The programs in List A on page 196 will be held in rooms of KICH. These programs are complimentary.

A visit to the Handicraft Center for traditional handicraft demonstrations and shopping will be organized, separate form PA2 and PA14 in List C. Other visits to places for traditional handicrafts of Kyoto are being planned. Their Schedule will be announced in KICH at the time of the conference.

Bus tours PA1–PA16 in List C on pages 198-199 are offered by the Japan Travel Bureau and can be booked by sending in the enclosed Form C. Payment of the fee is to be made to the Japan Travel Bureau. The method of payment is described in the Form C. Support is available from the Congress at the rate of ¥2,000 per person. You can deduct ¥2,000 times the number of Accompanying Members who are participating at the PA-programs in List C. This amount is (F) in the Application Form on page 212. Please note that this subsidy is not available for on-site application.

Ordinary Members can participate in these programs for Accompanying Members but the subsidy is not available.

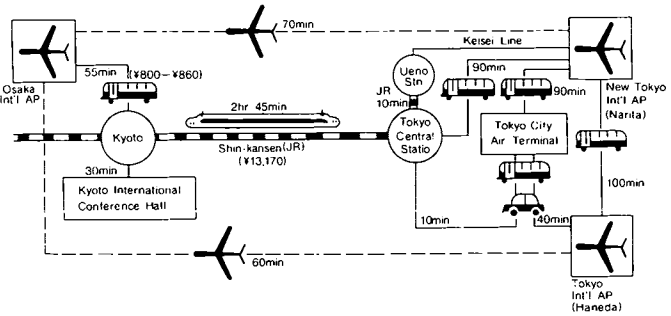
5. Travel

(a) Access to Kyoto
The Kyoto International Conference Hall is located in the northern part of Kyoto City. The airport closest to Kyoto is Osaka International Airport, which is about 55 minutes to Kyoto by the airport bus service. The buses leave the airport every 20 minutes between the hours of 7:55 to 21:30. The bus fare to Kyoto Station (the first stop) is ¥800. Buses leaving the airport 40 minutes after the hour stop at several hotels beyond Kyoto Station while the other buses stop only at Kyoto Station. For two or more stops beyond Kyoto station, the bus fare is ¥860.

Kyoto is located 500 km west of Tokyo. A bullet train service (Shinkansen) from Tokyo to Kyoto is available every 10–30 minutes from 6:00 to 21:00. It takes about 2 hours and 45 minutes, and the current fare is ¥13,170 one way, economy class, ¥17,720 one way for green cars (1st class) which have wider seats and more leg room. (These prices are for high seasons such as August.)

It would be advisable to book an international flight to Osaka (possibly via Narita Airport). For those who arrive at the New Tokyo International Airport (Narita) one of the following four routes to Kyoto are possible:

1. Take a domestic flight from Narita to Osaka (but there are only few flights available).
2. Take a domestic flight to Osaka from Haneda Domestic Airport in Tokyo. However, this requires an airport-limousine bus transfer from Narita to Haneda, which takes about 2 hours. About 15 flights are available from Haneda to Osaka each day. It is advisable to make a reservation before leaving your country.
3. Take an airport-limousine bus to Tokyo Station and then board a Shinkansen train to Kyoto (see above). It will probably take 3 hours from the arrival of the flight to boarding the train.
4. Take the Keisei Line (train) to Ueno station, the JR line to Tokyo station and then Shinkansen as explained above.



(b) ICM-90 Information on Arrival
In the afternoon and evening of **August 20**, ICM-90 personnel carrying ICM-90 sign will be available as guides at following 3 places: (i) at the arrival hall of Osaka International Airport, (ii) Kyoto Station, and (iii)

at the first airport bus stop in Kyoto. Participants are advised to complete registration at the Keihan Hotel, just in front of the bus stop and towards left across the street from Shinkansen Kyoto Station (Hachijoguchi Exit on the south side). Free Congress buses will be available from there to hotels. The Congress Admission Badge obtained at the registration will entitle you to use them.

(c) About Kyoto

Kyoto, surrounded by gracefully wooded hills, was the capital of Japan from 794 A.D. to 1868 A. D. Besides two beautiful Imperial Villas, Kyoto has about 400 Shinto shrines and 1,650 Buddhist temples which dot the entire city. Kyoto offers innumerable cultural treasures and traditional crafts and attracts visitors from throughout the world as well as from within Japan. The city of Nara, which is an ancient capital and another renowned sightseeing center of old Japanese culture, can be reached within 30 minutes from Kyoto by an express train and makes an excellent one-day excursion.

(d) Passports and Visas

Every foreign national coming to Japan must have a valid passport.

Citizens of the countries which have Reciprocal Visa Exemption Arrangements with Japan (listed at the bottom of the page) are not required to have a visa to enter Japan for a short stay.

Citizens of all other countries must obtain a visa from a Japanese Embassy or Consulate prior to entering Japan. A visa cannot be issued in Japan.

Visa Application

To apply for a visa, one is usually requested to submit a letter of invitation. Therefore please send us the following information as soon as possible which will enable us to send you an invitation letter specifically for visa application and at the same time take the necessary procedures with our Ministry of Foreign Affairs. If details are not yet fixed, please send us a temporary itinerary as soon as possible and send us full details later.

(1) Full name. (Family name, given name and others in that order.)

(2) Birth date (day/month/year).

(3) Nationality.

(4) Address, telephone number, fax number, telex number, etc.

(5) Name of your Institution and your position there.

(6) Full itinerary in Japan with dates and purposes (the date of entry to Japan, conferences [ICM-90, satellite conferences] with dates of your attendance, Universities with dates of visit, itinerary of sightseeing and the date of departure from Japan).

It is advisable that foreign participants apply for a visa at least 3 months before the date on which they plan to enter Japan. Futhermore, when applying, the participant should inform the Japanese Consular Office that he/she will be attending an international congress held under the auspices of an ICSU member Union. If an applicant has not received a visa at least one month before the beginning of ICM-90, he/he is requested to contact us by fax, telex or other rapid means of communication and to give us the following information:

Name and address of applicant,

Passport number,

Date and place of visa application.

Appropriate efforts will be made immediately to resolve any problems, and information about the status of the visa application will be communicated to the participant. Should a participant apply for a visa through a Japanese Consular Office located outside of his/her own country, this information should be conveyed to us.

Countries having Reciprocal Visa Exemption Arrangement with Japan

As of July, 1989, citizens of the following countries are not required to obtain visas for a stay of 3 months or less (6 months or less for those with *): [Since there are occasional changes in the list, please *check the current situation at any Japanese Consulate in your country.*]

Austria*, Federal Republic of Germany*, Ireland*, Liechtenstein*, Mexico*, Switzerland*, United Kingdon*,

Argentina, Bahama, Barbados, Belgium, Canada, Chile, Columbia, Costa Rica, Cyprus, Denmark, Dominican Republic, El Salvador, Finland, France, Greece, Guatemala, Honduras, Iceland, Iran, Israel, Italy, Lesotho, Luxembourg, Malta, Malaysia, Mauritius, Netherlands, New Zealand, Norway, Peru, Portugal, San Marino, Singapore, Spain, Suriname, Sweden, Tunisia, Turkey, Uruguay, U.S.A., Yugoslavia.

14 days or less for Brunei.

(e) Official Airline

Japan Air Lines (JAL) is the official carrier for the Congress. Please contact the nearest JAL overseas offices for the appropriate air schedules.

(f) Official Travel Agency

The Japan Travel Bureau, Inc. (JTB) Kyoto Office has been appointed as an official travel agency for the Congress and is prepared to handle all travel arrangements related to the Congress. Hotel information is on page 193 and the Hotel Booking Form is on page 211.

Japan Travel Bureau, Inc.
Kyoto Office
Convention dept.
Higashi-shioxoji-cho, Shimogyo-ku
Kyoto 600, JAPAN
Tel: (075) 361-7241
Fax: (075) 341-1028
Telex: 5422014 JTBKYT J

JTB will maintain a desk in the Kyoto International Conference Hall for the duration of the Congress. Reconfirmation of flight reservations and other travel arrangements can be made there.

(g) Group Flights

Participants who are interested in joining group flights from Europe and the U.S.A. are advised to contact the following travel agents. They will be pleased to provide information on reasonably priced group flights.

[Europe]
STATUS
Festival Hall, Petersfield
Hampshire, GU31 4JW
ENGLAND
TEL: (0730)88544
FAX: *0730)68865

[U.S.A.] (West)
Japan Travel Bureau
International INC.
Suite 220,
5000, Birch St.
Newport Beach, CA 92660
TEL: (714) 476-8586
FAX: (714) 476-8695

[U.S.A.] (East)
Japan Travel Bureau
International INC.
Equitable Tower 11th Floor
787 Seventh Ave.
New York, N.Y. 10019
TEL: (212) 246-8030
FAX: (212) 246-5607

(h) Currency Exchange

Major banks that handle foreign currencies are located in the downtown area of Kyoto. Banks are open from 9:00 to 15:00 on weekdays. They are closed on Saturday, Sunday, and National Holidays (that is, closed on August 25 and 26). Major foreign currencies can also be exchanged at larger hotels. It is recommended that participants purchase traveler's checks in Japanese yen or US dollars before leaving their own countries.

(i) Access to the Congress Site

On important occasions including the morning of Aug. 21, free bus transportation between major hotels and the Congress Site (KICH) will be provided.

During hours of official programs at KICH as well as in the morning, we plan to run a frequent shuttle bus service between KICH and a stop near "Kitaoji" station, so that participants can use it in conjunction with a subway and the city buses (which run frequently from, to and through Kitaoji Station) to go to KICH from hotels, from KICH back to hotels or to go to sightseeing spots.

Further information about these free bus services will be included in the Third Announcement and in the Registration Packet.

KICH can also be reached by a city bus as described below.

(j) Local Transportation (Central Kyoto City)

Subway. A municipal subway runs north-south under Karasuma Dori (street). The northern terminal of the subway is "Kitaoji" station. From there, the Kyoto International Conference Hall (the bus-stop "Kokusai Kaikan-mae") can be reached by the free shuttle bus service described in (i) or by a bus No. 北4. (The current bus fare is ¥180 one way. It takes about 15 minutes.)

City buses. Apart from the subway, the bus is the only public transportation to most places in the city. One boards the bus through the back door and gets off through the front door. For buses running only in the central part (recognizable by either the red or blue color of the bus number), the current price is ¥180 per ride. For buses running a longer distance (recognizable by the black color of the bus number), take a slip of paper (available immediately to the left of the entrance) when boarding the bus. This paper indicates the zone number of your boarding point. The fares corresponding to that number are indicated on the panelboard located at the front of the bus. (They increase as the bus moves on.) When you get off the bus, you pay the fare by putting the exact amount and the slip of paper in a box on the side of the bus driver.

Taxi. For a small size taxi, which accommodates up to 4 persons, the initial 2km is ¥470 and each additional 540m is ¥90. (An additional time charge will set in when the taxi is moving slowly.) The distance from the center of town (Shijo-Kawaramachi) to KICH is 8km and normally costs about 1,600. The price goes up about 20% between 11 o'clock at night and 5 o'clock the next morning.

(k) Car Rentals

Rental cars can be booked at the JTB desk. An international driver's license must be carried together with the driving license of the driver's home country. In Japan, vehicles travel on the left (as in England.)

6. Accommodation

(a) Hotels

A large number of rooms have been reserved for the members of ICM-90. The specially discounted room rates (in yen), which include tax and service charges (but no meals), are listed in Table A on page 200.

Hotels in Class A will provide first class accommodation. Hotels in Class B are of good quality but somewhat less luxurious than those in Class A. Hotels in Class C provide adequate and comfortable accommodation. Hotels in Class D provide rooms of compact size but with the necessary facilities.

Accommodation in Class E and Youth Hostels will be on a 3–8 persons sharing basis. There is no private bath either at Tower Restel or Youth Hostels.

Room assignments in hotels will be made for the lowest priced rooms in the category chosen on a first-come, first-served basis.

Accommodation arrangements are handled by the Japan Travel Bureau. To book accommodation, fill in the Accommodation Form (Form C) on pages 211-212 and send it to the JTB Kyoto Office as soon as possible.

A deposit of ¥20,000 per room is required. Payment of the deposit is to be made to the Japan Travel Bureau. The method of payment is described in Form C.

Confirmation of your reservation will be made by the Japan Travel Bureau. Participants who would like to stay in hotels in Class E or youth hostels are requested to choose a representative. Representatives may apply for the accommodation in Application Form C with all the names of persons who will share a room and the deposit of ¥20,000. JTB will send the Confirmation Letter to the representative. JTB will accept only the representative's Application for hotel reservation to avoid a double booking.

(b) Dining (All prices are as of Autumn, 1989)

Numerous restaurants and eating places are found in the center of Kyoto. Inexpensive breakfasts can be found at fast food chain stores and small eating places. Many restaurants close around 21:00.

Lunches at KICH range from ¥800 to ¥1,200. A buffet style lunch (i.e. you can eat as much as you want) will be arranged at the price of ¥1,200. A fixed number of tickets for the buffet lunch will be sold at KICH. Sandwiches will also be sold at KICH for a takeout lunch.

A map of nearby restaurants and eating places will be included in the Registration Packet to be given at the Registration Desk in Kyoto.

7. Registration

(a) Rules

All adults are required to wear a Congress Admission Badge to enter and to remain in the Kyoto International Conference Hall. To obtain a Congress Admission Badge, one must register.

All mathematicians who wish to attend sessions should register as Ordinary Members. Others age 16 or above should register as Accompanying Members. Those under 16 should register as Child Members.

Accompanying and Child Memberships are available only to persons who accompany an Ordinary Member and who do not participate in the scientific activities of the Congress.

Participants should be aware that registration is not considered valid until payment has been made and cleared to the ICM-90 account.

All Ordinary Members are entitled to participate in all Congress activities and will receive a Registration Packet including a Congress Admission Badge, the program, abstracts, etc. at the Registration Desk in Kyoto as well as a complimentary copy of the Proceedings when published.

All Accompanying and Child Members are entitled to participate in all social activities of the Congress. Each Accompanying Member will receive a Registration Packet for Accompanying Members including a Congress Admission Badge and information about social activities of the Congress and about sightseeing in Kyoto.

(b) Preregistraton

Complete the Preregistration Form (pages 203-204) and send it to us. (Address on page 188.) Please take note of the following important points:

(i) You are requested to attach a copy of the remittance statement you receive from your bank (or Post Office) to your Preregistration Form so that your payment can be identified and confirmed.

(ii) Registration at reduced rates is applicable if the fee is paid on or before **May 15, 1990**.

(iii) If you wish to present a short communication, an abstract should be sent together with the Preregistration Form, and we must receive them before **April 15, 1990**.

(iv) Preregistration of Accompanying and Child Members is to be made in conjunction with the preregistration of Ordinary Members.

(v) Write your mailing address on the Acknowledgement Card on page 205 and enclose it with the preregistration documents.

Those who have completed preregistration will receive the Acknowledgement Card. Be sure to bring the card as you will receive the Registration Packet in exchange for this Card at the Registration Desk in Kyoto.

(c) Registration Fees

	On or before May 15, 1990	After May 15, 1990
Ordinary Members	¥ 30,000 *	¥ 40,000
Accompanying Members	¥ 10,000 *	¥ 10,000
Child Members	free	free

* However, see (d) (iii) on the next page.

(d) Remittance

All registration fees must be paid in one of the following four ways:

Please note that bank fees are not included in the registration fee. These must be paid by the participant. Also note the following.

Cash, personal checks, credit cards and bank drafts are unacceptable.

(i) In Japanese yen by bank remittance (ask for "mail transfer" or "wiring"at your bank) to the following account:

Name of the Bank: Kyowa Bank, Shinjukunishiguchi Branch

Account Holder (Payee's Name): ICM-90, KYOTO

Account Number: 143-500940.

Address of the Bank: 1-10-1 Nishishinjuku, Shinjuku-ku, Tokyo 163-91 JAPAN

(ii) In some countries, the payment can be made either by a postal money order or by postal (GIRO) transfer into the following postal account through Post Offices instead of (i).

Account Holder: ICM-90, KYOTO

Account Number: Kyoto 2-40872

(iii) For *oversea residents, if the payment is made on or before May 15, 1990*, registration fees may be paid in *U.S. dollars* by bank remittance or postal money order to the above accounts. (Postal Transfers are not available in the U.S. A postal money order can be sent to the Secretariat.) In this case, the registration fees are $200 for an Ordinary Member and $70 for an Accompanying Member. After May 15, the registration fees must be paid in Japanese Yen, ¥40,000 for an Ordinary Member and ¥10,000 for an Accompanying Member.

(iv) Residents in Japan may send the registration fee in Japanese Yen into the above postal account through Post Offices.

(e) Cancellation and additions

Cancelation and/or additions must be made in writing to the Secretariat. Refund of the registration fee for cancellation will be sent by bank remittance to the account specified in the cancellation letter, as follows:

Cancellation by **June 30, 1990**—the amount reduced by bank handling charges and possibly by currency exchange.

Cancellation after **July 1, 1990**—No refund

(f) Registration desk

A Registration Packet will be given to each Ordinary and Accompanying Members at the Registration Desk. On **Monday, August 20, 1990**, a Registration Desk will be open during 13:00–22:30 at the Hotel Keihan, in front of the first Airport but stop in Kyoto and near Kyoto Station. (See 5(b) on page 191.) Free Congress buses will be available from there to hotels. The Congress Admission Badge obtained at the registration entitles you to use these buses.

From **Tuesday, August 21, 1990**, the Registration Desk will be at the main entrance of the Kyoto International Conference Hall.

Important for preregistered participants: Be sure to bring the Acknowledgement Card of Registration sent from us as you will receive the Registration Packet in exchange for this Card. Those who do not receive the Card should bring a proof of payment such as a copy of your bank (or Post Office) remittance statement.

There will be a separate desk for On-Site Registration.

8. Publications

(a) Abstracts

Abstracts received from Plenary and 45-minute speakers and participants presenting Short Communications will be reproduced and distributed to all registered Ordinary Members with their Registration Packet at Kyoto.

(b) Proceedings

All invited addresses and lectures as well as a report of the Congress will be published in the Proceedings of the International Congress of Mathematicians, Kyoto, 1990. The Proceedings will be co-published by the Mathematical Society of Japan and Springer-Verlag, and each registered Ordinary Member of **ICM-90** will receive a complimentary copy.

Additional copies for institutions and non-participant individuals will be available directly from Springer-Verlag. They are available at 20% off the list price, if the order is placed with Springer-Verlag not later than **August 29, 1990** (the last day of the Congress). The order can be placed at the Springer-Verlag booth in the Book Exhibit on the fith floor of KICH during the Congress.

An alphabetical list of all **ICM-90** Ordinary Members, including their mailing addresses, will be kept at the **ICM-90** Registration Desk throughout the Congress. Ordinary Members are asked to check their own listing for accuracy while they are in Kyoto as this list will be used to prepare the official list of participants for inclusion in the Proceedings and to prepare mailing lables for shipment of the Proceedings in 1991.

(c) Program

All registered Ordinary Members will receive a copy of the official **ICM-90** program of the sessions with their Registration Packet.

(d) List of Participants

A list of preregistrants will be distributed to all Ordinary Members with their Registration Packet in Kyoto.

(e) Lecture Notes and Manuscripts

Lecture notes provided by any speaker prior to his/her talk will be made available to participants. These lecture notes should be given to the **ICM-90** Secretariat. Unfortunately, **ICM-90** does not have facilities for the duplication of notes, so that only the quantity provided by the speaker will be put out for distribution.

(f) Daily News
A newsletter containing program changes, announcements of informal seminars, and information of general interest to **ICM-90** participants will be available each morning from **August 21** through **August 29** in the Registration Desk area. Participants should plan to pick up a copy every day.

The **ICM-90** Secretariat will prepare the Daily Newsletter. Participants with items for the newsletter should be sure to submit them no later than 15:00 the day before.

9. Mail and Messages

(a) Mail
All mail, cables and telegrams for persons attending the Congress should be addressed to:

Name of the Participant
c/o ICM-90
Kyoto International Conference Hall
Takaraga-ike, Sakyo-ku, Kyoto 606, JAPAN
Telephone: (075) 791-3111
Telex: 5422353 INTHAL J
Fax: (075) 711-1100
Cable: INTHALL KYOTO

These items may be picked up at the mailbox in the ICM-90 registration area.

(b) Personal Messages
Participants wishing to exchange personal messages during **ICM-90** should use the mailbox mentioned above. Message pads and pencils are provided. We regret that messages left in the box cannot be forwarded to participants after the Congress is over.

(c) Telephone Messages
To avoid mistakes, only simple messages will be taken and will be placed in the mailbox mentioned above. It will not be possible for **ICM-90** Secretariat either to check the presence of a specific person or to check whether the message actually reaches the intended person.

(d) Overseas Telephone, Cables
There are pay telephones in the Kyoto International Congress Hall (KICH). Telephone cards can be purchased at the automatic vending machine next to the pay telephone. Cables can be sent at the Hall Office on the ground floor of KICH.

10. Other Information

(1) Official Languages
English, French, German and Russian will be the official languages of the scientific programs of the Congress including Abstracts and Proceedings Manuscripts, although no interpreters will be provided. Announcements and other business matters of the **ICM-90** will be carried out in English.

(2) Exhibits
The book display will be open on the fifth floor of KICH throughout the Congress period.

(3) Invitation Letters
An official Invitation will be sent by the Organizing Committee upon request. However, this invitation does not include the payment of any expenses, such as registration, travel, or accommodation fees. This request should be sent to the **ICM-90** Secretariat.

(4) Climate and Clothing
Kyoto is usually hot and humid in August. The average temperature in August is 27.5° C (81.5° F) and the average humidity is 77%. Accordingly, light and casual clothing is appropriate. The Conference Hall and all major hotels are well air-conditioned. A light sweater or cardigan may be useful there. No formal dress will be required on any occasion during the Congress.

(5) Credit Cards
Diners Club, American Express, Visa and Master Charge cards are widely accepted at hotels, department stores, shops, and restaurants as well as by major transportation systems. Other international credit cards have not yet been introduced in Japan. Note that credit cards will not be accepted for payment of the Registration fee of the Congress.

(6) Health and Accident Insurance
The Congress fee does not include insurance for the participants against accidents, sickness, or loss of personal property. All participants are advised to make necessary arrangements for short-term health and accident insurance before departure.

(7) Tipping
Tipping is not customary in Japan.

(8) Electric Current
The electric current is 100V, 60Hz AC in western Japan (e.g., Kyoto) and is 100V, 50Hz AC in eastern Japan (e.g., Tokyo).

List A Complimentary Program for Accompanying Members in KICH

These programs are complimentary. No application is necessary. They are on first-come first-served basis as long as capacity permits. All programs will be in KICH. The rooms will be announced in the Registration Packet for Accompanying Members.

KICH-1 Movies
Date: **Tuesday, August 21**, 14:00–15:00
Wednesday, August 22, 10:00–11:00

This will be to provide information about what is available for sightseeing in Kyoto and Nara.

KICH-2 Kyogen (Japanese comic play) in English
Date: **Thursday, August 23**, 10:00–11:00

One style of traditional drama reflecting everyday and social conditions, often making use of mime and comical situations.

KICH-3 Tea Ceremony
Date: **Friday, August 24** and **Monday, August 27**
10:00, 11:00, 13:30, 14:30 and 15:30

This will be held in Hoshoan Tea-ceremony House in the Garden of KICH. Capacity for one session is 35. Free entrance tickets will be available at the Registration Desk on first-come first-served basis.

KICH-4 Origami–the Art of Paper-Folding
Date: **Tuesday, August 21**, 15:00–16:30
Friday, August 24, 10:00–12:00

Participants of this program will learn the Japanese art of folding paper into various shapes and using them as decorations. Other paper works will also be included.

List B Excursions

Sunday, August 26 will be set aside for optional excursions and no lectures will be scheduled on this day. The following Excursions are operated by the Japan Travel Bureau. For application, please fill out the enclosed Form C.

For Ordinary and Accompanying Members, the Organizing Committee will subsidize excursions by deducting ¥3,000 from excursion fee or giving a one-day pass for buses & subway of Kyoto City. Please make a choice and make an application on Form C. *Excursions can also be booked at the Congress* but ¥3,000 support and the one-day pass will not be given in that case.

Pick-up services for these excursions are available from each hotel.

Actual pick-up times will be shown on a ticket which will be handed to you during the Congress.

Fares for children are the same as adults in case the children need their seats. Otherwise, they are free of charge.

EX-1 Kyoto Afternoon Tour (Same as PA-15.)
Date: **Aug. 26 (Sun.)**, Time: 13:00–17:30, Fee: ¥5,000
Hotel—Heian Shrine—Sanjusangendo Hall—Kiyomizu Temple—Hotel

Heian Shrine: is the most representative Shinto Shrine in Kyoto, and is dedicated to Emperor Kammu, the founder of the Kyoto Capital, and Emperor Komei, the last Emperor of the Kyoto Capital.

Sanjusangendo Hall: The present building was reconstructed about the middle of the 13th century, and is regarded as one of the best specimens of architecture of its kind. The temple is also known as the "Temple of Thousand Images" because of its numerous buddhist images.

Kiyomizu Temple: is one of the oldest temples in Kyoto, its origin dating back to the 8th century. Its main hall stands on a cliff, with a wooden platform in front from which a panoramic view of Kyoto can be enjoyed.

EX-2 Nara
Date: **Aug. 26 (Sun.)**, Time: 8:00–17:30, Fee: ¥9,200 (lunch included)
Hotel—Tobihino (Deer Calling)—Kasuga Shrine—Lunch at Nara Hotel—Todaiji Temple—Kofukuji Temple—Hotel

Tobihino (Deer Calling): Hundreds of deer will gather at the caretaker's trumpet-call. This is truly a magnificent scene.

Kasuga Shrine: consists of four small shrines.

Todaiji Temple: boasts of two of the world's largest work of man. One is the Daibutsu or Great Buddha, the largest bronze statue on earth. The other is the Daibutsuden or the Hall of the Great Buddha in which the Daibutsu is enclosed. It is the largest wooden structure made by man.

Kofukuji Temple: founded in Nara in 710 as the tutelary temple of the Fujiwara nobility. A large museum houses some of the finest images of Buddha in Japan, dating from the 7th century through the Kamakura period (1185–1333). The collection is regarded as essential to the study of Japanese culture.

EX-3 Mt. Hiei & Lake Biwa
Date: **Aug. 26 (Sun.)**, Time: 8:15–16:30, Fee: ¥11,700 (lunch included)
Hotel—Enryakuji Temple—Biwako O'hashi Bridge—Lunch at Biwako Hotel—Lake Biwa Cruise—Hotel

Enryakuji Temple: is located atop Mt. Hiei in a thick grove of Japanese cypress-trees.

Biwako O'hashi Bridge: is a 1,350 meters long toll bridge.

Lake Biwa: is the largest fresh-water lake in Japan. Enjoy a delightful cruise on Lake Biwa aboard a large sightseeing vessel called the "Michigan".

EX-4 Rapids Shooting & Arashiyama
Date: **Aug. 26 (Sun.)**, Time: 9:00–16:30, Fee: ¥11,500 (lunch included)
Hotel—Kameoka—Arashiyama—Lunch at Rantei—Tenryuji Temple—Ryoanji Temple—Hotel

Rapids Shooting: is an exciting 16 kilometer, ninety-minute trip downsteam, shooting the Hozu Rapids aboard a flat-bottomed boat from Kameoka to scenic Arashiyama.

Arashiyama: is a beautiful spot where one finds within its limited area all the beauties of nature.

Tenryuji Temple: is the headquarters of the Tenryuji school of the Rinzai sect.

Ryoanji Temple: was founded by Priest Giten under the patronage of Katsumoto Hosokawa in 1448. Its gardens have remained intact, and the temple is especially noted for its five hundred year old rock garden, which contains no trees at all. The garden was constructed around 1450, soon after the founding of the temple. As it contains no plants, it is one of the very few old gardens which can be seen exactly as the designer made it.

List C Program of Accompanying Members (PA)

Persons registered as Accompanying Members may apply for this program. For application, please fill out the enclosed Form C.

Any of the following programs will be cancelled if the number of participants for the program is less than 30 persons.

For Accompanying Members, the Japanese Organizing Committee will subsidize a total amount of ¥2,000 per person for these programs.

Actual pick-up times will be shown on a ticket which will be handed out during the Congress.

A combination of morning, afternoon and night programs on the same day is possible.

Fares for children are the same as adults in case the children need their seats. Otherwise, they are free of charge.

PA-1 Yuzen Dyeing & Pottery Making
Date: **Aug. 22 (Wed.)**, 8:30–12:00, Fee: ¥8,500
Hotel—Kodai-Yuzen-en (Yuzen Dyeing)—Ashahido (Kiyomizu Pottery)—Hotel

Kodai-Yuzen-en: The Kyo-Yuzen process, devised about 300 years ago, is a unique technique for dyeing clothes beautifully. Yuzen (printed silk) is one of representative dyed goods in Japan.

You will also enjoy dyeing your own handkerchief!

Asahido (Kiyomizu Pottery): Kiyomizu-yaki (pottery) is the most popular chinaware produced in Kyoto. You can enjoy making pottery yourself and can observe the various techniques to produce Kiyomizu pottery.

PA-2 Tea Ceremony, Flower Arrangement, Origami Art (paper folding) & Shopping
Date: **Aug. 22 (Wed.)**, 13:00–16:30, Fee: ¥8,300
Hotel—Higashiyama Saihoji (Tea Ceremony, Flower Arrangement and Origami Art)—Kyoto Handicraft Center—Hotel

The tea ceremony: which originated with Sen-no-Rikyu in the 16th century is a ceremony practiced in cultured circles in Japan and is a means of cultivating mental composure and poise. In the ceremony, powdered green tea is whipped with hot water in a special tea bowl and served to participants with Japanese sweet cakes.

Demonstration and practice of flower arrangement: The lesson, in which flowers are arranged in a vase, will be given in the traditional style.

Origami Art (paper folding): The history of Origami dates back so far that it is not quite certain how and when the popular images such as the crane or treasure boat became established. Enjoy making paper images.

Kyoto Handicraft Center: A place to observe exhibitions and demonstrations of Japanese traditional arts and crafts.

PA-3 Japanese Calligraphy and Traditional Arts
Date: **Aug. 23 (Thu.)**, 9:00–12:00, Fee: ¥7,000
Hotel—Kanpo Kaikan (Japanese Calligraphy)—Kyoto Municipal Museum of Traditional Industry—Hotel

Kanpo Kaikan: You can learn the history of Japanese calligraphy and try it by yourself at the Japan Calligraphy Education Foundation.

Kyoto Municipal Museum of Traditional Industry: opened in 1976, exhibits Kyoto's traditional handicrafts and features demonstrations in the actual making of the articles.

PA-4 Kyoto Garden Tour
Date: **Aug. 23 (Thu.)**, 13:00–17:00, Fee: ¥5,200
Hotel—Myoshinji Temple—A Gardener's Residence—Ryoanji Temple—Hotel

Myoshinji Temple (Garden of Taizo-in): The entire area of the garden is covered with nearly 40 species of green and yellow moss, some grown to an unusual thickness, and is world famous for this unique feature seen nowhere else.

A Gardener's Residence: Visit a farmhouse style private home with its traditional kitchen, and its lovely garden.

Ryoanji Temple: See EX-4.

PA-5 Rapids Shooting & Arashiyama
Date: **Aug. 24 (Fri.)**, 8:30–12:00, Fee: ¥7,800
Hotel—Kameoka—Arashiyama—Hotel

Rapids Shooting: See EX-4.

Arashiyama: See EX-4.

PA-6 Japanese Religion and Kimono Show
Date: **Aug. 24 (Fri.)**, 3:00–17:30, Fee: ¥5,500
Hotel—Daitokuji Daisen-in Temple—Nishijin Textile Center—Inaba Cloisonné—Hotel

Daitokuji Daisen-in Temple: founded in 1319 by Abbot Daito. Later, Abbot Ikkyu reconstructed it as one of the chief temples of the Rinzai sect. Karesansui (garden which uses white sand and rocks to symbolize water and lands) is known for its special scenic beauty. You will observe a sermon by the priest.

Nishijin Textile Center: You will enjoy a Kimono fashion show, a demonstration of weaving, and displays of Nishijin silk fabrics.

Inaba Cloisonné: Cloisonné originated in Central Asia, which was a center of ancient culture. The art came to Japan with Buddhism. Inaba Cloisonné Co., established in 1887, has about 100 years of experience.

PA-7 Traditional Market & Cooking
Date: **Aug. 25 (Sat.)**, 8:30–13:30, Fee: ¥11,000
Hotel—Nishiki Market—Taiwa Cooking School—Hotel

Nishiki Market: Nishiki street in the downtown area is lined with many shops for daily necessities. You can find a scene of Japanese life in this shopping street.

Taiwa Cooking School: The Taiwa Cooking School was begun in 1931 by Mr. Tomojiro Tanaka, the father of the current president.

You can enjoy cooking Japanese style cuisine by yourself, then enjoy eating the results!

PA-8 Nara Full-Day Tour
Date: **Aug. 27 (Mon.)**, 8:30–17:30, Fee: ¥11,000 (lunch included)
Hotel—Byodoin Temple—Todaiji Temple—Kasuga Shrine Deer Park—Lunch at Nara Hotel—Kofukuji Temple—Hotel

Byodoin Temple: is composed of a number of splendid edifices with especially exquisite interior adornments. Its principal attraction is the main hall, the Phoenix Hall, where a magnificent sculpture of the Amitabha is enshrined.

Todaiji Temple: See EX-2.

Kasuga Shrine: See EX-2.

Deer Park: covers 525 hectares. It is noted for the tame deer that roam the park in small groups.

Kofukuji Temple: See EX-2.

PA-9 Mt. Hiei & Lake Biwa
Date: **Aug. 28 (Tue.)**, 8:30–17:00, Fee ¥13,000 (lunch included)
Hotel—Enryakuji Temple—Biwako O'hashi Bridge—Lunch at Lake Biwa—Hamaotsu—Miidera Temple—Hotel

Enryakuji Temple: See EX-3.

Biwako O'hashi Bridge: See EX-3.

Lake Biwa: See EX-3.

Miidera Temple: is the headquarters of the Tendai-Jimon sect, and was founded in 674 in memory of Emperor Kobun.

PA-10 Automobile Factory & Sake Brewery
Date: **Aug. 29 (Wed.)**, 8:30–13:00, Fee: ¥4,900
Hotel—Nissan Motors, Ltd.—Gekkeikan Sake Brewery—Hotel—KICH

Nissan Motors, Ltd: A factory belonging to one of the leading automobile companies in Japan.

Gekkeikan Sake Brewery: Sake is a traditional Japanese rice wine, produced strictly from moldy rice, steamed rice and water. Sake tasting will take place at the end of the tour.

**After this tour, you can attend the Banquet at KICH.

PA-11 Matsushita & Brewery Company
Date: **Aug. 30 (Thu.)**, 8:30–17:00, Fee: ¥10,000 (lunch included)
Hotel—Matsushita Museum of Technology—Lunch at Moriguchi Prince Hotel—Kirin Brewery Company—Hotel

Matsushita Museum of Technology: Numerous types of developed electric and electronic equipment are exhibited.

Kirin Brewery Company, Limited: The Kirin Brewery company you will visit is the biggest producer of beer in Japan. Beer tasting will take place at the end of the tour.

PA-12 Shoren-in & Gion Corner (Night Tour)
Date: **Aug. 23 (Thu.)**, 18:30–22:00, Fee: ¥8,000 (dinner not included)
Hotel—Shoren-in—Gion Corner—Hotel

Shoren-in: The garden is regarded as one of the best landscape gardens in Kyoto. Enjoy the demonstration of Koto Music and the Japanese tea ceremony.

Gion Corner: The tea ceremony, flower arranging, ancient court music, Kyoto dance by geisha girls and Bunraku puppet drama are all demonstrated here.

PA-13 Japanese Martial Arts & Tempura Dinner (Night Tour)
Date: **Aug. 27 (Mon.)**, 18:30–22:30, Fee: ¥10,500 (dinner included)
Hotel—Seibukan (Japanese Martial Arts Demonstration)—Dinner at Japanese restaurant—Hotel

Seibukan (Japanese Martial Arts Demonstration): You will be thrilled by the exciting demonstrations of JUDO, KARATE, AIKIDO, KENDO, and IAI at teh Seibukan, and still active and authentic dojo, or drill hall.

Tempura Dinner at Japanese restaurant: A delicious combination of shrimp, fish, seaweed and vegatables fried in featherlight batter, TEMPURA is something no visitor to Japan should miss.

PA-14 Kyoto Morning Tour
Date: *Daily* 8:30–13:00, Fee: ¥5,000
Hotel—Nijo Castle—Golden Pavilion—Kyoto Imperial Palace—Kyoto Handicraft Center—Hotel

Nijo Castle: served as the residence of the Tokugawa Shoguns when they visited Kyoto. The typical style of art of the warrior class which can be observed here, is in clear contrast to that of the Court noblemen.

Golden Pavilion: Yoshimitsu, the third Shogun of the Ashikaga Shogunate, laid out an extensive garden and built a beautiful pavilion toward the end of the 14th century. The pavilion became known as the "Golden Pavilion" or Kinkaku because of its gorgeous gilding.

Kyoto Imperial Palace: was originally built in 794.

(On Sundays, National Holidays, the 2nd & 4th Saturdays and several other days, Higashi-Honganji Temple will be visited instead.)

Kyoto Handicraft Center: See PA-2.

PA-15 Kyoto Afternoon Tour
Date: **Daily**, 13:00–17:30, Fee: ¥5,000
Hotel—Heian Shrine—Sanjusangendo Hall—Kiyomizu Temple—Hotel

Same as EX-1.

PA-16 Nara Afternoon Tour
Date: **Daily**, 13:00–18:30, Fee: ¥5,700
Hotel—Todaiji Temple—Kasuga Shrine—Deer Park—Hotel

Todaiji Temple: See EX-2.

Kasuga Shrine: See EX-2.

Deer Park: See PA-8.

Table A HOTEL ACCOMMODATIONS

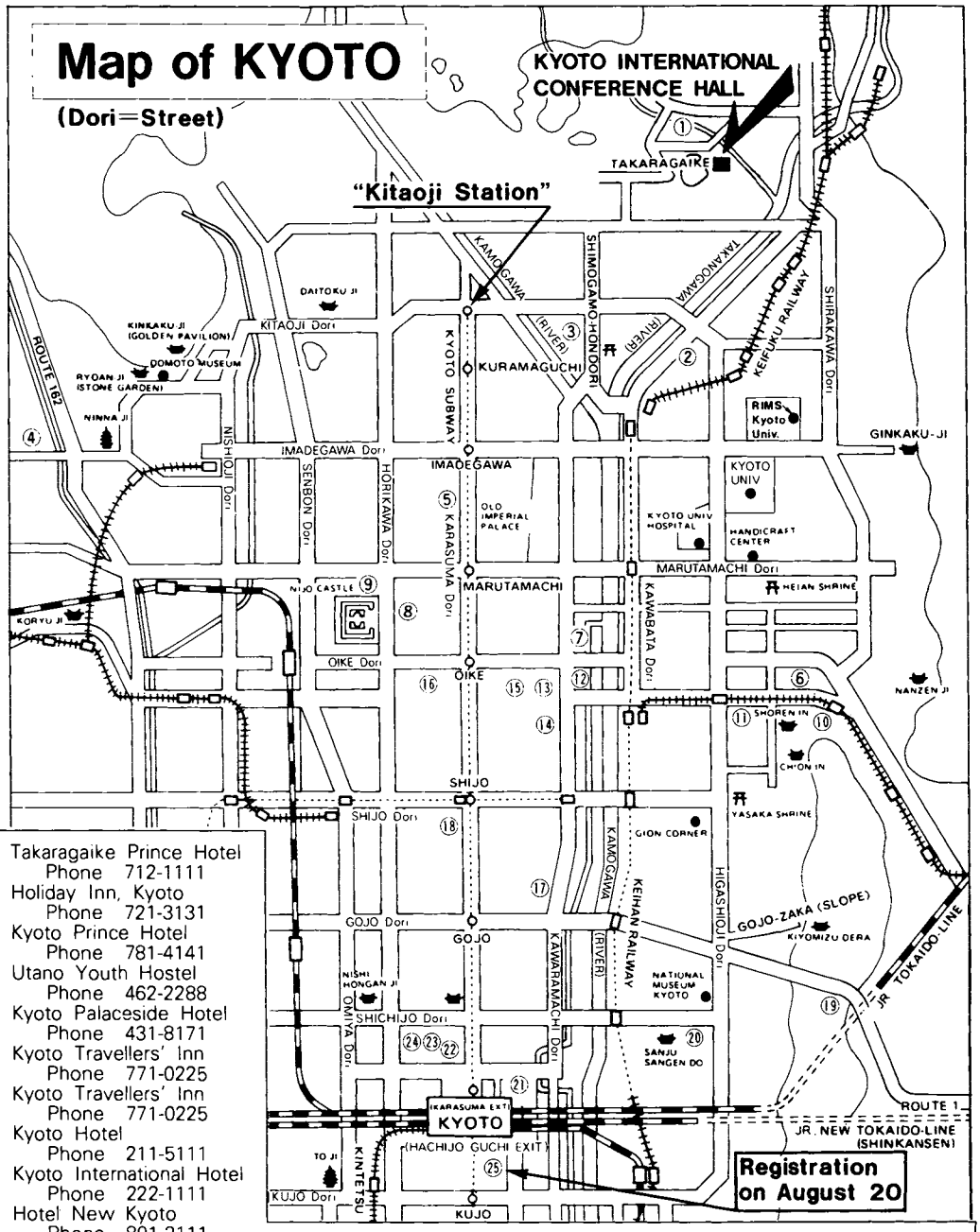
= the number in the map

Class	Name of Hotel	#	Twin	Single
A	a. Takaragaike Prince Hotel	1	¥20,000	*¥13,000
	b. Miyako Hotel	10	¥19,000	*¥12,000
	c. Kyoto Royal Hotel	12	¥18,000	¥10,000
	d. Kyoto International Hotel	8	¥18,000	¥9,000
	e. Kyoto Hotel	7	¥17,000	¥9,000
B	f. Holiday Inn, Kyoto	2	¥14,000	¥8,000
	g. Kyoto Park Hotel	20	¥13,000	¥8,000
	h. Karasuma Kyoto Hotel	18	¥13,000	¥8,000
	i. Kyoto Palaceside Hotel	5	¥12,000	¥8,000
	j. Hotel Keihan Kyoto	25	¥12,000	¥7,500
C	k. Hotel New Kyoto	9	¥11,000	¥7,000
	l. Kyoto Tower Hotel	22	¥11,000	¥7,000
	m. Kyoto Daini Tower Hotel	21	¥11,000	¥7,000
	n. Kyoto Daisan Tower Hotel	24	¥11,000	¥7,000
	o. Hotel Rich	17	¥11,000	¥7,000
	p. Hotel Alpha, Kyoto	13	¥10,000	¥7,000
	q. Sun Hotel, Kyoto	14	¥11,000	¥6,800
	r. Kyoto Garden Hotel	16	¥11,000	¥6,500
	s. Hotel Gimmond	15	¥11,000	¥6,500
	t. Kyoto Prince Hotel	3	¥10,000	¥6,500
D	u. Kyoto Tokyu Inn	19	¥9,000	¥5,500
	v. Kyoto Travellers' Inn	6	¥9,000	¥5,000
**E	w. Kyoto Travellers' Inn	6	4 beds in 1 room with bath ¥3,500/person	
	x. Kyoto Tower Restel	23	4 beds in 1 room with bath ¥3,090/person	
*** Youth Hostel	y. Utano Youth Hostel	4	3 - 8 beds in 1 room without bath ¥2,450/person	
	z. Higashiyama Youth Hostel	11	6 - 8 beds in 1 room without bath Dinner & Breakfast included ¥3,295/person	

* Single occupancy of twin room.

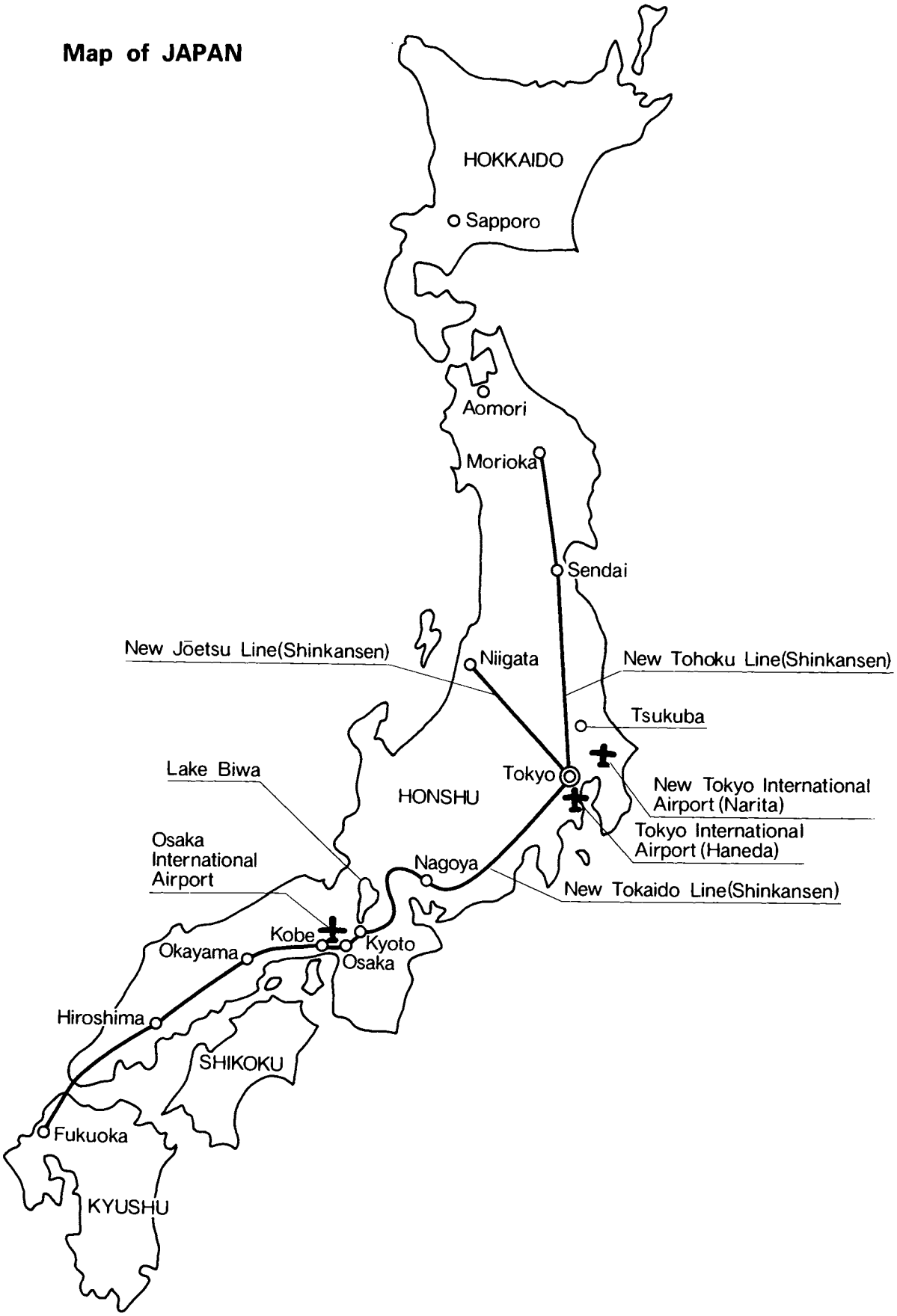
** If you wish to book a Class E room, please find 3 other people with whom you can share a room, and include their names on the application form (Form C). Only one representative out of 4 room-mates should make the application. (See page 12.)

*** Similarly, if you wish to book a room in a youth hostel, find 2 ~ 7 other people to share a room (3 ~ 8 people in one room) and choose one representative, who should write the name of all other roommates in Form C as Hotel Room-mates and make the application.



1. a) Takaragaike Prince Hotel
   Phone 712-1111
2. f) Holiday Inn, Kyoto
   Phone 721-3131
3. t) Kyoto Prince Hotel
   Phone 781-4141
4. y) Utano Youth Hostel
   Phone 462-2288
5. i) Kyoto Palaceside Hotel
   Phone 431-8171
6. v) Kyoto Travellers' Inn
   Phone 771-0225
   w) Kyoto Travellers' Inn
   Phone 771-0225
7. e) Kyoto Hotel
   Phone 211-5111
8. d) Kyoto International Hotel
   Phone 222-1111
9. k) Hotel New Kyoto
   Phone 801-2111
10. b) Miyako Hotel
    Phone 771-7111
11. z) Higashiyama Youth Hotel
    Phone 761-8135
12. c) Kyoto Royal Hotel
    Phone 223-1234
13. p) Hotel Alpha Kyoto
    Phone 241-2000
14. q) Sun Hotel Kyoto
    Phone 241-3351
15. s) Hotel Gimmond
    Phone 221-4111
16. r) Kyoto Garden Hotel
    Phone 255-2000
17. o) Hotel Rich
    Phone 341-1131
18. h) Karasuma Kyoto Hotel
    Phone 371-0111
19. u) Kyoto Tokyu Inn
    Phone 593-0109
20. g) Kyoto Park Hotel
    Phone 525-3111
21. m) Kyoto Daini Tower Hotel
    Phone 361-3261
22. l) Kyoto Tower Hotel
    Phone 361-3211
23. x) Kyoto Tower Restel
    Phone 371-1269
24. n) Kyoto Daisan Tower Hotel
    Phone 343-3111
25. j) Hotel Keihan, Kyoto
    Phone 661-0321

Map of JAPAN


HOKKAIDO
Sapporo
Aomori
Morioka
Sendai
New Jōetsu Line(Shinkansen)
Niigata
New Tohoku Line(Shinkansen)
Tsukuba
Lake Biwa
Tokyo
HONSHU
New Tokyo International Airport (Narita)
Tokyo International Airport (Haneda)
Osaka International Airport
Nagoya
New Tokaido Line(Shinkansen)
Kobe
Kyoto
Osaka
Okayama
Hiroshima
SHIKOKU
Fukuoka
KYUSHU

Form A

Preregistration Form
International Congress of Mathematicians 1990 (ICM-90)
Kyoto, August 21 - 29, 1990

Please type or print all information in Roman letters. Please avoid using cyrillic alphabets, Chinese Characters, etc.

This Form must be sent to:

Secretariat ICM-90
Research Institute for Mathematical Sciences
Kyoto University
Kitashirakawa, Sakyo-ku
Kyoto 606, JAPAN

A. Personal data of the Ordinary Member.

Name: _____ _____ _____
(Last=Family=Surname) (First=Given Name) (Middle Name/Initial)

Title: Mr. Ms. Dr. Prof. Others (Specify):

Name of Institution: _____

Telephone: _____ Fax: _____ Telex: _____

Email address: _____

Mailing Address: _____
_____
_____
_____

Nationality (Citizenship): _____

(We will need correct information in connection with your visa application.)

Name of the country to be used on the Congress Admission Badge: _____

B. Accompanying Members

Number of Accompanying Members: _____

Name(s): 1. _____ _____ _____
(Last=Family=Surname) (First=Given Name) (Middle Name/Initial)
2. _____ _____ _____
(Last=Family=Surname) (First=Given Name) (Middle Name/Initial)

C. Child Members

Number of Child Members:_____

Name(s): 1._____ _____ _____

(Last=Family=Surname) (First=Given Name) (Middle Name/Initial) (Age)

2._____ _____ _____

(Last=Family=Surname) (First=Given Name) (Middle Name/Initial) (Age)

D. Short Communication (Deadline: April 15, 1990)

1. I ☐ wish to contribute a short communication
   I ☐ do not wish to contribute a short communication

2. Abstract of Short Communication is enclosed(in case you wish to contribute)
   ☐ yes
   ☐ no because_____

E. Number of members from your party participating in social events

	reception	performances musical	concert	banquet
Ordinary Members				
Accompanying Members				
Child Members				

F. Registration Fee

	on or before May 15, 1990	After May 15, 1990	To be sent before May 15
Ordinary Member	☐ ¥ 30,000	☐ ¥ 40,000	☐ U.S. $200
Accompanying Members	¥ 10,000 X_____persons =_____		US $70 x___ persons=___
Total	¥		U.S. $

The method of payment: as explained in the copy of the enclosed bank statement.
(If proof of payment is not enclosed, please explain the situation in exact detail.)

G. Special Requests

Acknowledgement Card
International Congress of Mathematicians 1990
August 21 - 29, 1990 Kyoto, Japan

The secretariat acknowledges receipt of

☐ your preregistration
- ☐ with a proof of payment
- ☐ without a proof of payment

☐ your abstract
- ☐ in good order
- ☐ resubmission required

You will be notified of the acceptance/rejection of your short communication and the date of presentation in due course.

Date received:

Reg. No.

Please indicate your Reg. No. in any further correspondence.

Acceptance-Rejection Card
International Congress of Mathematicians 1990
August 21 - 29, 1990 Kyoto, Japan

Your abstract entitled _____

_____

_____

has been ☐ accepted in the section _____

☐ not accepted

Reg. No.

Date:

Tentative Schedule	Aug. 22	Aug. 23	Aug. 24	Aug. 27	Aug. 28

***IF AT ALL POSSIBLE, USE THE CARDS PROVIDED IN THE OFFICIAL ICM-90 SECOND ANNOUNCEMENT*

The Forms are to be enclosed with a completed Preregistration Form.
If you are applying for a Short Communication, please enclose both cards.
Otherwise, enclose only the Acknowledgement Card.
Do not forget to write your name and address on the other side of the cards.

POST CARD

Secretariat ICM-90
Research Institute for
Mathematical Sciences
Kyoto University
Kitashirakawa, Sakyo-ku
Kyoto 606, Japan

STAMP

To Name:
Address:

Country:

Air Mail

POST CARD

Secretariat ICM-90
Research Institute for
Mathematical Sciences
Kyoto University
Kitashirakawa, Sakyo-ku
Kyoto 606, Japan

STAMP

To Name:
Address:

Country:

Air Mail

Instruction for preparation of abstracts

(i) Each abstract should be typewritten (or of letter quality if a computer printer is used) on good quality, heavy, white paper, using black ribbon. If symbols are added by hand, black ink must be used. It should be in a form ready for photographic reproduction.

(ii) The typed portion must be within a rectangle 20cm (width) x 10cm (height) (8″ x 4″).

(iii) Name, affiliation, country and title should be typed single-spaced on the first lines, as in the following example:

Newton, Isaac, Cambridge Univ., United Kingdom, Theory of the Moon's Motion

(iv) A classification of the subject according to the 18 sections listed on page 189 should be given at the top of the page *outside* the rectangle containing the text of your abstract. In some cases, we might change the section of your talk so that related talks are presented in the same session. Thus the Section in the acceptance card may be different from your selection of sections.

(v) In case of joint authorship, the presenter's name should appear outside the rectangle.

N.B. If the abstract does not conform to the above rules, it will be returned to the author for resubmission.

Please refer to the example on page 208. In photographic reproduction, the size will be reduced to 70%. Thus the example on p. 208 will be reduced to the following size.

NEWTON, Isaac, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Silver Street, Cambridge, CB3 9EW, UK and GAUSS, Carl F., Faculty of Mathematics, University of Göttingen, 6400 Göttingen, FRG.–Theory of the Moon's Motion.

The irregularity of the Moon's Motion has been all along the just complaint of astronomers; and indeed we have always looked upon it as a great misfortune that a planet so near us as the Moon is, and which might be so wonderfully useful to us by her motion, as well as her light and attraction (by which our tides are chiefly occasioned) should have her orbit so unaccountably various, that it is in a manner vain to depend on any calculation of an eclipse, a transit, or an appulse of her, tho never so accurately made.....

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A National Science Foundation grant has allowed the free distribution of Volume 1 (six issues) of **UME** TRENDS in the United States to all AMS, MAA, and SIAM members, as well as a few other groups and individuals.

Volume 2 will also be distributed without charge to those requesting a subscription. Send your request to:

Customer Services Department
American Mathematical Society
P.O. Box 6248
Providence, Rhode Island 02940-6248

If you have not already done so, be sure to mail your request to continue receiving UME TRENDS.

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We hope you enjoyed the first issues of **UME** TRENDS and found the articles helpful. Future plans for the publication depend on the number of people requesting **UME** TRENDS, so please respond today.

Ed Dubinsky, Editor
UME TRENDS

Presenter = Newton

Section = 13

NEWTON, Isaac, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Silver Street, Cambridge, CB3 9EW, UK and GAUSS, Carl F., Faculty of Mathematics, University of Gottingen, 6400 Gottingen, FRG, - Theory of the Moon's Motion -

The irregularity of the Moon's Motion has been all along the just complaint of astronomers ; and indeed we have always looked upon it as a great misfortune that a planet so near us as the Moon is, and which might be so wonderfully useful to us by her motion, as well as her light and attraction (by which our tides are chiefly occasioned) should have her orbit so unaccountably various, that it is in a manner vain to depend on any calculation of an eclipse, a transit, or an appulse of her, tho never so accurately made.....

10 cm = 4 inches

20 cm = 8 inches

Form B

Abstract Form for Short Communications
(For remittance, see page 189)

Presenter =

Section =

Do not fold. Protect surface from damage.

**IF AT ALL POSSIBLE, USE THE FORMS PROVIDED IN THE OFFICIAL ICM-90 SECOND ANNOUNCEMENT*

THE INTERNATIONAL CONGRESS OF MATHEMATICIANS 1990
KYOTO, JAPAN
August 21 - 29, 1990

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FORM C

ACCOMODATIONS AND TOUR APPLICATION FORM

INTERNATIONAL CONGRESS OF MATHEMATICIANS
Kyoto, Japan, August 21 - 29, 1990

Return this form by June 30, 1990 to
JAPAN TRAVEL BUREAU
Kyoto Office, ICM-90 Dept.
Higashi-shiokoji-cho
Shimogyo-ku, Kyoto 600, Japan

Type or print in BLOCK LETTERS

Name :
Prof. / Dr. / Mr. / Mrs. / Ms. _____ (Family Name) _____ (First Name) _____ (Middle Initial)

Affiliation : _____ (University, Company, etc.)

Address : _____ (Street) _____ (City)

☐ Office
☐ Home

_____ (Province/State) _____ (County) _____ (Postal Code)

_____ (Telephone) _____ (Telex) _____ (Facsimile)

Accompanying Person(s) : _____ (Family Name) _____ (First Name)

PAYMENT: Total Amount ¥ _____(Details on the reverse side)

☐ I enclose herewith a bank draft, covering the above total, payable to the order of the Japan Travel Bureau, Inc. (Personal checks will not be accepted.)

☐ I would like to pay the above total by Credit Card. (Please fill in the following form.)

Record of Charges

Total Amount : ¥ _____
Name of Card : Diners/Master/Visa/Amex (Circle one)
Cardmember Account No. : _____
Valid Dates: _____
Cardmember Signature : _____

Payment or proof of payment should accompany this form. If it is impossible to send fees beforehand, please attach a letter to this form, explaining the reason.

Your Address for further Correspondence

Please print or type your name and mailing address in the space above. It will be used for further correspondence.

Date : _____ Signature: _____
(This application will be valid upon your receiving confirmation from JTB.)

HOTEL ACCOMMODATIONS

1st Choice:	No. of Twin Rooms: ____	Check-in: Aug.____ , 1990
2nd Choice:	No. of Single Room: ____	Check-out: Aug.____ , 1990 = ____ night(s)

Hotel Deposit: ____ room(s) X ¥20,000 = ¥ ____ (a)

Hotel Room-mates (In case of Class E Hotels and Youth Hostels) ____

EXCURSIONS (EX)

Aug. 26(Sun)	EX-1	Kyoto Afternoon Tour	¥5,000 X	person(s)	¥
Aug. 26(Sun)	EX-2	Nara	¥9,200 X	person(s)	¥
Aug. 26(Sun)	EX-3	Mt. Hiei & Lake Biwa	¥11,700 X	person(s)	¥
Aug. 26(Sun)	EX-4	Rapids Shooting & Arashiyama	¥11,500 X	person(s)	¥
				Subtotal :	¥ (b)

☐ I prefer to have a deduction from the tour ¥3,000 X ____ person(s) ¥ ____ (c)

☐ I prefer to have a One-Day pass of buses and subway ____ person(s)

(b) – (c) ¥ ____ (d)

PROGRAMS FOR ACCOMPANYING MEMBERS (PA)

Aug. 22(Wed)	PA-1	Yuzen Dyeing & Pottery Making	¥8,500 X	person(s)	¥
Aug. 22(Wed)	PA-2	Tea Ceremony, Flower Arrangement, Origami Art & Shopping	¥8,300 X	person(s)	¥
Aug. 23(Thu)	PA-3	Japanese Calligraphy & Traditional Arts	¥7,000 X	person(s)	¥
Aug. 23(Thu)	PA-4	Kyoto Garden Tour	¥5,200 X	person(s)	¥
Aug. 24(Fri)	PA-5	Rapids Shooting & Arashiyama	¥7,800 X	person(s)	¥
Aug. 24(Fri)	PA-6	Japanese Religion & Kimono Show	¥5,500 X	person(s)	¥
Aug. 25(Sat)	PA-7	Traditional Market & Cooking	¥11,000 X	person(s)	¥
Aug. 27(Mon)	PA-8	Nara Full-Day Tour	¥11,000 X	person(s)	¥
Aug. 28(Tue)	PA-9	Mt. Hiei & Lake Biwa	¥13,000 X	person(s)	¥
Aug. 29(Wed)	PA-10	Automobile Factory & Sake Brewery	¥4,900 X	person(s)	¥
Aug. 30(Thu)	PA-11	Matsushita & Brewery Company	¥10,000 X	person(s)	¥
Aug. 23(Thu)	PA-12	Shoren-in & Gion Corner (night)	¥8,000 X	person(s)	¥
Aug. 27(Mon)	PA-13	Japanese Martial Arts & Tempura Dinner (night)	¥10,500 X	person(s)	¥
Aug. ____	PA-14	Kyoto Morning Tour (Fill in date!)	¥5,000 X	person(s)	¥
Aug. ____	PA-15	Kyoto Afternoon Tour (Fill in date!)	¥5,000 X	person(s)	¥
Aug. ____	PA-16	Nara Afternoon Tour (Fill in date!)	¥5,700 X	person(s)	¥
				Subtotal :	¥ (e)

Support from the Congress	¥2,000 X	person(s)*	¥ (f)
	(e) – (f)		¥ (g)

* The number of accompanying persons participating in PA.

Total (a) + (d) + (g) = ¥ ____

*The number of accompanying persons participating in PA.

The Accidental Mathematician

*Michael Albertson**

The Organizing Committee of the International Congress has earned our gratitude. They amply document a carefully planned event; however, a little more information might increase your enjoyment. Here is some of what I would tell my friends about going to Kyoto.

Invest a little time now. **First**, pick up some language. Before our first visit to Japan we took an evening course (twice a week for ten weeks). Even that miniscule amount offered us opportunities that were not available to typical tourists. As an alternative there are some language tapes that are commercially available. We have been satisfied with Japanese, Module 1 [Advanced Memory Research]. Practice listening and speaking while commuting. Together with the above obtain a copy of *Everyday Japanese* [Schwarz and Ezawa, Passport Books]. It is superb.

Second, learn something about Kyoto. *Kyoto, a Contemplative Guide* [Mosher, Tuttle] is on everyone's short list of what to read about the city. Although its details (prices, transportation, hours, etc.) are outdated, the historical descriptions are vivid. There are a number of guidebooks available but we have not discovered one to recommend without reservation. For example *Kyoto, Seven Paths to the Heart of the City* [Durston, Kodansha] contains excellent photographs and suggestions for walks, but its details and maps are too often inaccurate.

Third, learn something about the rest of Japan. If you have the time, money, and inclination, there is much to see not too far from Kyoto. There are numerous Guide books: Japan Solo may be slightly better than most. Tokyo is an especial favorite of mine, and *Discover Shitamachi* [Enbutsu, Shitamachi Times] is the best way to find out about it. If you are considering travel around Japan, look into a Japan Rail pass. For a little more than the round trip cost from Tokyo to Kyoto on the Shinkansen you can purchase a week of free rail transportation.

Finally immerse yourself in all things Japanese. Your library will have Japanese fiction in translation: your video store will have movies to rent: CNN has a weekly news program on Japan. Practice eating with chopsticks.

Most of the remainder of this article is meant to be read in parallel with the second announcement. For ease of reference, the numbering scheme is the same.

5a. The Kyoto International Conference Hall is located in what we would call the suburbs of Kyoto. Although the design is based on that of ancient Buddhist temples, the scaling and the materials cause the building to remind me of a sci-fi starship. However, its setting is congenial. Immediately behind the center, there is a park with several trails and a lake where rental boats are available.

5b. The tourist bureau gives out an excellent map of Kyoto. It shows major sites and transportation lines in English as well as Kanji. Thus if you show it to a taxi driver, he will be able to read it as well. They also publish (in English) a monthly Visitor's Guide. If these are not available at the registration desk at the Keihan Hotel then you can obtain them at the Tourist Information Center. This is located on the west side of Karasuma-dori just north of the station. This center is open during standard Japanese business hours; the staff is both exceedingly helpful and fluent in English.

5h. You will probably need yen for such items as ground transportation immediately after arrival, but do not buy a lot in the United States. The "spread" at U. S. banks (the difference in the price to buy and sell yen) is likely to be several times that of a Japanese bank. It will take some time to change dollars or traveler's checks in a Japanese bank: you fill out currency exchange forms and hand them over together with your dollars or checks at the counter, then sit until your number or name is called indicating that your cash is ready. The rates at hotels will not be quite as attractive as at Japanese banks.

5i. The free bus service provided by the conference sounds excellent. Should you want to travel from the Conference Center to Kitaoji when a bus is not available,

*EDITOR'S NOTE: Michael Albertson is a professor of mathematics and computer science at Smith College, Northampton, MA 01063, albertson@smith.bitnet. Last spring he spent a sabbatical as a visiting scholar at Doshisha University in Kyoto. He and his wife and three children lived in Iwakura, less than a kilometer from the Conference Center. He and Joan Hutchinson have recently co-authored the book *Discrete Mathematics with Algorithms*, John Wiley & Sons, Inc.

a taxi would hold four and cost about 1000 yen.

5j. Subway. To ride on the subway, purchase a ticket at a vending machine in the station. The amount of the fare will depend on the distance you want to travel. Some machines will change 1000 yen notes: all will change coins. There are large subway maps with fares above the vending machines. Insert your ticket in one of the machines at the gate. Watch someone to see where. Be sure to pick your ticket up at the other end of the machine, since you will need it to get out of the station where you get off.

5j. City buses. When you get on a bus, work your way towards the front so you can be ready to get off. Take a seat if one is available. The gray colored seats near the front on the left are reserved for senior citizens. The buttons located next to the seats and overhead signal the driver to stop at the next stop. Bus drivers tend not to answer questions. Note that the buses have a machine next to the driver that will change a 1000 yen note as well as various coins. The drivers can also give you small change (e.g. 20 yen if you put two 100 yen coins in the machine when the fare is 180 yen). There is a recorded voice that announces popular tourist stops in English.

5j. Taxi. The left rear door opens automatically.

5k. I do not recommend attempting to drive in Japan unless you read Kanji and are used to driving on the left side of the road.

6a. The Takaragaike Prince is across the street from the conference center and looks pretty fancy from the outside. The Miyako is a Kyoto landmark. In general, hotel rooms in Japan are smaller than their counterparts in the U. S., but equipped with more gadgets. A pot to make hot water for tea seems to be standard. The hotel will provide (green) tea bags. If you are a coffee addict you might want to bring a jar of instant coffee.

6b. Kyoto is an international city and, as you might expect, has a wide variety of eating establishments. Numerous restaurants serve western style food; however, the preparation tends to be indifferent and the prices high. Chinese restaurants are plentiful but you can probably get better Chinese food in this country. We ate out often, at small restaurants, fancy restaurants, hotels, and street vendors; and we had only one awful experience - the restaurant was trying to be Swiss. My principal advice is to eat Japanese.

There are small Japanese restaurants all over the city. Most have glass cases with plastic copies of the dishes on the menu and their prices. You don't need to know the name of anything: pointing suffices. The set meals, "teishoku" (tay-show-koo), tend to be a good value. Usually these have rice, soup, and a small saucer of pickled vegetables accompanying the main dish. Stuff on noodles (sometimes cold) is also popular. Note that the rice is of the short grained variety: it will seem somewhat sticky. My favorite lunch (take out) was a box of sushi - for 600 yen there would be about a dozen pieces. Expect to pay anything above 1000 yen for dinner in a Japanese restaurant. If it looks fancy, the price could be astronomical. Skip dessert. Expensive restaurants will automatically add a service charge to the bill: reasonable ones include it in the price. Don't tip.

There are several alternatives for breakfast. Small restaurants will offer what is called a morning set consisting of a boiled egg, toast and coffee (no refills): this might cost 400 yen. The major hotels also offer a breakfast buffet. For perhaps 1500 yen, you can serve yourself eggs, fruit, toast, juice, coffee, as well as rice, fish, miso soup, and other Japanese delicacies. Finally, Japanese bakeries are excellent: I recommend croissant, baggette, and many of the pastries. Here the etiquette is to pick up a tray and a pair of tongs when you enter, select what you want with the tongs, and take it to the cashier, who will wrap it. If you pick up something that is heavier than you expect, put it back. It is probably filled with a brown bean paste called "an" (ahn): an acquired taste.

Kyoto is filled with coffee shops. They are places to sit and read or talk. The coffee tends to be strong, come in small cups, and cost 400 yen or more. If you are not there at meal-time, you won't be rushed. There are many familiar fast food chains. McDonalds has recognizably the same food with reasonable prices. If you have a craving for pizza, practice abstinence. Vending machines are more common than here and have a greater variety of both hot and cold items. Canned sodas are 100 yen, but don't expect sugar-free.

7d. As this is being written, the better deal is to pay for registration in dollars. This will remain true as long as the value of the dollar is below 150 yen. I recommend a Postal money order sent directly to the Secretariat (the cost will be $3).

9d. Telephones in Japan are easy to use, and pay phones are readily available, though some only accept NTT phone cards. Calling the U.S. from Japan is more expensive than in the opposite direction.

10(5). Japan is much more of a cash society than we are. Credit cards are not as widely accepted as this paragraph suggests. You can buy a lot with plastic, but you will need cash for admissions as well as for restaurants and merchants who do not specially cater to tourists.

Sightseeing. During your stay in Kyoto, you will probably want to see some of the major temples, shrines, gardens, etc. The tours suggested in the second announcement, run by the Japan Travel Bureau, are likely to be well organized, informative, and relatively comfortable (air conditioned busses, etc.) On the other hand, their schedule will be inflexible, and you will not have the opportunity to explore on foot, which is one of Kyoto's greatest pleasures. If you travel in a small group and use public transport and taxis, you should be able to arrange

your own tour for less money. A clerk in your hotel will write your various destinations for you in Kanji, should you get hopelessly lost. The dangers you expect in a large city here are virtually nonexistent in Kyoto. It is a good idea to carry small packs of tissues since paper is not usually available in public restrooms. A small cloth to dry your hands after washing is similarly recommended. While Japanese-style toilets are still common, western-style are almost always available.

EX-1. The Heian Shrine and Kiyomizu are two must-see sights. The former, including its garden, takes about an hour to explore. The temple compound at Kiyomizu is only part of the reason for a visit here. The nearby streets, especially the Sannenzaka, comprise a historic preservation district. One can easily spend several hours here. From Kiyomizu it is mostly downhill towards the city. I would pass on the Sanjusangendo.

EX-2. Todaiji temple and its Daibutsu are impressive. You can easily arrange your own excursion to Nara by train.

EX-3. Mt. Hiei rises about 850 meters above northeastern Kyoto. It is the dominant geographical feature near the conference center. One can get to the top by hiking or by taking a cable car. The station is just a short cab ride from the conference center. There are temples, huge cypress trees, and a rotating observation deck. Smog frequently obscures an otherwise outstanding view.

EX-4. I have never done the rapids to Arashiyama, but friends highly recommend it. The stone garden at Ryoanji is justly famous, though it will probably be very crowded on a Sunday afternoon.

Program for Accompanying Members. Some of the listed programs include an introduction to various Japanese crafts. I don't feel qualified to comment on how rewarding such a trip might be.

PA-2,3,6. Certainly the Museum of Traditional Industry, the Kyoto Handicraft Center, and the Nishijin Textile Center are worth a visit - good things to do on a rainy day.

PA-7. Visiting a traditional Japanese market such as Nishiki is fascinating: wandering through a supermarket or the basement food section of one of the large department stores would be an interesting contrast. Nishiki is not far from the intersection of Sanjo and Kawaramachi. Also nearby are Daimaru, my favorite department store; Maruzen, a bookstore with a surprisingly large collection of titles in English (upstairs); and Teramachi, a covered pedestrian street full of souvenir shops. A visit here can be combined with an early evening stroll through the Pontocho and/or Gion sections.

PA-12. The gardens and screens at Shoren-in are lovely. The first time we visited Kyoto we went to Gion Corner and were not impressed.

PA-14. Nijo Castle is a favorite. This could be combined with Daitokuji. Instead of the Golden Pavilion (Kinkakuji) try the Silver (Ginkakuji). The gold on the former is garish, while the gardens at the latter are exquisite. Ginkakuji is less than fifteen minutes by number 5 bus from the Conference Center. Skip the Imperial Palace, though the grounds are a nice place for a picnic.

The planned excursions visit most of the famous Kyoto sights. There is one half-day trip that would make an excellent addition. Northeast of Kyoto, past Mt. Hiei is the rural village of Ohara. This is accessible by city bus from a stop not too far from the Conference Center. Ohara contains a number of ancient temples. At Sanzen-in, the most famous, you will be required to trace some calligraphy (this is a tax dodge) as well as pay a stiff admission fee. The grounds are sublime. For those travelling with children, the movie village Eigamura in the western part of Kyoto is likely to be a big hit.

Savoir Faire. If you are planning on visiting a Japanese mathematician at his or her university or perhaps enjoying a social occasion together during the conference, bring a small something that represents your hometown or institution. A small picture book would suffice - anything typical would be appropriate. An invitation to a Japanese home is considered a great honor: it is much more common to entertain visitors at a restaurant. Should you receive such an invitation, take flowers at least. When we invited Japanese visitors to our house, they, as often as not, brought an entire meal's worth of food with them.

Souvenirs. Consider before you go what you might want to bring back. The items that we typically identify as Japanese (electronics, cameras, etc.) are likely to be much more expensive than in your local store. For example, a videocamera in Kyoto might be twice the price that Sears sells it for. Of course there are some such things that you can buy in Japan that you can't buy here: we brought friends a heated toilet seat. On this trip I plan on bringing back an automatic rice cooker. Our favorite souvenirs from Japan are silks, ceramics, and art. Forget buying a new silk kimono: they are interesting to price. You can get antique haori coats and kimono at Nishimura on Furomonzen in the Gion section. A man's black silk haori coat with an elegant ukiyo-e lining might cost 15000 yen: without the lining, maybe a third of that. A woman's haori or kimono might even be cheaper, depending on the style and condition. For widely available souvenirs such as paper fans, t-shirts, cotton yukata, and lacquer chopsticks, prices and quality will vary depending on where you buy. Hotel gift shops are likely to be expensive. Consider ticket prices as fixed, i.e. do not attempt to bargain.

Assuming that you have done your homework, the best advice I can offer is to be adventurous. Try anything - go anywhere. The Japanese will be extraordinarily helpful, kind, and generous.

Mathematical Sciences Meetings and Conferences

THIS SECTION contains announcements of meetings and conferences 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 *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. Asterisks (*) mark those announcements containing new or revised information.

IN GENERAL, announcements of meetings and conferences 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. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences should be sent to the Editor of *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 *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.

EFFECTIVE with the 1990 volume of *Notices*, the complete list of Mathematical Sciences Meetings and Conferences will be published only in the September issue. In all other issues, only meetings and conferences for the twelve-month period following the month of that issue will appear. As new information is received for meetings and conferences that will occur later than the twelve-month period, it will be announced at the end of the listing in the next possible issue. That information will not be repeated until the date of the meeting or conference falls within the twelve-month period.

1989–1990. **Academic Year Devoted to Hyperbolic Geometry and Quasiconformal Mappings**, Mittag-Leffler Institute, Djursholm, Sweden. (Dec. 1988, p. 1584)

1989–1990. **Special Year in Geometry**, University of Maryland, College Park, MD. (Dec. 1989, p. 1432)

1990. **IMACS International Workshop on Massively Parallel Methods in Computational Physics**, Boulder, Colorado. (Sep. 1989, p. 914)

1990. **IMACS Conference on Computer Aided Design**, Yugoslavia. (Sep. 1989, p. 914)

* 1990. **CWI-IMACS Symposia on Parallel Scientific Computing**, Amsterdam, The Netherlands.

ORGANIZING COMMITTEE: H.J.J. teRiele (CWI), Th. J. Dekker (Univ. of Amsterdam), H.A. van der Vorst (Univ. of Delft).

INFORMATION: H.J.J. teRiele, Dept. of Numerical Math., Stichting Mathematisch Centrum, Centrum voor Wiskunde en Informatica, Kruislaan 413, 1098 SJ Amsterdam, The Netherlands.

1990–1991. **Academic Year Devoted to Operator Theory and Complex Analysis**, Mittag-Leffler Institute, Djursholm, Sweden. (Dec. 1989, p. 1432)

March 1990

1–4. **Mathematicians and Education Reform Network**, Ohio State University, Columbus, Ohio. (Nov. 1989, p. 1248)

4–10. **Interval Methods for Numerical Computation**, Oberwolfach, Federal Republic of Germany. (Mar. 1989, p. 315)

5–7. **SIAM Conference on Applied Probability in Science and Engineering**, New Orleans, LA. (Nov. 1988, p. 1389)

5–7. **Symposium on Symbolic Computation (on the occasion of the sixtieth birthday of Erwin Engeler)**, Zürich, Switzerland. (Sep. 1989, p. 915)

5–9. **Bifurcations Dynamiques**, Marseille, France. (Jan. 1990, p. 53)

* 9–11. **Sixth Annual Geometry Festival**, University of Maryland, College Park, MD.

INVITED SPEAKERS: M. Gromov, R. Schoen, S.-T. Yau.

INFORMATION: P. Green, 301-454-4800, psg@julia.umd.edu; H. Gluck, 215-898-8178; D. Gromoll, 516-632-8286; K. Grove, Mathematics Dept., Univ. of Md., College Park, MD 20742, 301-454-7075; H. King, 301-454-7068, hck@athena.umd.edu; S. Wolpert, 301-454-5014, saw@athena.umd.edu; J.Y. Wu, 301-454-3275.

11–17. **Mathematische Stochastik**, Oberwolfach, Federal Republic of Germany. (Mar. 1989, p. 315)

12–16. **Twist Mappings and Their Applications**, Minneapolis, MN. (Nov. 1989, p. 1248)

13–16. **Twenty-first Annual Iranian Mathematics Conference**, University of Isfahan, Iran. (Jul./Aug. 1989, p. 766)

14–19. **East European Category Seminar**, Predela, Bulgaria. (May/Jun. 1989, p. 601)

15–21. **International Conference on Dif-**

ferential Equations and Mathematical Physics, University of Alabama at Birmingham, Alabama. (Oct. 1989, p. 1094)

16–17. **Central Section Meeting of the AMS**, Kansas State University, Manhattan, KS.

INFORMATION: W. Drady, AMS, P.O. Box 6248, Providence, RI 02940.

16–18. **Conference on Stochastic Flows**, University of North Carolina at Charlotte, NC. (Dec. 1989, p. 1434)

18–24. **Masstheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1989, p. 315)

18–24. **Third Centenary Celebration of the Mathematische Gesellschaft in Hamburg**, Bundesstraße, Hamburg. (Oct. 1989, p. 1094)

19–22. **Eleventh Annual National Graphics Association Conference and Exposition**, Anaheim, CA. (Jul./Aug. 1989, p. 766)

19–24. **US-USSR Approximation Theory Conference**, University of South Florida, Tampa, FL. (Jul./Aug. 1989, p. 766)

19–April 13. **Mathematical Physiology and Differential-Delay Equations**, Minneapolis, MN. (Nov. 1989, p. 1248)

20–23. **Directions in Matrix Theory**, Auburn, AL. (May/Jun. 1989, p. 601)

*23. **Twelfth N.M. Riviere Memorial Lecture**, University of Minnesota, Minneapolis, MN.

INVITED SPEAKER: Jürgen Moser.
INFORMATION: E. Fabes, School of Mathematics, University of Minnesota, Minneapolis, MN 55455, 612-625-9365.

23–24. **Southeastern Section Meeting of the AMS**, University of Arkansas, Fayetteville, AR.

INFORMATION: W. Drady, AMS, P.O. Box 6248, Providence, RI 0240.

23–24. **University of Arkansas' Fourteenth Annual Lecture Series in Mathematical Sciences**, Univ. of Arkansas, Fayetteville, Arkansas. (Oct. 1989, p. 1095)

25–31. **Kontinuumsmechanik der Festen Körper**, Oberwolfach, Federal Republic of Germany. (Mar. 1989, p. 315)

*26–27. **Disorder in Physical Systems**, Mathematical Institute at Oxford University, England.

INFORMATION: G.R. Grimmett, School of Mathematics, University Walk, Bristol BS8 1TW; email: grimmett@npla.bristol.ac.uk or D.J.A. Welsh, Merton College, Oxford, OX1 4JD.

26–29. **Workshop on Number Theory and Algorithms**, Berkeley, CA. (Sep. 1989, p. 916)

26–April 6. **Workshop on Group Theory from a Geometrical Viewpoint**, International Centre for Theoretical Physics, Trieste, Italy. (May/Jun. 1989, p. 601)

28–29. **Chaos in Praxis: The Application of Nonlinear Dynamics in Social Realms**, Battelle Conference Center, Seattle, WA. (Nov. 1989, p. 1249)

29–31. **Modern Perspectives of Mathematics: Mathematics in Academia, Mathematics as a Consumer Good**, Cornell University, Ithaca, NY. (Nov. 1989, p. 1249)

30–31. **Illinois Number Theory Conference**, Urbana, IL. (Jan. 1990, p. 53)

April 1990

1–3. **Low Dimensional Dynamics**, University of Maryland at College Park. (Jan. 1990, p. 54)

1–4. **ENAR Spring Meeting**, Baltimore, MD. (Jul./Aug. 1989, p. 766)

1–7. **Design and Codes**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 766)

1–14. **NATO Advanced Study Institute on "Generators and Relations in Groups and Geometries"**, Castelvecchio Pascoli (Lucca), Italy. (Sep. 1989, p. 916)

3–4. **Mathematics in a Changing Culture**, Glasgow College, Glasgow, Scotland. (Jan. 1990, p. 54)

3–5. **Forty-second British Mathematical Colloquium**, University of East Anglia, Norwich, Norfolk, England. (Jan. 1990, p. 54)

4–7. **Symposium on Distributions with Given Marginals (In Memory of Giuseppe Pompilj)**, Rome, Italy. (Oct. 1989, p. 1095)

5–7. **Twenty-fourth Annual Spring Topology Conference**, Southwest Texas State Univ., San Marcos, TX. (Nov. 1989, p. 1249)

5–8. **Conference on Algebraic K-theory and Algebraic Number Theory**, Johns Hopkins Univ., Baltimore, MD. (Jan. 1990, p. 54)

7–8. **Eastern Section Meeting of the AMS**, Pennsylvania State University, University Park, PA. (Note change in date from Oct. 1989, p. 1095)

INFORMATION: W. Drady, AMS, P.O. Box 6248, Providence, RI 02940.

*7–8. **1990 Association for Symbolic Logic Spring Meeting (in conjunction with a Spring meeting of the AMS and a MAMLS meeting)**, Pennsylvania State University, University Park, PA. (Please note changes from Nov. 1989, p. 1249)

INVITED SPEAKERS: L. Lipshitz, A. Pheidas, H. Friedman, S. Lang, L. van den Dries.

8–12. **Gamm-Jahrestagung**, Hannover, Federal Republic of Germany. (Jan. 1990, p. 54)

8–14. **Arbeitsgemeinschaft Mit Aktuellem Thema (wird in den Mitteilungen der DMV Heft 1/1990 bekanntgegeben)**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 766)

9–13. **Fifth Workshop on Mathematical Aspects of Computer Science**, Mägdesprung, German Democratic Republic. (Nov. 1989, p. 1249)

15–21. **Mathematical Concepts of Dependable Systems**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 766)

*16–20. **Using Algebraic Processors in Dynamical Systems**, University of Minnesota, Minneapolis, MN.

INVITED SPEAKERS: R. Grossman, J. Guckenheimer, D. Lewis, N. Lloyd, K. Meyer, P. Olver, D. Schmidt, B. Sturmfels.
INFORMATION: Institute for Mathematics and its Applications, 514 Vincent Hall, 206 Church St. S.E., Minneapolis, MN 55455; 612-624-4066.

17–21. **Phenomenes de Stokes et Resurgence**, Marseille, France. (Jan. 1990, p. 54)

*17–21. **International Conference on Effective Methods in Algebraic Geometry**, Castiglioncello (near Pisa), Italy.

CONFERENCE TOPICS: Effective methods and complexity issues in commutative algebra, projective geometry, real geometry, algebraic number theory; Algebraic geometric methods in

algebraic computing.
INVITED SPEAKERS: R. Benedetti, B. Buchberger, M. Demazure, G. Pfister, N. Vorobjov.
PROGRAM COMMITTEE: A. Conte (Torino), J. Davenport (Bath), A. Galligo (Nice), Y. Grigoriev (Leningrad), J. Heintz (Buenos Aires), W. Lassner (Leipzig), D. Lazard (Paris), H.M. Möller (Hagen), T. Mora (Genova), M. Pohst (Düsseldorf), T. Recio (Santander), J.J. Risler (Paris), M.F. Roy (Rennes), R. Schoof (Utrecht), C. Traverso (Pisa).
INFORMATION: C. Traverso, Dipartimento di Matematica, Via Buonarroti 2, 1-56100 Pisa (Italy); email: traverso@icnucevm.bitnet.

*18–20. **Biological Fluid Dynamics Workshop**, Pittsburgh Supercomputing Center, Pittsburgh, PA.

PROGRAM: The workshop will familiarize biomedical researchers with computational methods for problems in biological fluid dynamics and provide practice in applying supercomputing resources to such problems. Previous supercomputing experience is not necessary. The workshop will emphasize computer modeling of flow problems in which a fluid interacts with an elastic or muscular boundary. The workshop is funded by a grant from the Division of Research Resources Biomedical Research Technology (BRT) Program of the National Institutes of Health (NIH).
DEADLINES: Deadline for submission of applications is March 15, 1990. Enrollment is limited to 20 participants.
INFORMATION: C. Brooks, Biomedical Initiative Coordinator, Pittsburgh Supercomputing Center, 4400 Fifth Avenue, Pittsburgh, PA 15213, 412-268-5206 or 1-800-222-9310 (PA); 1-800-221-1641 (outside PA).

18–21. **Sixty-eighth Annual Meeting of the National Council of Teachers of Mathematics**, Salt Lake City, UT. (Jul./Aug. 1989, p. 766)

19–21. **Fourth National Conference on Undergraduate Research**, Union College, Schenectady, NY. (Nov. 1989, p. 1249)

19–21. **Conference on Function Spaces**, Southern Illinois University, Edwardsville, IL. (Dec. 1989, p. 1435)

19–22. **1990 Far Western Section**, University of New Mexico, Albuquerque, New Mexico.

INFORMATION: W. Drady, AMS, P.O. Box 6248, Providence, RI 02940.

22–25. **Directions for the Decade in SUPERcomputing**, University of Florida, Gainesville, FL. (Jan. 1990, p. 54)

22–27. **Tenth Conference on Analytic Functions**, Kozubnik, Poland. (Oct. 1989, p. 1095)

22–28. **Einhollende Algebren und Ringe Von Differentialoperatoren**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 766)

*24–26. **Second IMACS/ACM-SIGNUM International Conference on Expert Systems for Numerical Computing**, Purdue University, West Lafayette, Indiana.

ORGANIZING COMMITTEE: E. Houstis, J.R. Rice, R. Vichnevetsky.
INFORMATION: E. Houstis, Dept. of Comp. Sci., Purdue Univ., West Lafayette, IN 47907; 317-494-6003; Arpanet: enh@cs.purdue.edu.

*27–30. **Conference on Geometry and Topology**, Harvard University, Cambridge, MA.

SPONSOR: Lehigh University.
INVITED SPEAKERS: I. Singer, J. Kollar, R. Schoen, E. Witten.

28–29. **Symposium on Value Distribution Theory in Several Complex Variables**, Univ. of Notre Dame, Notre Dame, Indiana. (Nov. 1989, p. 1250)

29–May 5. **Gruppentheorie (Pro-Endliche Gruppen)**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 766)

30–May 4. **Mathematiques pour la Robotique**, Marseille, France. (Jan. 1990, p. 54)

May 1990

3–4. **Twenty-first Annual Pittsburgh Conference on Modeling and Simulation**, University of Pittsburgh, Pittsburgh, PA. (Sep. 1989, p. 916)

5–6. **Pacific Northwest Geometry Seminar**, University of Oregon, Eugene, OR. (Jan. 1990, p. 55)

*6–9. **Computer Algebra and Differential Equations (CADE-90)**, Cornell University, Ithaca, NY. (Please note changes from Dec. 1989, p. 1435)

INFORMATION: M. Singer, N.C. State Univ., Dept. of Math., Box 8205, Raleigh, NC 27695-8205; 919-737-2671; singer%matagh@ncsuvx.edu; singer@ncsumath.bitnet.

6–12. **Geschichte der Mathematik**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 766)

7–9. **1990 IEEE Symposium on Research in Security and Privacy**, Oakland, CA. (Oct. 1989, p. 1095)

7–10. **SIAM Conference on Applications of Dynamical Systems**, Orlando, FL. (Sep. 1989, p. 916)

7–11. **Recent Advances in Regression**, Montréal, Canada. (Jan. 1990, p. 55)

7–11. **Algorithme et Programmation**, Marseille, France. (Jan. 1990, p. 55)

*7–11. **Statistics Week**, Université de Montréal, Canada.

SPONSOR: Canadian Statistical Society.
ORGANIZING COMMITTEE: M. Bilodeau, G. Ducharme, C. Léger, Y. Lepage, S. Tardif, Y. Yatracos (Coordinator).
INVITED SPEAKERS: L. Brown (Cornell U.), R. Carroll (Texas A&M), R.D. Cook (U. of Minnesota), K.-C. Li (U.C.L.A.), C.E. Särndal (U. de Montréal), S. Weisberg (U. of Minnesota).
INFORMATION: S. Chênevert, J. Roy, CRM, Université de Montréal, C.P. 6128-A, Montréal, Qc, H3C 3J7, Canada; 514-343-7501; Fax: 514-343-2254; email: crm@cc.umontreal.ca.

7–June 1. **College on Recent Developments and Applications in Mathematics and Computer Science**, International Centre for Theoretical Physics, Trieste, Italy. (May/Jun. 1989, p. 601)

*9–12. **Computer Algebra and Parallelism (CAP-90)**, Cornell University, Ithaca, NY. (Please note changes from Dec. 1989, p. 1435)

INVITED SPEAKERS: J. von zur Gathen, B. Halstead, M. Karpinski, D. Kozen, G.L. Miller, W. Neun, B.S. Saunders, E. Sibert.

13–19. **Abstrakte Konvexe Analysis**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 766)

14–15. **Regional Workshop on Nonlinear Conservation Laws**, Stony Brook, NY. (Jan. 1990, p. 55)

14–18. **Conference on Nonlinear Analysis and Partial Differential Equations**, Rutgers University, New Brunswick, NJ. (Jul./Aug. 1989, p. 767)

14–18. **Workshop on K-Theory**, Mathematical Sciences Research Institute, Berkeley, CA. (Jan. 1990, p. 55)

14–18. **Singularities et Theorie de Hodge**, Marseille, France. (Jan. 1990, p. 55)

17–19. **Interface '90 (formerly Computer Science and Statistics: Symposium on Interface)**, East Lansing, MI. (Sep. 1989, p. 916)

17–19. **Colloquium: Computer Graphics in Pure Mathematics**, University of Iowa, Iowa City, IA. (Dec. 1989, p. 1435)

*18–20. **Nineteenth Annual State of Jefferson Mathematics Congress**, Whiskeytown, CA.

INFORMATION: J. Ladwig, Dept. of Math. and Stat., California State Univ., Chico, CA 95929-0525.

20–25. **NSF/CBMS Conference on Operator Algebras**, Texas Christian University, Fort Worth, TX. (Jan. 1990, p. 55)

20–26. **The Schrödinger Equation and Its Classical Counterparts**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 767)

21–24. **The Simulation of Random Processes and Fields – Mathematics and Applications**, Portofino, Italy. (Sep. 1989, p. 916)

21–25. **NSF-CBMS Regional Conference on The Interface between Analytic Number Theory and Harmonic Analysis**, Manhattan, KS. (Jan. 1990, p. 55)

21–25. **Eleventh United States National Congress of Applied Mechanics**, Tucson, AZ. (Nov. 1988, p. 1389)

21–25. **Nonlinear Analysis, Function Spaces and Applications IV**, Czechoslovakia. (Jan. 1990, p. 56)

23–25. **1990 International Symposium on Multiple-Valued Logic**, Charlotte, NC. (Apr. 1989, p. 496)

*23–25. **Workshop on Viscous and Numerical Approximation of Shock Waves**, North Carolina State University, Raleigh, NC.

SPONSORS: Center for Research in Scientific Computation, NCSU; U.S. Army Research Office.
CONFERENCE TOPICS: Travelling waves for viscous conservation laws, reaction diffusion equations, and numerical methods for nonlinear hyperbolic equations.
INVITED SPEAKERS: M. Brio, R. Gardner, J. Glimm, D. Hoff, C. Jones, B. Keyfitz, T.-P. Liu, B. McKinney, R. Menikoff, K. Mischaikow, S. Osher, F. Palmeira, S. Schecter, M. Slemrod, J. Smoller, T. Ting, J. Trangenstein, Z.P. Xin.
CALL FOR PAPERS: There will be sessions for fifteen minute contributed papers. The title and abstract of papers should be received by March 20, 1990. A proceedings volume will be published.
INFORMATION: M. Shearer, Dept. of Math., North Carolina State University, Box 8205, Raleigh, NC 27695-8205; 919-737-3298; shearer@matagh.ncsu.edu.

*23–27. **Azumaya Algebras, Group Actions, and Modules: A Conference in Honor of Goro Azumaya's 70th Birthday**, Indiana University, Bloomington, IN.

PURPOSE: The dual purpose of this conference is to honor Goro Azumaya and to bring together for useful interaction mathematicians in three areas of Professor Azumaya's research: Azumaya algebras, group actions and module theory. These are areas of active research with significant historical intersection; the scientific aim of the conference is to encourage and revitalize that intersection.
ORGANIZERS: D. Haile, Indiana University and J. Osterburg, University of Cincinnati.
INVITED SPEAKERS: S. Amitsur, M. Artin, G. Azumaya, K. Fuller, S. Montgomery, D. Passman, D. Saltman, L. Small, and R. Swan.
INFORMATION: D. Haile, Dept. of Math., Indiana Univ., Bloomington, IN 47405; 812-855-2197; email: haile@iubacs.bitnet.

*24. **Second Conference on Lagrange Calculus**, Community College of Philadelphia, Philadelphia, PA.

PURPOSE: The conference is designed to bring together faculties engaged or interested in experimenting with a calculus based on Lagrange's approach, that is on the use of Taylor expansions obtained a priori and from which all the concepts of the calculus, including (sided) limits, are then derived.
PROGRAM: The conference will include a minicourse, contributed papers from faculties who have used the approach and a discussion session.
INFORMATION: A. Schremmer, Mathematics Department, Community College of Philadelphia, Philadelphia, PA 19130. Background papers will be sent on request.

24–25. **Twelfth Symposium on Mathematical Programming with Data Perturbations**, George Washington Univ., Washington, DC. (Nov. 1989, p. 1250)

24–26. **Conference on Probability Models in Mathematical Physics**, Colorado Springs, CO. (Jan. 1990, p. 56)

25–31. **Tenth International Conference on Pattern Recognition**, Resorts Hotel, Atlantic City, NJ. (Mar. 1988, p. 466)

27–June 2. **Lyapunov-Exponents**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 19 89, p. 767)

28–June 1. **Twenty-second Annual Conference on Statistics**, Tours, France. (Jan. 1990, p. 56)

28–June 1. **Tenth International Conference on Distributed Computing Systems**, Paris, France. (Jan. 1990, p. 56)

28–June 1. **Mecanique Celeste et Systemes Hamiltoniens**, Marseille, France. (Jan. 1990, p. 56)

*28–June 1. **Workshop on Set Theoretic Methods in Algebra**, Baylor University, Waco, Texas.

CONFERENCE THEME: The focus of the conference will be on the application of set theory in algebra, especially in abelian groups, rings and modules.
INVITED SPEAKERS: P. Eklof, A. Mekler.
INFORMATION: M. Dugas, Dept. of Math., Baylor Univ., Waco, TX 76798-7328; 817-755-3561; email: dugasm@baylor.bitnet.

28–June 2. **Geometry of Complex Projective Varieties**, Cetraro, Italy. (Nov. 1989, p. 1250)

29–30. **Algebraic Logic Conference in Honour of Professor Don Monk**, Boulder, Colorado. (Nov. 1989, p. 1250)

29–31. **GAMM/IFIP Workshop: "Stochastic Optimization: Numerical Methods and Technical Applications"**, Neubiberg, Federal Republic of Germany. (Jan. 1990, p. 56)

29–June 1. **Eleventh Annual Conference**

of the Canadian Applied Mathematics Society, Halifax, Nova Scotia. (Oct. 1989, p. 1096)

29–June 2. **Dynamical Theories of Turbulence in Fluid Flows**, Minneapolis, MN. (Nov. 1989, p. 1250)

29–June 2. **Workshop on Dynamical Systems in Fluid Mechanics**, Minneapolis, MN. (Nov. 1989, p. 1251)

30–31. **Conference on Algebraic Logic**, Boulder, Colorado. (Dec. 1989, p. 1436)

* 31–June 1. **Annual Meeting of the Canadian Society for History and Philosophy of Mathematics**, University of Victoria, British Columbia.

PURPOSE: The aim of the conference is to exchange ideas in the history and philosophy of mathematics. There will be a special session on history and pedagogy of mathematics organized by Victor Katz, Univ. of the District of Columbia, Washington, DC in which J. Grabiner is the principle speaker.
INFORMATION: F. Abeles, Dept. of Math./Comp. Sci., Kean College, SCNJ, Union, NJ 07083; cpsf01@turbo.kean.edu.

31–June 3. **Percolation Models of Material Failure**, Cornell University, Ithaca, NY. (Dec. 1989, p. 1436)

June 1990

June/July 1990. **International IMACS Conference on Mathematical Modelling and Applied Mathematics**, Vilnius, USSR. (Sep. 1989, p. 917)

1–8. **Third International Symposium on Orthogonal Polynomials and Their Applications**, Erice-Trapani (Sicily), Italy. (Dec. 1989, p. 1436)

1–10. **Fourth Annual Meeting of the International Workshop in Analysis and its Applications**, Dubrovnik-Kupari, Yugoslavia. (Oct. 1989, p. 1096)

3–6. **1990 Annual Meeting of the Statistical Society of Canada**, St. John's, Newfoundland, Canada. (Sep. 1989, p. 917)

3–6. **Symposium on Chaos in Biological and Agricultural Systems**, Lincoln, Nebraska. (Jan. 1990, p. 56)

3–9. **Graphentheorie**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 767)

4–7. **Fifth Annual IEEE Symposium on Logic in Computer Science**, Philadelphia, PA. (Sep. 1989, p. 917)

4–8. **Workshop on Model Theory**, Berkeley, CA. (Sep. 1989, p. 917)

4–8. **Nonlinear Phenomena in Atmospheric and Oceanic Sciences**, Minneapolis, MN. (Nov. 1989, p. 1251)

4–8. **International Conference on Approximation Interpolation and Summability in Honor of A. Jakimovski**, Tel Aviv, Israel. (Dec. 1989, p. 1436)

4–8. **International Conference on Bootstrapping and Related Techniques**, Trier, Federal Republic of Germany. (Jan. 1990, p. 56)

* 4–12. **Recent Developments in Geometric Topology and Related Topics**, Villa "La Querceta", Montecatini Terme.

SCIENTIFIC DIRECTORS: P. De Bartolomeis (Univ. di Firenze), E. Tricerri (Univ. di Firenze).
INVITED SPEAKERS: Ch. Okonek (Univ. Bonn, BRD), J. Cheeger (Courant Inst., USA), M. Gromov (I.H.E.S., France).
INFORMATION: P. Zecca, Secretary, CIME, Istituto Matematico U. Dini, Viale Morgagni, 67/A, I 50134 Firenze, Italy.

4–15. **Analyse Harmonique sur Les Groupes Reductifs P-Adiques**, Marseille, France. (Jan. 1990, p. 56)

* 4–28. **Supercomputing Program for Undergraduate Research**, Cornell National Supercomputing Facility, Ithaca, NY.

INFORMATION : D. Smith, Conference Coordinator, CNSF, Campus Rd. and Central Ave., Ithaca, NY 14853-8301; 607-255-3985; 1-800-346-2673; donna@tcgould.tn.cornell.edu. Applications must be received by March 23, 1990. A stipend of $2,000 for the four-week course will be provided to undergraduates who are accepted.

6–8. **First IFIP Conference on Fractals**, Lisbon, Portugal. (Jan. 1990, p. 57)

6–9. **Fifth Annual Conference of the European Consortium for Mathematics in Industry**, Lahti, Finland. (Apr. 1989, p. 496)

6–12. **1990 Barcelona Conference on Algebraic Topology**, Centre de Recerca Matematica, Barcelona, Spain. (Sept. 1988, p. 1060)

6–15. **Third Logical Biennial (in honour of S.C. Kleene)**, Chaika (near Varna), Bulgaria. (Oct. 1989, p. 1096)

7–July 4. **1990 Joint Summer Research Conferences in the Mathematical Sciences**, University of Massachusetts at Amherst, MA.

INFORMATION: C. Kohanski, AMS, P.O. Box 6248, Providence, RI 02940.

* 10–14. **Sixth Haifa Matrix Conference Technion City**, Haifa, Israel.

ORGANIZING COMMITTEE: A. Berman and D. Hershkowitz.
INFORMATION: Dept. of Math., Technion-Israel Institute of Technology, Haifa 32000, Israel; email: mar23aa@technion.bitnet or mar64aa@technion.bitnet.

10–16. **Reelle Algebraische Geometrie**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 767)

10–16. **Fourth Czechoslovak Symposium on Combinatorics**, Prachtice, Czechoslovakia. (Nov. 1989, p. 1251)

11–14. **Fourteenth Rolf Nevanlinna Colloquium**, University of Helsinki, Helsinki, Finland. (Jul./Aug. 1989, p. 767)

11–14. **World Organization of Systems and Cybernetics Eighth International Congress**, New York, NY. (Mar. 1989, p. 315)

11–14. **Fifth SIAM Conference on Discrete Mathematics**, Atlanta, GA. (Sep. 1989, p. 917)

11–15. **Chaotic Processes in the Geological Sciences**, Minneapolis, MN. (Nov. 1989, p 1251)

11–15. **Third International Conference on Hyperbolic Problems**, Uppsala, Sweden. (Jan. 1990, p. 57)

11–15. **Rigorous Results in Quantum Dynamics**, Liblice Castle, Czechoslovakia. (May/Jun. 1989, p. 602)

11–15. **NSF/CBMS Conference on Wavelets**, University of Lowell, Lowell, MA. (Nov. 1989, p. 1251)

11–15. **IMACS First International Conference on Computational Physics**, Boulder, CO. (Jan. 1990, p. 57)

12–15. **Ninth International Conference on Analysis and Optimization of Systems**, Antibes, France. (Jan. 1990, p. 57)

* 12–15. **Workshop on Spectral and Scattering Theory of Partial Differential Operators**, Institute of Mathematics, Hebrew Univ., Jerusalem, Israel.

PROGRAM: Invited Talks.
SPONSOR: U.S.-Israel Binational Science Foundation.
ORGANIZERS: M. Ben-Artzi, P. Constantin, Y. Kannai, Y. Kifer, M. Marcus, E. Shamir.
INFORMATION: Secretary, Conference on PDE, Institute of Mathematics, Hebrew Univ., Jerusalem 91904, Israel.

13–15. **Seventh Annual Quality and Productivity Research Conference**, Madison, WI. (Mar. 1989, p. 315)

*13–16. **Function Estimation and Statistical Applications**, Cornell University, Ithaca, NY.

ORGANIZERS: D. Ruppert, Cornell Univ.; J.S. Marron, Univ. of North Carolina, Chapel Hill.
PURPOSE: This workshop is on modern statistical methods that do not relay on parametric assumptions.
INVITED SPEAKERS: N. Altman, R.J. Carroll, D. Cline, D. Cox, R. Eubank, P. Hall, I. Johnstone, R. Liu, J.S. Marron, D. Nychka, J. Rice, D. Scott, P. Speckman, M. Wells.
INFORMATION: D. Ruppert, School of Operations Research and Industrial Engineering, Cornell Univ., 343A Upson Hall, Ithaca, NY 14853; 607-255-9136; davidr@orie.cornell.edu.

13–22. **Free Boundary Problems: Theory and Applications**, Centre de Recherches Mathématiques, Université de Montréal, Canada. (Jul./Aug. 1989, p. 767)

*14–16. **Sixth Summer Conference on General Topology and Applications**, Long Island Univ. (C.W. Post Campus), Brookville, NY.

ORGANIZING COMMITTEE: S. Andima (Chair), Long Island Univ.; E. Beckenstein, St. John's SI; N. Cleopa, Long Island Univ.; S. Hechler, Queens College-CUNY; M. Henriksen, Harvey Mudd College; R. Kopperman, City College of NY-CUNY; P. Misra, College of Staten Island-CUNY; C. Neville, Central Conn. State College; R. Resch, College of Staten Island-CUNY; R. Shortt, Wesleyan; A. Todd, Baruch College; J. Vaughan, Univ. of North Carolina at Greensboro.
CONFERENCE TOPICS: General topology, relations between general topology and functional analysis, category theory, computer science, and other fields.
INVITED SPEAKERS: A.V. Arhangel'skii (Moscow State Univ.), B. Banaschewski (McMaster Univ.), W.W. Comfort (Wesleyan Univ.), G. Gruenhage (Auburn Univ.), L. Nachbin (Brazilian Center for Physical Research; Univ. of Rochester), S. Watson (York Univ.).
CALL FOR PAPERS: Participants are invited to present half-hour talks. Abstracts should be submitted by May 1, 1990.
INFORMATION: S. Andima, Department of Mathematics, Long Island Univ., C.W. Post Campus, Brookville, NY 11548; 516-299-2448; email: andima@liuvax.bitnet.

14–16. **Fifth Southeast Asian Conference on Mathematical Education (SEACME 5)**, Gadong, Brunei Darussalam. (Nov. 1989, p. 1251)

15–20. **Global Differential Geometry and Global Analysis**, Berlin, Federal Republic of Germany. (Jan. 1990, p. 57)

17–23. **Partial Differential Equations in Complex Analysis**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 767)

18–20. **Joint WNAR-IMS Regional Meeting**, Montana State University, Bozeman, MT. (Mar. 1989, p. 315)

*18–21. **A Conference on Partial Differential Equations, in Honor of Shmuel Agmon**, Institute of Mathematics, Hebrew Univ., Jerusalem, Israel.

PROGRAM: Invited Talks.
SPONSORS: Israel Academy of Sciences, Hebrew Univ., Technion-Israel Institute of Technology.
ORGANIZERS: M. Ben-Artzi, P. Constantin, Y. Kannai, Y. Kifer, M. Marcus, E. Shamir.
INFORMATION: Secretary, Conference on PDE, Institute of Mathematics, Hebrew Univ., Jerusalem 91904, Israel.

18–22. **Fourteenth Mathematical Sciences Lecture Series on Partially Ordered Sets**, Johns Hopkins University, Baltimore, Maryland. (Oct. 1989, p. 1096)

18–22. **Approximations Diophantiennes et Nombres Transcendants**, Marseille, France. (Jan. 1990, p. 57)

*18–26. **Recent Developments in H_∞ Control Theory**, Villa Olmo, Como.

SCIENTIFIC DIRECTORS: E. Mosca (Univ. di Firenze), L. Pandolfi (Pol. di Torino).
INVITED SPEAKERS: F. Foias (Indiana Univ.), H. Kwakernaak (Univ. of Twente, The Netherlands), J.P. Pearson (Rice Univ.), B.A. Francis (Univ. of Toronto), I.W. Helton (Univ. of California at San Diego).
INFORMATION: P. Zecca, Secretary, CIME, Istituto Matematico U. Dini, Viale Morgagni, 67/A, I 50134 Firenze, Italy.

18–29. **Radar/Sonar**, Minneapolis, MN. (Nov. 1989, p. 1251)

18–29. **AMS-SIAM Summer Seminar on Vortex Dynamics and Vortex Methods**, University of Washington, Seattle, WA.

INFORMATION: B. Verducci, AMS, P.O. Box 6248, Providence, RI 02940.

20–22. **Sixteenth International Workshop on Graph-Theoretic Concepts in Computer Science**, Berlin, Federal Republic of Germany. (Jan. 1990, p. 57)

24–30. **Mathematische Probleme in der Nichtlinearen Elastizität**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 767)

25–29. **International Symposium on Fuzzy Approach to Reasoning and Decision Making**, Bochyne, Czechoslovakia. (Oct.
1989, p. 1096)

*25–29. **Logique et Informatique**, Marseille, France. (Please note changes from Jan. 1990, p. 58)

PURPOSE: The purpose of the meeting is to bring together logicians and computer scientists. Most of the talks will be invited lectures so there should be ample time for discussions.
CONFERENCE TOPICS: Categorical logic, complexity theory, logic programming, modal logic, type theory.
PROGRAM COMMITTEE: S. Artemov (Moscow), G. Blanc (Marseille), L. Esakia (Tbilisi), A. Preller (Montpellier).
ORGANIZER: G. Blanc.
INVITED SPEAKERS: M. Abashidze (Tbilisi), K. Apt (Amsterdam), J. Barzdin (Riga), L. Beklemishev (Moscow), A. Berarducci (Siena), C. Bernardi (Roma), Cl. Bertrand (Marseille), A. Blass (Ann Arbor), G. Boolos (MIT), E. Borgër (Pisa), A. Chan-

dra (IBM-New York), Th. Coquand (INRIA-Paris), G. Corsi (Firenze), D. de Jongh (Amsterdam), Ph. Enjalbert (Caen), L. Farinas (Toulouse), M. Fitting (New York), M. Fouda (Montpellier), J.Y. Girard (Paris), Y. Gurevitch (Ann Arbor), G. Japaridze (Tbilisi), J.L Krivine (Paris), J.L. Lassez (IBM-NY), G. Mints (Tallin), F. Montagna (Siena), H. Ono (Hiroshima), J. Paris (Manchester), A.M. Pitts (Cambridge), V. Sazonov (Novosibirsk), E. Shapiro (Weizmann Inst.), V. Shevrukov (Moscow), C. Smorynski (San Jose), R. Smullyan (New York), R. Solovay (Berkeley), Th. Streicher (Passau), J. Stern (Paris), A. Visser (Utrecht).

25–July 13. **SMS-NATO ASI: Shape Optimization and Free Boundaries**, Université de Montréal, Montréal, Canada. (Dec. 1989, p. 1437)

27–29. **ACM Conference on Lisp and Functional Programming**, Nice, France. (Jan. 1990, p. 58)

27–30. **Fourth International Congress on Algebraic Hyperstructures and Applications**, Xanthi, Greece. (Apr. 1989, p. 496)

July 1990

July 1990. **AMS Summer Research Institute on Differential Geometry**, University of California, Los Angeles, CA.

INFORMATION: W. Drady, AMS, P.O. Box 6248, Providence, RI 02940.

1–7. **Modulfunktionen In Mehreren Variablen**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

1–15. **International Symposium on Algebraic Topology - Adams Memorial Symposium**, University of Manchester, England. (Sep. 1989, p. 918)

1–18. **Twentieth Summer Session on Probability Theory**, Saint-Flour (Cantal), France. (Mar. 1989, p. 315)

2–6. **Tenth Australian Statistical Conference/Second Pacific Statistical Congress**, Sydney, Australia. (Jul./Aug. 1989, p. 768)

2–6. **The Jónsson Symposium**, Laugarvatn, Iceland. (Sep. 1989, p. 918)

2–6. **Thirty-fourth Annual Meeting of the Australian Mathematical Society**, Townsville, Queensland, Australia. (Oct. 1989, p. 1097)

2–6. **Fifteenth International Biometric Conference**, Budapest, Hungary. (Jan. 1990, p. 58)

2–7. **Groupes Ordonnes et Groupes de Permutation**, Marseille, France. (Jan. 1990, p. 58)

*2–10. **Continua with Microstructures**, Villa "La Querceta", Montecatini Terme.

SCIENTIFIC DIRECTOR: G. Capriz (Univ. di Pisa).
INVITED SPEAKERS: C. Davini (Univ. di Udine), N.D. Mermin (Cornell Univ.), J.T. Jenkins (Cornell Univ.), M. Kléman (Univ. Paris-Sud, France).
INFORMATION: P. Zecca, Secretary, CIME, Istituto Matematico, U. Dini, Viale Morgagni, 67/A, I 50134 Firenze, Italy.

2–31. **Time Series**, Minneapolis, MN. (Nov. 1989, p. 1252)

*2–August 10. **Représentations des Groupes et des Algèbres de Lie**, Université de Montréal, Canada.

ORGANIZER: R. Langlands (IAS, CRM).
INVITED SPEAKERS: J. Arthur (Univ. of Toronto), L. Clozel (Univ. de Paris, Orsay), R. Langlands (IAS, CRM), R. Moody (Univ. of Alberta), L. Vinet (Univ. de Montréal).
INFORMATION: S. Chênevert, J. Roy, CRM, Université de Montréal, C.P. 6128-A, Montréal, Québec, H3C 3J7 Canada; 514-343-7501; Fax: 514-343-2254; email: crm@cc.umontreal.ca.

3–6. **Eleventh Dundee Conference on Ordinary and Partial Differential Equations**, Dundee, Scotland. (Sep. 1989, p. 918)

*5–7. **Lattice Path Combinatorics and Applications**, McMaster University, Hamilton, Ontario, Canada.

INFORMATION: S.G. Mohanty, McMaster Univ., Dept. of Math. and Stat., Hamilton, Ontario, Canada; 416-525-9140, ext. 3422; email: mohanty@sscvax.mcmaster.ca.

*6–7. **International Colloquium on Applications of Mathematics (on the occasion of the 80th birthday of Lothar Collatz)**, Hamburg, West Germany. (Please note changes from Nov. 1989, p. 1252)

INFORMATION: G. Opfer, University of Hamburg, Institute of Applied Mathematics, Bundesstraße 55, D-2000 Hamburg 13, West Germany.

8–14. **Variationsrechnung**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

9–11. **"Universita'di Genova - The Ohio State University Joint Conference" on New Trends in Systems Theory**, Genoa, Italy. (Jul./Aug. 1989, p. 768)

9–14. **4ème Colloque International de Theorie des Graphes et de Combinatoire**, Marseille-Luminy, C.I.R.M., France. (Jan. 1990, p. 58)

9–20. **Geometry and Topology of Four-Manifolds**, McMaster University, Hamilton, Ontario, Canada. (May/Jun. 1989, p. 602)

15–21. **Stochastic Image Models and Algorithms**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

*15–22. **1990 European Summer Meeting (Logic Colloquium '90)**, University of Helsinki, Finland. (Please note changes from Nov. 1989, p. 1252)

PURPOSE: Logic Colloquium '90 is the annual European Summer Meeting of the Association for Symbolic Logic.
ORGANIZERS: J. Väänänen (Chairman), I. Niiniluoto (Vice Chairman).
CONFERENCE TOPICS: Model Theory, Set theory, proof theory, computer science and recursion theory, and philosophy.
INVITED SPEAKERS: D. Gabbay, R. Jensen, P. Kolaitis, R. Laver, P. Martin-Löf, A. Mekler, G. Mints, Y. Moschovakis, S. Shelah.
CALL FOR PAPERS: Contributed papers for 20 minute talks are invited from all areas of logic. Abstracts of one typewritten page (max. 300 words) should be sent before April 1, 1990.

15–23. **Colloquium in Honor of Roland Fraisse**, Centre International de Recontres Mathématiques, Luminy, France. (May/Jun. 1989, p. 602)

16–20. **SIAM Annual Meeting**, Chicago, IL. (Nov. 1988, p. 1389)

16–20. **Symposium Fraisse**, Marseille, France. (Jan. 1990, p. 58)

22–28. **Konvexgeometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

*23–27. **CADE 10 - Tenth International Conference on Automated Deduc-**

tion, West Germany.

CONFERENCE TOPICS: Theorem proving, unification, term rewriting, decision procedures, program verification/synthesis, deductive databases, logic programming, inference systems, applications.
PROGRAM COMMITTEE: P. Andrews, W. Bibel, W.W. Bledsoe, A. Bundy, R. Constable, J.-P. Jouannaud, D. Kapur, M. Kaufmann, C. Kirchner, J.-L. Lassez, D. Loveland, E. Lusk, M. McRobbie, D. Miller, H.J. Ohlback, R. Overbeek, W. Pase, L. Paulson, F. Pereira, D. Plaisted, J. Siekmann, M. Stickel (Chair), R. Waldinger, C. Walther.
INFORMATION: M. Stickel, Artificial Intelligence Center, SRI International, 333 Ravenswood Ave., Menlo Park, CA 94205.

23–28. **Fourth International Congress on Computational and Applied Mathematics**, Leuven, Belgium. (Jan. 1990, p. 58)

* 23–August 4. **Third Workshop on Stochastic Analysis**, Silivri, Istanbul-Turkey.

PROGRAM: The first week will be devoted to lectures and the second week to contributed talks. All participants are encouraged to give a talk. The deadline for the titles with a brief summary is May 1, 1990.
INFORMATION: H. Korezlioglu (1-45817495) or A.S. Ustunel (1-45817267), E.N.S.T., Dépt. Réseaux, 46, Rue Barrault, 75634 Paris cedex 13, France; Fax: 1-45891664, email: korez@ulysse.enst.fr.

26–29. **International Conference on New Trends in Geometric Function Theory and Applications**, University of Madras, Madras, India. (Sep. 1989, p. 918)

29–August 4. **Mechanik Und Algebraische Geometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

30–August 4. **The Fourth International Conference on Fibonacci Numbers and their Applications**, Wake Forest University, Winston Salem, NC. (Nov. 1989, p. 1252)

31–August 2. **Dynamics of Numerics and the Numerics of Dynamics**, Bristol, England. (Nov. 1989, p. 1252)

August 1990

5–9. **From Topology to Computation: Unity and Diversity in the Mathematical Sciences (in Honor of Professor Stephen Smale's 60th Birthday)**, Berkeley, CA. (Jan. 1990, p. 58)

5–11. **Mathematical Methods in Tomography**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

5–11. **International Conference on Approximation Theory**, Hungary. (Oct. 1989, p. 1097)

6–7. **AMS Short Course on Combinatorial Games**, Columbus, Ohio.

INFORMATION: M. Foulkes, AMS, P.O. Box 6248, Providence, RI 02940.

6–9. **1990 Joint Statistical Meetings**, Anaheim, CA. (Mar. 1988, p. 466)

* 6–10. **Singularities**, Honolulu, Hawaii.

PROGRAM: The conference will cover all branches of singularity theory, but with emphasis on singularities of mappings, singularities of real varieties, foundational properties (differential analysis, subanalytic sets, etc.), and applications (e.g. to differential geometry). Speakers will be determined near to the time of the conference.
ORGANIZERS: L.C. Wilson (Univ. of Hawaii), W. Kucharz (Univ. of Hawaii), T. Gaffney, (Northeastern Univ.), A. du Plessis (Aarhus Univ.).
INFORMATION: L.C. Wilson, Dept. of Math., Univ. of Hawaii at Manoa, Honolulu, HI 96822; 808-948-7217; email: les@uhccux.uhcc.hawaii.edu or les@uhccux.bitnet.

8–11. **Joint Mathematics Meetings**, Ohio State University, Columbus, OH. (including the summer meetings of the AMS, AWM, MAA and PME). This is the 75th Anniversary of the MAA.

INFORMATION: H. Daly, AMS, P.O. Box 6248, Providence, RI 02940.

12–18. **Algebraische Zahlentheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

* 12–18. **Pre-Congress Topology Conference**, University of Hawaii, Honolulu, HI. (Please note change from Feb. 1989, p. 183)

INFORMATION: For a copy of the second announcement contact K.H. Dovermann at the Univ. of Hawaii.

13–16. **Alaska Conference, Quo Vadis, Graph Theory?**, University of Alaska, Fairbanks, AK. (Oct. 1989, p. 1097)

13–17. **Fifth International Conference on Hadronic Mechanics and Nonpotential Interactions**, University of Northern Iowa, Cedar Falls, Iowa. (Jul./Aug. 1989, p. 768)

13–17. **Eleventh IFAC World Congress**, Tallin, USSR. (Sep. 1989, p. 918)

13–17. **Algebraic Geometry and Analytic Geometry**, Tokyo, Japan. (Sep. 1989, p. 919)

13–17. **1990 International Conference on Parallel Processing**, Pennsylvania State University, University Park, PA. (Dec. 1989, p. 1438)

13–18. **Institute of Mathematical Statistics Fifty-third Annual Meeting(jointly with the Second World Congress of the Bernoulli Society)**, Uppsala, Sweden. (Sep. 1989, p. 919)

13–18. **Tsukuba International Conference on Representations of Algebras and Related Topics**, University of Tsukuba, Japan. (Nov. 1989, p. 1253)

14–18. **The Asian Mathematical Conference 1990**, Hong Kong, China. (Sep. 1989, p. 919)

* 14–18. **Harmonic Analysis, Sendai 1990**, Tohoku University, Sendai, Japan.

CONFERENCE TOPICS: Recent progress in the field of harmonic analysis with emphasis on Fourier analysis on Eucledean spaces. The related fields and their applications.
INFORMATION: S. Igari, Mathematical Institute, Tohoku Univ., Sendai 980, Japan; Phone: 022-222-1800 ext. 3210, 3234; Fax: 022-263-6793.

* 14–18. **Zeta Functions in Geometry**, Tokyo Institute of Technology, Tokyo, Japan.

CONFERENCE TOPICS: Various zeta functions and L-functions in spectral geometry, dynamical systems, algebraic geometry, and number theory, including the Riemann zeta function and Selberg zeta functions.
INFORMATION: T. Sunada, Dept. of Math., Faculty of Science, Nagoya Univ., Nagoya 464-01, Japan; Phone: 052-781-5111 ext. 6638; Fax: 052-

781-4437. Deadline for registration: May 31, 1990.

15–19. **International Conference on Knot Theory and Related Topics**, International House, Osaka, Japan. (Apr. 1989, p. 497)

* 15–19. **International Conference on Commutative Algebra and Combinatorics**, Nagoya University, Nagoya, Japan.

INFORMATION: H. Matsumura, Dept. of Math., Faculty of Science, Nagoya Univ., Nagoya 464-01, Japan; Phone: 052-781-5111 ext. 6434; Fax: 052-781-4437.

15–20. **Conference on Gaussian Random Fields (The Third Nagoya Lévy Seminar)**, Nagoya University, Nagoya, Japan. (Nov. 1989, p. 1253)

16–18. **SIGAL International Symposium on Algorithms**, Tokyo, Japan. (Oct. 1989, p. 1097)

* 16–19. **Current Topics in Operator Algebras**, Nara Ken-New Public Hall, Nara, Japan.

CONFERENCE TOPICS: C*-dynamical systems and derivations, non commutative differential geometry, index theory, quantum groups and galois theory.
INFORMATION: Y. Nakagami, Dept. of Math., Yokohama City Univ., 22-2 Seto, Kanazawa-ku, Yokohama 236, Japan; Phone: 045-787-2198; Fax: 045-787-2202.

* 18–22. **The Second International Conference on Graph Theory**, Kanagawa, Japan.

INFORMATION: H. Akiyama, Dept. of Math., Tokai Univ., Hiratsuka, Kanagawa 259-12, Japan.

* 19–20. **Inverse Problems in Engineering Sciences**, Osaka Institute of Technology, Osaka, Japan.

CONFERENCE TOPICS: Inverse scattering problems, determination of unknown coefficients in differential equations, inverse eigenvalue problems, determination of boundaries and domains, parameter estimation, numerical analysis and synthesis for those problems.
DEADLINES: Deadline for registration: June 30, 1990; Deadline for submission of papers: April 30, 1990.
INFORMATION: M. Yamamoto, Dept. of Math., College of Arts and Sciences, Univ. of Tokyo, Komaba, Meguro, Tokyo 153, Japan; Phone: 03-467-1171 ext. 443 or 296; Fax: 2426-728.

19–25. **Mathematische Methoden Des VLSI-Entwurfs Und Des Distributed Computings**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

* 20–24. **Second International joint Conference of the ISSAC-90 and the AAECC-8**, Nihon University, Tokyo, Japan.

CONFERENCE TOPICS: Symbolic and algebraic computation, error correcting codes, etc.
INFORMATION: H. Kobayashi, Conference Secretariat IJC-2, c/o Scientist, Inc., Yamazaki Bldg., 3-2 Kanda Surugadai, Chiyoda-ku, Tokyo, 101, Japan; Fax: 03-255-6847.

20–25. **Fifth Conference on Numerical Methods**, Miskolc, Hungary. (Jan. 1990, p. 59)

21–29. **The International Congress of Mathematicians 1990**, Kyoto, Japan. (Nov. 1988, p. 1389)

23–September 1. **Twenty-eigth International Symposium on Functional Equations**, Graz-Mariatrost, Austria. (Dec. 1989, p. 1438)

26–September 1. **Komplexe Analysis**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

27–31. **Eleventh Prague Conference on Information Theory, Statistical Decision Functions and Random Processes**, Praha, Czechoslovakia. (Jan. 1990, p. 59)

28–30. **IMACS European Simulation Meeting on Problem Solving by Simulation**, Esztergom, Hungary. (Mar. 1989, p. 316)

28–31. **Operations Research 1990, International Conference Operations Research**, Vienna, Austria. (Jul./Aug. 1989, p. 768)

* 29–31. **International Colloquium on Words, Languages, and Combinatorics**, Kyoto Sangyo University, Kyoto, Japan.

CONFERENCE TOPICS: Codes, free monoids, transformation semigroups, automata, formal languages, word problems and combinatorics.
INFORMATION: M. Ito, Dept. of Math., Faculty of Science, Kyoto Sangyo Univ., Kyoto 603, Japan; phone: 075-701-2151; Fax: 075-722-2630.

* 30–September 1. **International Symposium on the Semigroup Theory and its Related Fields**, Ritsumeikan University, Kyoto, Japan.

CONFERENCE TOPICS: Semigroup theory and its related fields; theory of automata, universal algebra and lattice theory.
INFORMATION: M. Yamada, Dept. of Math., Shimane Univ., 1060 Nishikawatsu-cho, Matsue 690, Japan; phone: 0852-21-7100; Fax: 0852-31-0812.

* 30–September 2. **International Symposium on Functional Differential Equations and Related Topics**, Kyoto Shigaku Kaikan (YOUANDI),Kyoto, Japan.

INFORMATION: J. Kato, Mathematical Institute, Tohoku Univ., Sendai 980, Japan; phone: 022-222-1800; Fax: 022-262-6609.

30–September 4. **International Conference on Potential Theory**, Nagoya, Japan. (May/Jun. 1989, p. 602)

* 30–September 4. **International Symposium on Computational Mathematics**, Matsuyama, Japan.

INFORMATION: T. Yamamoto, Dept. of Math., Fac. of Sci., Ehime Univ., Matsuyama, Ehime 790, Japan.

* 31–September 1. **Tokyo History of Mathematics Symposium 1990**, University of Tokyo, Tokyo, Japan.

CONFERENCE TOPICS: History of modern mathematics, mathematical traditions in the east.
INFORMATION: C. Sasaki, Dept. of History and Philosophy of Sci., College of Arts and Sciences, Univ. of Tokyo, Komaba, Meguro-Ku, Tokyo 153, Japan; phone: 03-467-1171 ext. 363, 543; Fax: 03-467-2568.

* 31–September 2. **Conference on Representation Theories of Lie Groups and Lie Algebras**, Lake-Kawaguchi, Yamanashi, Japan.

CONFERENCE TOPICS: Representation theories of real and p-adic Lie groups and Lie algebra, harmonic analysis on homogeneous spaces, their applications and related topics.
INFORMATION: T. Oshima, Dept. of Math., Fac. of Sci., Univ. of Tokyo, Tokyo 113, Japan; Fax: 03-814-9488;

email: c31282%tansei.cc.u-tokyo.ac.jp @relay.cs.net.

* 31–September 4. **International Symposium on Functional Analysis and Related Topics**, Sapporo, Japan.

CONFERENCE TOPICS: Banach spaces, banach algebras, function spaces, harmonic analysis, operator theory, applications of functional analysis and related topics.
INFORMATION: S. Koshi, Dept. of Math., Fac. of Sci., Hokkaido Univ., Sapporo 060, Japan; phone: 011-716-2111 ext. 2672; Fax: 011-727-3705; deadline for registration: May 31, 1990.

* 31–September 4. **General Topology and Geometric Topology Symposium**, University of Tsukuba, Japan.

CONFERENCE TOPICS: Topological spaces, set-theoretic topology, dimension theory, shape theory, ANR theory, and continua theory.
INFORMATION: Y. Kodama, Institute of Mathematics, Univ. of Tsukuba, Ibaraki 305, Japan; phone: 0298-53-4375; Fax: 0298-53-6501.

September 1990

September/October 1990. **IMACS-GAMM Conference on Computer Arithmetic, Scientific Computation and Mathematical Modelling**, Bulgaria. (Sep. 1989, p. 919)

IMACS Symposium on Modelling and Simulation of Electrical Machines, ENSEM - Nancy, France. (May/Jun. 1989, p. 602)

2–7. **Twelfth International Conference on Nonlinear Oscillations**, Cracow, Poland. (Sep. 1989, p. 919)

2–7. **International Conference on Integral Equations and Boundary Value Problems**, Yantai University, Shandong, People's Republic of China. (Nov. 1989, p. 1253)

2–8. **Topologie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

3–6. **Fourth Asian Logic Conference**, Tokyo, Japan. (Mar. 1989, p. 316)

3–7. **IMACS Symposium on Intelligent Models in Systems Simulation**, Brussels, Belgium. (Mar. 1989, p. 316)

3–7. **Representation des Groupes et Analyse Complexe**, Marseille, France. (Jul./Aug. 1989, p. 768)

* 3–7. **International Conference on Dynamical Systems and Related Topics**, Nagoya University, Nagoya, Japan.

INFORMATION: K. Shiraiwa, Dept. of Math., College of General Education, Nagoya Univ., Nagoya 464-01, Japan; phone: 052-781-5111 ext. 4749; Fax: 052-782-8261.

8–12. **Neuronet-90: IMACS International Symposium on Neural Nets and Neural Computers**, Prague, Czechoslovakia. (Please note change from May/Jun. 1989, p. 602)

9–15. **Surgery and L-Theory**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

10–12. **Second International Workshop on Advances in Robot Kinematics**, Linz, Australia. (Jan. 1990, p. 59)

10–14. **Mathematiker-Kongress**, Dresden, German Democratic Republic. (Jul./Aug. 1989, p. 769)

10–14. **Greco Calcul Formel**, Marseille, France. (Jan. 1990, p. 60)

10–October 5. **School on Qualitative Aspects and Applications of Nonlinear Evolution Equations**, International Centre for Theoretical Physics, Trieste, Italy. (May/Jun. 1989, p. 602)

16–22. **Risikotheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

17–21. **Atelier International de Theorie des Ensembles**, Marseille, France. (Jan. 1990, p. 60)

17–22. **DMV-Jahrestagung 1990**, Bremen, Federal Republic of Germany. (Jul./Aug. 1989, p. 769)

23–29. **Random Graphs and Combinatorical Structures**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

24–28. **International Symposium on Mathematical Theories**, San Sebastián, Spain. (Jan. 1990, p. 60)

24–28. **Structure Galoisienne Arithmetique**, Marseille, France. (Jan. 1990, p. 60)

* 24–28. **IMACS-GAMM International Symposium on Computer Arithmetic, Scientific Computation and Mathematical Modelling - SCAN 1990**, Albena (near Varna), Bulgaria.

PURPOSE: The conference is devoted to some new trends in the field of scientific computation. It should serve as a forum for the presentation of new ideas in relation with this methodology and for the exchange of experiences in its use in various areas of scientific modelling situations.
CALL FOR PAPERS: Three copies of an extended abstract (max. of 4 pages) are to be submitted to the address below. Deadlines: submission of abstract-April 30, 1990; notification of acceptance-June 30, 1990; Registration-July 30, 1990.
INFORMATION: S. Markov, Coordinating Centre for Informatics and Computer Technology, Bulgarian Academy of Sciences, Acad. G. Bonichev str., bl.25a, BG-1113 Sofia, Bulgaria; Telex: 22628; Telefax: 359-2-707273.

* 24–29. **Mathematical Modelling of Industrial Processes**, Tecnopolis, Bari.

SCIENTIFIC DIRECTORS: V. Capasso (Univ. di Bari), A. Fasano (Univ. di Firenze).
INVITED SPEAKERS: B. Forte (Univ. of Waterloo), H.K. Kuiken (Philips Research Lab., Olanda), S. Busenberg (Harvey Mudd College).
INFORMATION: P. Zecca, Secretary, CIME, Istituto Matematico U. Dini, Viale Morgagni, 67/A, I 50134 Firenze, Italy.

30–October 6. **Diophantische Approximationen**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

October 1990

1–5. **Organisations et Theorie des Jeux**, Marseille, France. (Jan. 1990, p. 60)

5–6. **Math-History Conference**, LaCrosse, WI. (Jan. 1990, p. 60)

7–13. **Arbeitsgemeinschaft Mit Aktuellem Thema**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

8–12. **Congres Franco-Sovietique de Programmation Mathematique**, Marseille, France. (Jan. 1990, p. 60)

14–20. **Geometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

15–19. **Modeles pour L'Analyse des Donnees Multidimensionnelles**, Marseille, France. (Jan. 1990, p. 60)

* 15–19. **Tercer Congreso Nacional de Matemáticas**, San José, Costa Rica.

SPONSOR: Asociación Costarricense de Matemáticas.
CONFERENCE TOPICS: Pure and ap-

plied mathematics, mathematics education.
CALL FOR PAPERS: Abstracts by May 10, 1990.
INFORMATION: H. Barrantes, Escuela de Matemática, Universidad de Costa Rica, San José, Costa Rica; Tel: 53-7025; Fax: 34-0452.

*21–22. **Eastern Section**, University of Massachusetts at Amherst, Amherst, MA.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6248, Providence, RI 02940.

21–27. **Mathematische Methoden In Der Robotik**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

21–27. **Arithmetik der Körper**, Oberwolfach, Federal Republic of Germany. (Oct. 1989, p. 1098)

21–27. **International Functional Analysis Meeting on the Occasion of the Sixtieth Birthday of Professor M. Valdivia**, Peñiscola, Spain. (Oct. 1989, p. 1098)

22–25. **Fifth Jerusalem Conference on Information Technology (JCIT-5)**, Jerusalem, Israel. (Jan. 1990, p. 60)

*26–27. **Statistical Mechanics at the 45th Parallel: Fourth Annual Meeting**, Université de Montréal, Canada.

ORGANIZER: C. Van Vliet (CRM).
INFORMATION: S. Chênevert or J. Roy, CRM, Université de Montréal, C.P. 6128-A, Montréal, Québec, H3C 3J7, Canada; 514-343-7501; Fax: 514-343-2254; email: crm@cc.umontreal.ca.

28–November 3. **Mathematical Economics**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

29–November 2. **Trieste Conference on Integrable Systems**, Trieste, Italy. (Jan. 1990, p. 61)

29–November 2. **Algorithme Parallele et Architectures Nouvelles**, Marseille, France. (Jan. 1990, p. 61)

29–November 16. **Workshop on Mathematical Ecology**, Trieste, Italy. (Jan. 1990, p. 61)

*31–November 3. **Latinamerican Seminar on Applications of Mathematics and Computer Science to Biology**, La Habana, Cuba.

SPONSORS: The National Center for Scientific Research of Cuba (CENIC) and the Latinamerican Society of application of Mathematics and Computer Science to Biology.
PROGRAM: Scientific sessions will include conferences, contributed papers, workshops, and poster sessions.
CONFERENCE TOPICS: Mathematical models of biological systems, artificial intelligence in biological research, computer assisted molecular modelling, biological signal processing, image processing in biological research.
INVITED SPEAKERS: J. Demongeot (France), D. Castelle (France), F. Hirzebruch (F.R.G.), E. Clementi (U.S.A.).
CALL FOR PAPERS: Authors should send abstracts of their papers before May 31, 1990. Abstracts should have less than 150 words and shall include name and address of all authors and institutions involved. Acceptance letters will be sent before July 31, 1990.
INFORMATION: L. Sastre, Departamento de Matemática, Centro Nacional de Investigaciones Cientificas, Apartado 6990, La Habana, Cuba; Telex: 51-1582 CNICA CU.

November 1990

2–3. **Central Section Meeting of the AMS**, University of North Texas, Denton, TX.

INFORMATION: W. Drady, AMS, P.O. Box 6248, Providence, RI 02940.

4–10. **Wahrscheinlichkeitsmaße auf Gruppen**, Oberwolfach, Federal Republic of Germany. (Oct. 1989, p. 1098)

5–7. **Second SIAM Confernce on Linear Algebra in Signals, Systems & Controls**, San Francisco, CA. (Sep. 1989, p. 920)

12–16. **Supercomputing '90**, New York, NY. (Sep. 1989, p. 920)

12–16. **Workshop on Representations of Reductive Groups over Finite Fields**, Mathematical Sciences Research Institute, Berkeley, CA. (Jan. 1990, p. 61)

18–24. **Komplexitätstheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

25–December 1. **Stochastische Approximation Und Optimierungsprobleme In Der Statistik**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

25–December 1. **Lineare Modelle und Multivariate Statistische Verfahren**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 769)

December 1990

2–8. **Multigrid Methods**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

3–5. **First International Symposium on Uncertainty and Analysis: Fuzzy Reasoning, Probabilistic Methods and Risk Management**, College Park, Maryland. (Oct. 1989, p. 1098)

*3–7. **Sixteenth Australasian Conference on Combinatorial Mathematics and Combinatorial Computing**, Palmerston North, New Zealand. (Please note change in title from Feb. 1989, p. 183)

3–7. **SINO-JAPANESE Joint Seminar on Nonlinear PDEs with Emphasis on Reaction-Diffusion Aspects.**, Taipei, Taiwan. (Jan. 1990, p. 61)

3–7. **Workshop on General Group Representation Theory**, Mathematical Sciences Research Institute, Berkeley, CA. (Jan. 1990, p. 61)

9–15. **Allgemeine Ungleichungen**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

16–22. **Mathematische Logik**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

25–January 1. **Lineare Modelle Und Multivariate Statistische Verfahren**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

January 1991

7–10. **Sixth Caribbean Conference in Combinatorics and Computing**, University of the West Indies, St. Augustine, Trinidad. (Jan. 1990, p. 61)

16–19. **Joint Mathematics Meetings**, San Francisco, CA. (including the annual meetings of the AMS, AWM, MAA, and NAM)

INFORMATION: H. Daly, AMS, P.O. Box 6248, Providence, RI 02940.

February 1991

25–March 1. **IEEE Computer Society COMPCON Spring '91**, San Francisco, CA. (Jan. 1990, p. 62)

New AMS Publications

New Series

The AMS is pleased to announce a new book series: The Conference Board of the Mathematical Sciences (CBMS): Issues in Mathematics Education Series published in cooperation with the Mathematical Association of America. The purpose of this new series is to stimulate the flow of information among mathematical scientists, mathematics educators, and mathematics teachers about innovative efforts to revitalize the teaching of mathematics and statistics at all levels. The inaugural volume of CBMS Issues in Mathematics Education is described below. Standing orders are accepted for any book series published by the Society. Proforma invoices are sent to standing order customers prior to the publication of each new volume. Shipment is made upon receipt of payment and publication. To begin a standing order for this new series or for any other AMS series, please contact Customer Services.

MATHEMATICIANS AND EDUCATION REFORM

Naomi Fisher, Harvey Keynes, and Philip Wagreich, Editors

(CBMS Issues in Mathematics Education, Volume 1)

Educational issues are receiving unprecedented attention in the broad mathematical sciences community, as mathematicians and other scientists have become concerned about the quality of instruction in the nation's schools, colleges, and universities. A mathematically literate population is crucial to supporting our increasingly technological society. In addition, the mathematical sciences community faces the challenge of increasing the number of students who are prepared to pursue a career in mathematics, science, or engineering. This challenge requires not only raising the quality of mathematics education, but also showing students the beauty and usefulness of the subject. In these ways, mathematical scientists can make crucial contributions to educational reform.

In response to these concerns, the Conference Board of the Mathematical Sciences has launched a new book series published by the American Mathematical Society in cooperation with the Mathematical Association of America entitled Issues in Mathematics Education. The purpose of this new series is to stimulate the flow of information among mathematical scientists, mathematics educators, and mathematics teachers about innovative efforts to revitalize the teaching of mathematics and statistics at all levels.

The present volume, *Mathematicians and Education Reform*, the first in this new series, contains the proceedings of the Mathematicians and Education Reform workshop held in July 1988, at the University of Illinois at Chicago. The workshop provided an opportunity for participants to share ideas about the various ongoing precollege projects organized and directed by mathematicians and to reflect on the most effective ways that mathematicians can contribute to educational reform. The major part of the proceedings is devoted to in-depth articles that explore the process of designing an educational project. A section on issues and reactions presents a forum for exchanging ideas on more general issues.

From practical information about organizing a program to exploration of the intellectual issues of educational reform, this volume presents a range of views on various aspects of the involvement of mathematicians in educational change. While it will prove especially useful for those considering involvement in an educational program, this book is also important reading for the entire community, for the issues explored here will be of increasing importance for the future of the mathematical sciences.

Contents

Projects: The Challenge of Educating Mathematically Talented Students: The University of Minnesota Talented Youth Mathematics Program (UMTYMP)–**Thomas Berger** and **Harvey Keynes**; Teaching Mathematics to a Changing Population: The Professional Development Program (PDP) at the University of California at Berkeley–**Rose Asera**, **Philip Uri Treisman**; Teaching Integrated Math and Science: A Curriculum and Staff Development Project for the Elementary School–**Howard Goldberg** and **Philip Wagreich**; Improving College Readiness Through School/University Articulation–**Franklin Demana**; A Problem Solving Approach to Renewing Secondary Mathematics Teachers–**Thomas Berger** and **Harvey Keynes**; My Experience in Starting a Minority Program–**Bhushan L. Wadhwa**; The Geometry Teacher's "Do-It-Yourself" Kit–**Herbert Clemens**; Master Teachers as Teacher Role Models–**Joe Dan Austin**, **Elizabeth Herbert**, and **R. O. Wells, Jr.**; Issues and Reactions: Non-traditional Instruction in College Mathematics–**Roger H. Marty**; A Proposal for a Directory–**Klaus Fischer**; The Need to Recruit Women into Mathematics–**Jonell**

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COMPUTATIONAL ASPECTS OF VLSI DESIGN WITH AN EMPHASIS ON SEMICONDUCTOR DEVICE SIMULATION

Randolph E. Bank, Editor

(Lectures in Applied Mathematics, Volume 25)

Numerical simulation is rapidly becoming an important part of the VLSI design process, allowing the engineer to test, evaluate, and optimize various aspects of chip design without resorting to the costly and time-consuming process of fabricating prototypes. This procedure not only accelerates the design process, but also improves the end product, since it is economically feasible to numerically simulate many more options than might otherwise be considered. With the enhanced computing power of today's computers, more sophisticated models are now being developed.

This volume contains the proceedings of the AMS-SIAM Summer Seminar on Computational Aspects of VLSI Design, held at the Institute for Mathematics and Its Applications at the University of Minnesota, in the spring of 1987. The seminar featured presentations by some of the top experts working in this area. Their contributions to this volume form an excellent overview of the mathematical and computational problems arising in this area.

Contents

Peter A. Markowich, Spatial-temporal structure of solutions of the semiconductor device problem; **Christian Ringhofer**, The shape of solutions to the fundamental semiconductor device equations; **Franco Brezzi**, Singular perturbation analysis of (strongly) reverse biased semiconductor devices; **Pierre Degond, Frederic Poupaud, Bernard Niclot, and Frederique Guyot**, Semiconductor modelling via the Boltzmann equation; **Thomas I. Seidman**, The transient semiconductor problem with generation terms; **James L. Blue and Charles L. Wilson**, Modelling gallium arsenide transistors; **Mel S. Berger**, Nonlinear mathematical phenomena associated with semiconductor devices; **W. M. Coughran, Jr. and Joseph W. Jerome**, Modular algorithms for transient semiconductor device simulation, Part I: Analysis of the outer iteration; **Thomas Kerkhoven**, Efficiency and acceleration of steady-state decoupling algorithms; **Hans D. Mittelmann**, Continuation methods for parameter-dependent boundary value problems; **Linda R. Petzold**, Recent developments in the numerical solution of differential/algebraic systems.

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LA PROPRIÉTÉ (T) DE KAZHDAN POUR LES GROUPES LOCALEMENT COMPACTS

de M. Burger

(Astérisque, Number 175)

A locally compact group G is said to have Kazhdan's property (T) if any isometric affine action of G in a Hilbert space has a fixed point. Typical examples of non compact groups with property (T) are $SL_n(\mathbb{R})$, $SL_n(\mathbb{Z})$ and $SL_n(\mathbb{Q}_p)$ for $n \geq 3$. The purpose of these notes is to show several equivalent definitions of this property, to give a large number of examples, and to point at several nice applications to discrete subgroups of Lie groups as well as to various problems of geometry and graph theory.

TABLE DES MATIÈRES

Définitions et premières conséquences; **Principaux exemples: groups de Lie**: Le cas de $SL_n(\mathbb{R})$; Autres goupes de Lie simples à centres finis; Propriété (T) et revêtements; **Principaux exemples: groupes discrets**: Sous-groupes de Kazhdan d'un groupe de Kazhdan; Centre d'une partie bornée dans un espace métrique où l'inégalité de la médiane est vraie; A propos d'un théorème de Wang; Exemples de Serre et de Gromov; **Définition cohomologique de la propriété (T)**: Propriété (FH) de propriété (T); La famille $(\mathcal{H}_t)_{t>0}$ associée à un espace de Hilbert affine; **Propriété (T), fonctions de type positif et fonctions conditionnellement de type négatif**: Noyaux de type positif; Noyaux conditionnellement de type négatif; **Applications géométriques**: Arbres; Arbres réels; Complexes de Coxeter; Espaces hyperboliques; **Le problème de Ruziewicz: Un problème de centraux téléphoniques**: $Sp(1, n)$ **est un groupe de Kazhdan** $(n \geq 2)$: Preuve du théorème A; Preuve du théorème B; **Algèbres d'opérateurs**.

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Recent Appointments

Committee members' terms of office on standing committees expire on December 31 of the year given in parentheses following their names, unless otherwise specified.

Richard Mandelbaum (1992) was appointed to the *Committee on Computer Operations and Facilities* by then chair of the Board of Trustees, M. Susan Montgomery. Peter J. Weinberger (1990) has been appointed chair. Continuing members of the committee are Ronald L. Graham (ex officio), and Jill P. Mesirov (1991).

M. Susan Montgomery, then chair of the Board of Trustees, appointed Murray Gerstenhaber as chair to the *Committee on Legal Aid.* Continuing members of the committee are Steve Armentrout and Todd Dupont.

Susan Friedlander (1992) was appointed to the *Committee on Membership* by then chair of the Board of Trustees, M. Susan Montgomery. Continuing members of the committee are Frederick W. Gehring (1990), chair, Melvin Henriksen (1990), Irwin Kra (1990), and Hugo Rossi (1991).

Robert L. Devaney (1992), and Eric Friedlander (1992) were appointed and Ramesh A. Gangolli (1992) and Andrew M. Odlyzko (1992) were reappointed by then chair of the Board of Trustees, M. Susan Montgomery, to *The Publication Program Committee.* Professor Gangolli has also been appointed chair. Continuing members of the committee are Steve Armentrout (1990), Robert M. Fossum (ex officio), William H. Jaco (ex officio), Mary C. Lane, consultant, Cathleen S. Morawetz (1991), John C. Polking (ex officio), and Paul J. Sally, Jr. (ex officio).

Carlos E. Kenig (1991) has been appointed by President William Browder to the *Editorial Boards Committee.* Continuing members of the committee are Linda Keen (1992), Haynes R. Miller (1990), Richard M. Schoen (1990), Barry Simon (1992), and Daniel Zelinsky (1991), chair.

President William Browder has appointed Alan D. Weinstein (1990) chair of the *Nominating Committee.* Other members of the committee are Joan S. Birman (1990), James E. Humphreys (1990), Barbara Lee Keyfitz (1992), Victor L. Klee, Jr. (1990), Ray Kunze (1992) and Robert Williams (1992).

Spencer Bloch (1992) has been appointed to the *Program Committee for National Meetings* by President William Browder and Jean Taylor (1992) has been appointed chair. Continuing members of the committee are James G. Arthur (1991), Robert M. Fossum (ex officio), Peter B. Gilkey (1990), George A. Hagedorn (1990), and Peter Sarnak (1991).

Carolyn S. Gordon (1991) and Robert Griess (1991) have been appointed by President William Browder to the *Central Section Program Committee.* Mark Mahowald (1990) has been appointed chair. Continuing members of the committee are Dennis A. Hejhal (1990), and Andy Roy Magid (ex officio).

President William Browder has appointed Richard N. Lyons (1991) to the *Eastern Section Program Committee.* Jerry L. Kazdan (1990) has been appointed chair. Continuing members of the committee are W. Wistar Comfort (ex officio), Detlef Gromoll (1990), and Walter A. Strauss (1990).

Michael Aschbacher (1991), and Michael G. Crandall (1991) have been appointed to the *Far Western Program Committee* by President William Browder. Sun-Yung Alice Chang (1990) has been appointed chair. Continuing members of the committee are Lance W. Small (ex officio) and John R. Stallings (1990).

Ronald F. Gariepy (1991) and Edward B. Saff (1991) have been appointed by President William Browder to the *Southeastern Section Program Committee.* William Pardon has been appointed chair. Continuing members of the committee are Joseph A. Cima (ex officio), and Ray Kunze (1990).

Karen Uhlenbeck and David A. Vogan, Jr. have been appointed by President William Browder to the *Committee to Select the Gibbs Lecturer for 1991 and 1992.* Elliott H. Lieb has been appointed chair.

Hyman Bass (1992) has been appointed to the *Progress in Mathematics Committee* by President William Browder. Continuing members of the committee are Armand Borel (1991), Paul H. Rabinowitz (1990), Hugo Rossi (1990), and Alan D. Weinstein (1991).

Ellis Kolchin (1992), Mary Ellen Rudin (1992), have been appointed and Gail S. Young (1992) has been reappointed by President William Browder to the *Committee on Academic Freedom, Tenure, and Employment Security.* Continuing members

of the committee are Thomas G. Kurtz (1990), Barbara L. Osofsky (1990), chair, and Charles E. Rickart (1991).

President William Browder has appointed Raymond Ayoub (1991), Joan S. Birman (1992), Chandler Davis (1991), Cora S. Sadosky (1992), and Steven H. Weintraub (1992) to the *Committee on Human Rights of Mathematicians*. Continuing members of the committee are Michael I. Brin (1990), Joel Lebowitz (1990), and Alice T. Schafer (1990), chair.

Henry Alder (1990), Rhonda J. Hughes (1991), Ivan Niven (1990), Eileen Poiani (1992), Bruce Reznick (1990), Carol L. Walker (1991), and Carol S. Wood (1992) have been appointed to the *Pi Mu Epsilon Liaison Committee* by President William Browder. Professor Walker will serve as chair.

Everett Pitcher (1992) has been appointed chair of the *Committee on Professional Ethics* by President William Browder. Continuing members of the committee are C. Edmund Burgess (1990), Harold M. Edwards (1991), Frank L. Gilfeather (1990), and George B. Seligman (1991).

President William Browder has appointed Joseph J. Kohn (1992), Joel L. Lebowitz (1992), Paul J. Sally, Jr. (1992), and Mary F. Wheeler (1992) to the *Science Policy Committee*. Michael C. Reed (1992) has been appointed chair. Other members of the committee are Michael Artin (ex officio), Hyman Bass (1990), William Browder (ex officio), Frank L. Gilfeather (1990), William H. Jaco (ex officio), Jerrold E. Marsden (1991), Cathleen S. Morawetz (1991), John C. Polking (1990), Oscar S. Rothaus (1991), and David A. Vogan, Jr. (1991).

Charles Herbert Clemens, Samuel Gitler, Carlos E. Kenig, Joseph J. Kohn, Horacio A. Porta, Cora S. Sadosky, and David A. Sanchez have been appointed by President William Browder to an ad hoc *Committee on Cooperation with Latin American Mathematicians*. Professor Clemens will serve as chair.

Ronald G. Douglas, Robert M. Fossum (ex officio), John C. Polking, David P. Roselle, and David A. Sanchez have been appointed to the *Committee to Select the Winner of the Award for Public Service* by President William Browder. Professor Fossum will serve as chair.

Dusa McDuff (1991), Alexander J. Nagel (1991), and Karl Rubin (1991) have been appointed by President William Browder to the *Committee on Centennial Fellowships*. Karen A. Vogtmann (1990) has been appointed chair. Continuing members of the committee are David Eisenbud (1990), Lawrence Craig Evans (1990), and Victor L. Klee, Jr. (1990).

Sylvia T. Bozeman (1992), Claudette Bradley (1992), and Johnny E. Brown (1992) have been appointed by Presidents William Browder (AMS) and Lida K. Barrett (MAA) to the AMS-AAAS-MAA *Committee on Opportunities in Mathematics for Underrepresented Minorities*. Gloria F. Gilmer (1992) has been appointed chair. Continuing members of the committee are Shirley Malcom (ex officio), and Argelia Veléz-Rodriguez, consultant.

William Abikoff, Hyman Bass, and Robert M. Fossum have been appointed by President William Browder to the AMS-LMS *Joint Program Committee*.

The Data Subcommittee has split off from the AMS-MAA *Committee on Employment and Educational Policy* and is now a standing joint committee called the AMS-MAA *Data Committee*. Presidents William Browder (AMS) and Lida K. Barrett (MAA) have appointed Edward A. Connors (AMS, 1990), John D. Fulton (MAA, 1991), James F. Hurley (AMS, 1991), Charlotte Lin (AMS, 1992), Don O. Loftsgaarden (MAA, 1990), David J. Lutzer (MAA, 1990), Donald E. McClure (AMS, 1990), and Donald C. Rung (AMS, 1992) to the committee. Lincoln K. Durst is a consultant and James W. Maxwell (AMS) serves as ex officio. Professor Connors will serve as chair.

Morton Brown (MAA, 1992), David J. Lutzer (MAA, 1992), and Bernard L. Madison (AMS, 1992) have been appointed by Presidents William Browder (AMS) and Lida K. Barrett (MAA) to the AMS-MAA *Committee on Employment and Educational Policy*. Continuing members of the committee are Donna Beers (AMS, 1991), Edward A. Connors (AMS, 1991), chair, Philip C. Curtis, Jr. (MAA, 1990), James W. Maxwell (ex officio), and James J. Tattersall (MAA, 1990).

Presidents William Browder (AMS) and Lida K. Barrett (MAA) have appointed Edward A. Connors (AMS, 1991), Steve Doblin (MAA, 1991), Don R. Lick (MAA, 1991), and Shelba J. Morman (MAA, 1992) to the AMS-MAA *Committee on Teaching Assistants and Part Time Instructors* (TA/PTI). John P. Huneke (MAA, 1992) has been appointed chair. Continuing members of the committee are Thomas F. Banchoff (AMS, 1992), Thomas T. Read (AMS, 1991), and Robert H. Szczarba (AMS, 1990).

Miscellaneous

Personal Items

Duncan A. Buell, director for algorithms research at the Supercomputing Research Center, Institute for Defense Analyses, in Bowie, Maryland, will serve as a volunteer in a new program called Institute for Middle School Science and Mathematics Teachers. In the program, sponsored by Bell Atlantic and the American Association for the Advancement of Science, forty participating teachers will team up with practicing scientists to improve science and mathematics education.

David Gilat, of Tel Aviv University, has been promoted to Associate Professor of that institution.

Hans G. Kaper, director of the Mathematics and Computer Science Division at Argonne National Laboratory, has been named a corresponding member of the Royal Dutch Academy of Sciences.

Mokhtar Hassan Konsowa, of the University of Cincinnati, has been appointed an Assistant Professor at the College of Business and Economics, King Saud University, AL Qasseem Branch in the Kingdom of Saudi Arabia.

Harald Niederreiter, of the Austrian Academy of Sciences in Vienna, has been appointed director of the Institute for Information Processing at that Academy.

Hugo Rossi, Dean of the College of Science at the University of Utah, has been appointed director of the Cold Fusion Project at that institution.

Deaths

John Brode, of SimuLogics, Cambridge, Massachusetts, died on September 9, 1989, at the age of 57. He was a member of the AMS for 10 years.

Reuven H. Gurevic, of the University of Wisconsin, died on October 9, 1989, at the age of 37. He was a member of the AMS for 9 years.

Arthur O. Hickson, Professor Emeritus of Duke University, died on October 14, 1989, at the age of 93. He was a member of the Society for 66 years.

Stephanie F. Troyer, of the University of Hartford, died on November 1, 1989, at the age of 45. She was a member of the Society for 17 years.

Visiting Mathematicians

Arpad Takaći and Djurdjica Takaći, from the Institute of Mathematics at Novi Sad, Yugoslavia, are spending the 1989–1990 academic year at Virginia Commonwealth University, Richmond, Virginia.

Some Mathematical Questions in Biology: MODELS IN POPULATION BIOLOGY

Alan Hastings, Editor
(Lectures on Mathematics in the Life Sciences, Volume 20)

Population biology has had a long history of mathematical modeling. The 1920s and 1930s saw major strides with the work of Lotka and Volterra in ecology and Fisher, Haldane, and Wright in genetics. In recent years, much more sophisticated mathematical techniques have been brought to bear on questions in population biology. Simultaneously, advances in experimental and field work have produced a wealth of new data. While this growth has tended to fragment the field, one unifying theme is that similar mathematical questions arise in a range of biological contexts.

This volume contains the proceedings of a symposium on Some Mathematical Questions in Biology, held in Chicago in 1987. The papers all deal with different aspects of population biology, but there are overlaps in the mathematical techniques used; for example, dynamics of nonlinear differential and difference equations form a common theme. The topics covered are cultural evolution, multilocus population genetics, spatially structured population genetics, chaos and the dynamics of epidemics, and the dynamics of ecological communities.

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PRIMES ASSOCIATED TO AN IDEAL

Stephen McAdam
(Contemporary Mathematics, Volume 102)

This book discusses five closely related sets of prime ideals associated to an ideal *I* in a Noetherian ring: the persistent, asymptotic, quintasymptotic, essential, and quintessential primes of *I*. Since the appearance of the author's last book on the subject, which focused on the first two of these prime ideals, the other three sets were developed and new results were obtained for the first two. Current results are scattered over some three dozen papers, making it difficult for interested readers to become familiar with the subject.

The aim of this book is to present in an efficient way the most important and interesting ideas in the subject and to show how these prime ideals reveal information about both *I* and the ring. Because the required background consists of little more than a standard one-year course in commutative ring theory, the book should be accessible to graduate students. The work is primarily intended for commutative ring theorists, but noncommutative ring theorists and algebraic geometers may also find it of interest.

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UNIVERSITY OF TENNESSEE
Department Head

The University of Tennessee at Chattanooga invites applications for Head, Department of Mathematics. PhD in mathematical sciences with previous administrative experience desired. The Head should provide leadership in curriculum development and support for teaching and scholarship. The Department has 22 faculty members including a Chair of Excellence in applied mathematics. In this primarily undergraduate institution, the faculty is expected to exhibit excellence in teaching while maintaining a strong commitment to research and public service. UTC has 7800 students in a very scenic metropolitan area of 400,000. Send applications with vita and 3 letters of reference to: Dr. Paul L. Gaston, Dean, College of Arts and Sciences, 119 Holt Hall, UTC, Chattanooga, TN 37403. Those received before March 1, 1990 will be given preference. Women and minorities are encouraged to apply. UTC is an Equal Opportunity Employment/Affirmative Action/Title IX/Section 504 Institution.

UNIVERSITY OF LIVERPOOL
Chair of Pure Mathematics

Applications are invited for a Chair in the Department of Pure Mathematics. There are two chairs in the Department; the other is held by Professor C. T. C. Wall, F.R.S.

The Department works closely with the Departments of Applied Mathematics and Theoretical Physics and of Statistics and Computational Mathematics; undergraduate teaching is coordinated by a Board of Mathematical Studies. The Department has an excellent international reputation and attracts considerable research funding; it has been put in the top grade for research in each of the UGC/UFC assessments.

The salary will be within the range for non-clinical professorial salaries, curently not less than £25,919 per annum.

Applications together with the names of three referees, should be received not later than 15 March 1990, by The Director of Staffing Services (AS), The University, P. O. Box 147, Liverpool L69 3BX from whom further particulars may be obtained.

Quote ref. RV/573/NAMS

An Equal Opportunity Employer.

UNIVERSITY OF NORTH FLORIDA
DEPARTMENT OF MATHEMATICS AND STATISTICS

Applications are invited for a possible visiting position for the academic year 1990–91. Candidates must have the Ph.D. in Mathematics or the M.S. in Mathematics with strong coursework. All candidates must have an excellent teaching record; candidates with the Ph.D. must have a record of continuing scholarly activity. Teaching duties will depend on the qualifications of the individual; the Department offers service, major, and graduate courses. The Department offers the BA and BS in Mathematics and in Statistics and the MA with tracks in Mathematics, Statistics, and Computing. The regular faculty of 14 members is active in a variety of areas of Mathematics and Statistics. The University is a growing institution in the State University System of Florida; more than 7500 students are currently enrolled. Send resume, 3 letters of recommendation, and transcript by March 20, 1990, to Leonard J. Lipkin, Chairperson, Department of Mathematics and Statistics, University of North Florida, 4567 St. Johns Bluff Road South, Jacksonville, Florida 32216. The University is an affirmative action/equal opportunity employer and encourages applications from women and minorities.

IOWA STATE UNIVERSITY

The Department seeks qualified applicants for tenure track positions at the assistant professor level in Discrete Mathematics and in Mathematical Biology and for a tenure track position at the associate or full professor level in Computational Mathematics or Numerical Analysis starting August 21, 1990. The successful applicant for the senior position will be expected to seek outside funding for his or her research and to interact scientifically with colleagues in other campus departments. There will be start up funds available for the successful applicant for each of the three positions.

We will begin the interview process January 15, 1990. However, we shall continue to accept applications after that date until the positions are filled.

A number of visiting positions in diverse areas are expected to be available also and applications for them are also encouraged.

Women and minorities are encouraged to apply. Iowa State University is an Affirmative Action/Equal Opportunity Employer.

Applications should be sent to Howard A. Levine, Chair, Department of Mathematics, Iowa State University, Ames, Iowa 50011.

POSITIONS AVAILABLE

NORTH CAROLINA STATE UNIVERSITY
Department of Mathematics
RESEARCH INSTRUCTORSHIP IN PURE MATHEMATICS

The Department of Mathematics at North Carolina State University in Raleigh invites applications for the position of Research Instructorship in Pure Mathematics. This appointment will be for 2 years (with a possible extension for a third year) and will require teaching of two courses in the fall semester and one course in the spring semester.

The Department has over 15 active researchers in pure mathematics. Their research interests are currently concentrated in the areas of Lie theory, ring theory and mathematical physics. While all fields of concentration will be considered, special consideration will be given to candidates working in differential geometry, Lie groups, algebraic groups, Lie algebras and/or ring theory. The Department has an active seminar program including regularly scheduled seminars in algebra and mathematical physics as well as participation in the Duke/UNC-Chapel Hill algebraic geometry seminars.

Applicants should send a description of their research (1-3) pages, curriculum vitae and 3 letters of recommendation to Professor R. O. Fulp, Box 8205, N.C. State University, Raleigh, NC 27695-8205. To ensure full consideration applications should be received by March 15, 1990. NCSU is an AA/EOE.

DEPAUL UNIVERSITY
Department of Mathematical Sciences

Applications are invited for a tenure-track position at the assistant professor level beginning in September, 1990. A Ph.D. in Mathematics is required. We will consider strong candidates in any field of research. DePaul University is primarily an undergraduate institution. The Department of Mathematics has graduate programs in Mathematics Education and Applied Mathematics. Strong commitment to teaching is essential. The official teaching load is nine quarter courses/year, but a reduction to seven quarter course/year for research is possible. Applicants should send a vitae and 3-4 letters of recommendation, at least one of which pertains to teaching, to Hiring Commitee, Department of Mathematics, 2219 N. Kenmore, Chicago, IL **60614**. Women and minorities are encouraged to apply.

HONG KONG BAPTIST COLLEGE
Principal Lecturer/Lecturer in Mathematics (PR184)

Highly motivated applied mathematicians are invited to apply for the above posts commencing on or before September 1990. Baptist College is a government-funded institution with a student body of 3000. The Mathematics Department offers a comprehensive B.Sc. (Honours) curriculum and M.Phil. by research. Typical teaching load is two subjects (6 hours) per semester plus supervision of 4 final year project students. The atmosphere is congenial, and interdisciplinary collaboration is encouraged. Qualifications for Lecturer are a Ph.D., teaching experience, and research promise. Applicants for Principal Lecturer should have extensive teaching and research experience and the ability to provide academic leadership. Applicants with expertise in any area of applied mathematics are encouraged to apply—especially statisticians. Salary (under review) is US$46,070–US$57,185 p.a. for Principal Lecturer and US$24,485–US$37,155 p.a. for Lecturer. Benefits include housing assistance, medical/dental benefits, education allowance for children, passage and vacation leave. Overseas appointees will be offered an initial 2-year contract with 15-25% gratuity payable at the end of the contract. Appointment may be renewed subject to mutual agreement. To apply send complete curriculum-vitae and three letters of reference to the Personnel Section, Hong Kong Baptist College, 224 Waterloo Road, Kowloon, Hong Kong. Deadline for applications is February 15, 1990 or until vacancies have been filled.

LEHMAN COLLEGE (CUNY)
Department of Mathematics and Computer Science

Tenure track position anticipated in mathematics and computer science. Candidate must have an earned doctorate, a strong commitment to teaching and a demonstrated outstanding research potential. Rank and salary commensurate with qualifications. Send resume and names of three references to:

Prof. Robert Feinerman, Chairman
Department of Mathematics and Computer Science
Lehman College
Bronx, N.Y. 10468

AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER

UNIVERSITY OF CALIFORNIA RIVERSIDE
Announcement
Chairperson and Professor
Department of Mathematics

The College of Natural and Agricultural Sciences invites applications and nominations for the position of Chairperson and Professor of the Department of Mathematics, effective July 1, 1990. The department is responsible for both undergraduate and graduate teaching in one of the fastest growing universities in the country. Currently the department has twenty-eight full-time faculty with emphases in algebra, geometry, topology, and analysis combinatorics. There are 106 undergraduate majors and 36 graduate students.

Preference will be given to candidates capable of providing leadership in both the department and profession and in representing the faculty's perspective in the college; enhancing faculty performance and extramural support and connecting the various program interests in computing with a new College of Engineering. Candidates for the position should have the following qualifications: an earned doctorate in mathematics; a distinguished record of scholarship, teaching and service appropriate for the appointment as full professor; demonstrated administrative skills; and a strong commitment to academic values and the principles of affirmative action.

The chairperson reports to the Dean of the College of Natural and Agricultural Sciences and is responsible for providing leadership and representing faculty in matters such as teaching, personnel, and budget. Chairpersons are appointed for up to five years and may be reviewed. Salary will be commensurate with qualifications and experience. The faculty appointment is a nine-month position with additional compensation for duties while chairperson. The closing date for applications will be February 15, 1990. A letter of intent, along with a curriculum vitae, and the names, addresses and phone numbers of at least three references should be sent to:

Dr. Seymour D. Van Gundy
Interim Dean, College of Natural and Agricultural Sciences
University of California Riverside
Riverside, CA 92521

The University of California, Riverside is an Equal Opportunity, Affirmative Action Employer. Women and Minorities are encouraged to apply.

POSITIONS AVAILABLE

THE UNIVERSITY OF OKLAHOMA
Department of Mathematics

Applications are invited for one or more positions at the Assistant Professor level (or higher) in Mathematics beginning Fall 1990. Candidates must have a Ph.D. degree, demonstrated excellence in research, and potential for high-quality teaching. Strong candidates in all areas will be considered, with preference given to research interests compatible with those of our current faculty. Duties include research, normally teaching six credit hours per semester, and Departmental and University service appropriate to rank. Salary and rank will be commensurate with qualifications and experience. There may also be visiting positions. Applicants should send their vita and have at least three letters of reference sent to Dr. Ruediger Landes, Search Committee Chair, Department of Mathematics, University of Oklahoma, 601 Elm, Room 423, Norman, Oklahoma 73019-0315. Initial screening begins December 15, 1989 and every two weeks thereafter. Applications will be accepted until the position(s) are filled. The University of Oklahoma is an Affirmative Action/Equal Opportunity Employer.

NORTHERN MICHIGAN UNIVERSITY
DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

The Mathematics and Computer Science Department invites applications for an anticipated temporary position at the rank of Assistant Professor. All specialties welcome–mathematics, mathematics education, statistics, and computer science.

Northern is primarily an undergraduate institution and a commitment to teaching is an essential requirement for the positions. Scholarship and professional activity are both encouraged and supported.

Applicants should send a resume, transcripts, and three letters of reference to Dr. Terrance Seethoff, Head; Department of Mathematics and Computer Science; Northern Michigan University; Marquette, MI 49855.

Northern Michigan University is an equal opportunity, affirmative action employer.

THE UNIVERSITY OF OKLAHOMA
Applied Non-Linear Analysis
Applied Mathematics
Position (CAPS) Related

The University of Oklahoma seeks a (tenure track) Assistant Professor (or higher) with a speciality in Applied Non-Linear Analysis. A Ph.D. in Mathematics is required. Expertise in fluid dynamics and numerical and computational experience are desirable. Potential for excellence in mathematics teaching and research is required. Competitive Salary.

This position is expected to contribute to the mathematical support of the Center for the Analysis and Prediction of Storms, A Science and Technology Center at the University of Oklahoma funded by the National Science Foundation.

Applicants should send a letter of application, a complete vita, and have three letters of reference sent to: Andy R. Magid, Chair, Applied Analysis Search Committee, Department of Mathematics, University of Oklahoma, 601 Elm, Room 423, Norman, Oklahoma 73019-0315. Closing date for applications is December 20, 1989 and every two weeks thereafter until the position is filled. The University of Oklahoma is an Equal Opportunity/Affirmative Action Employer.

AUBURN UNIVERSITY
DIVISION OF MATHEMATICS
DEPARTMENT OF FOUNDATIONS, ANALYSIS, AND TOPOLOGY

We anticipate having at least two visiting positions available for the 1990-91 academic year. Partial appointments are also possible. The applicant's area of research should be compatible with the interests of present faculty. Closing date for applications: March 31, 1990.

Send vita and have three letters of recommendation sent to George Kozlowski, Head, Department of Foundations, Analysis, and Topology, AUBURN UNIVERSITY, AL 36849-5310.

Minorities and women are encouraged to apply.

AUBURN UNIVERSITY IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.

UNIVERSITY OF MARYLAND
COLLEGE PARK
DEAN
College of Computer, Mathematical and Physical Sciences

Applications and nominations are invited for the position of Dean of the College of Computer, Mathematical, and Physical Sciences at the University of Maryland, College Park campus. The Dean provides both academic and administrative leadership for the College and reports directly to the Vice Chancellor for Academic Affairs and Provost.

The College consists of the departments of Computer Science, Geology, Mathematics, Meteorology, and Physics and Astronomy, as well as the Applied Mathematics Program, the Center for Automation Research, the Chemical Physics Program, the Institute for Physical Science and Technology, the Institute for Advanced Computer Studies, and the Laboratory for Plasma Research. The College employs 472 faculty members and approximately 800 support personnel. Presently about 2300 undergraduate students and 800 graduate students are enrolled in degree programs within the College. In 1988-89, researchers in the College were awarded approximately $34 million in external grants and contracts. The state-supported budget was about $28 million.

A candidate should have an earned doctorate, be eligible for appointment in a department of the College at the rank of Professor with tenure, have successful experience as a teacher and a distinguished record of scholarly research, and have demonstrated leadership ability and management skills.

Applications should include a curriculum vitae and the names and addresses of at least four references. For best consideration, all applications should be submitted before March 1, 1990 to:

Patrick F. Cunniff
Office of Graduate Studies & Research
2125 Lee Building
University of Maryland
College Park, Maryland 20742

The University of Maryland is an equal opportunity, affirmative action employer. Women and minority cadidates are encouraged to apply.

POSITIONS AVAILABLE

MISSISSIPPI STATE UNIVERSITY
Department of Mathematics and Statistics

Applications are invited for two or more anticipated tenure-track or visiting positions for 1990-91. At least one of the positions will be in statistics and probably at least at the associate professor level. Candidates should possess a doctoral degree, demonstrate a strong potential for reseach, and have a commitment to effective teaching. All areas are welcomed but preference will be given to the following: for the mathematics position(s), applied mathematics, computational mathematics, and partial differential equations; for the statistics position(s), multivariate analysis, non-parametric and robust inference, categorical analysis, and linear and non-linear models.

The Department offers graduate programs leading to the Master of Arts degree (M.A.) and the Master of Science degree (M.S.) in both mathematics and statistics and the Doctor of Philosophy degree (Ph.D.) in mathematical sciences. Facilities exist for applicants with interest in interdisciplinary research efforts and in particular for applicants with an interest in the computational aspects of the mathematical sciences.

Applicants should send a curriculum vitae and arrange for three letters of recommendation to be sent to: John R. Gilbert, Chairman, Search Committee, Department of Mathematics and Statistics, P.O. Drawer MA, Mississippi State, MS 39762. The committee will begin to review applications on January 15, 1990, and continue until positions are filled. Mississippi State University is an equal opportunity/affirmative action employer.

COLUMBIA UNIVERSITY
Department of Computer Science
Lectureships

Positions as Lecturer or Senior Lecturer will be offered to excellent teachers with superior research and academic backgrounds. Faculty of all ranks in other mathematical disciplines, as well as computer science, are encouraged to apply for these non-tenured term appointments, whose duration will typically be three to six years. Pay is comparable to professorial levels.

These lectureships provide an opportunity for teacher/scholars with some substantial prior computing experience to make a transition to computer science. Columbia University has an outstanding young research faculty and facilities, now working in a five-million dollar office and research-laboratory building. All of our "lecturer alumni" are presently in good positions at leading universities and colleges.

Lecturers will teach two undergraduate courses each semester. They must be able to make highly effective presentations to large classes. The University has several SUN 4 computer systems dedicated to instructional use. Many terminals for students are in dormitories and other convenient locations. Knowledge of innovative uses of technology for teaching is desirable.

Send resume and three letters of reference by February 15, 1990, if possible, to Lecturer Recruiting, Department of Computer Science, Columbia University, New York, New York 10027.

Columbia University is an Equal Opportunity/Affirmative Action Employer. We are interested in receiving applications from qualified women and minorities.

THE CLARE BOOTHE LUCE FACULTY CHAIR AT CREIGHTON UNIVERSITY
in Mathematics/Computer Science

Creighton University invites applications from outstanding women candidates for appointment to the Clare Boothe Luce Faculty Chair in the Mathematics/Computer Science Department.

Candidates are expected to be excellent scholar/teachers who will serve as mentors and role models for undergraduate women interested in careers in scientific research. The Department will consider candidates in Mathematics, Statistics, or Computer Science. Candidates are expected to be interdisciplinary in approach and committed to a productive research program. The successful candidate will be expected to teach in the general mathematics/computer science/statistics program and in her area of specialization, and to develop an active research program involving undergraduate and graduate students. The initial appointment, at the Assistant Professor level, is renewable annually up to a total of five years. Salary is commensurate with the capabilities of an outstanding scholar/teacher.

Interested women should send a letter of intent, a **curriculum vitae**, official transcripts, three letters of reference, a statement of current research interests and achievements, and information on teaching experience and success. Materials should be mailed to meet a 15 February 1990 deadline. Please address applications and inquiries to: The Search Committee, Dean's office, College of Arts and Sciences, Creighton University, California at 24th Street, Omaha, NE 68178.

Creighton University is an equal opportunity, affirmative action employer.

UNIVERSITY OF VERMONT
Positions in Applied Mathematics

Positions for applied mathematicians, tenure-track or visiting. Salary and rank commensurate with ability and experience. Demonstrated excellence in research and teaching, interaction with other scientists and engineers. Also, postdoctoral positions in subjects of current departmental interest. Send vitae, description of research, and three letters of reference or names of references to Kenneth I. Gross, Personnel Committee, Department of Mathematics and Statistics, University of Vermont, Burlington, VT 05405. UVM is an Equal Opportunity/Affirmative Action Employer.

MARQUETTE UNIVERSITY

Mathematics/Statistics/Computer Science. Tenure-track Assistant Professorship requiring the Ph.D. to begin August, 1990. Preferred research area is computational group theory, and ability to teach upper division computer science courses is required. To apply send vita, transcripts and 3 letters of recommendation to Douglas Harris (Chairman), Department of Mathematics, Statistics and Computer Science, Marquette University, Milwaukee, Wisconsin, 53233. Closing date: February 28, 1990 or until filled. Marquette University is an EEO/AA employer.

SYRACUSE UNIVERSITY
Department of Mathematics

We anticipate positions available at the Assistant and Associate Professor level beginning Fall 1990. Candidates should have outstanding research ability and evidence of excellence in teaching. Applications are invited in any area of mathematics and in mathematics education and statistics. Send a letter of application and vita with a list of publications and three references to: Daniel Waterman, Chair, Syracuse University, Department of Mathematics, Box 1, Syracuse, NY 13244-1150.

POSITIONS AVAILABLE

THE UNIVERSITY OF NEW MEXICO
Albuquerque, New Mexico
Department of Mathematics and Statistics

The Department expects to have four tenure track positions available, beginning in the Fall Semester, 1990. We are particularly interested in candidates at the assistant professor level with postdoctoral experience, but we will consider outstanding applicants at all levels. Candidates must have a strong research record or outstanding potential and a commitment to excellence in teaching.

The Department of Mathematics and Statistics currently has 40 faculty members and an active and expanding graduate program. The Department has close research ties with Los Alamos and Sandia National Laboratories, and access to major computing facilities. Joint appointments with other departments are possible.

Review of applications will begin January 15, 1990, and will continue until the positions are filled. All exceptionally strong candidates, especially women and minority group members, are urged to apply. Please have vitae and three letters of reference sent to:

Professor Robert Cogburn, Chair
Hiring Committee
Dept. of Mathematics & Statistics
The University of New Mexico
Albuquerque, NM 87131

THE UNIVERSITY OF NEW MEXICO IS AN AA/EOE.

KENNESAW STATE COLLEGE
Mathematics Department
P.O. Box 444
Marietta, GA 30061

At least one tenure track position in Mathematics at the level of Assistant Professor beginning in September, 1990. A Ph.D. is required with a strong commitment to undergraduate education as well as an interest in scholarly activities. Preference will be given to degrees in Combinatorial Group Theory, Combinatorics, or Statistics. Salary and rank are competitive and commensurate with credentials and experience. The College is located in Northwest Metro Atlanta, and enrolls over 9000 day and evening students in undergraduate and graduate programs. The department of Mathematics has 18 full-time faculty and shares 6 others with the Department of Computer Science. Send resume and a list of three references to Dr. Nancy E. Zumoff, Chair, Search Committee. Application deadline is March 1, 1990, or until filled (EOE/AA)

MISSISSIPPI STATE UNIVERSITY
ADVERTISEMENT
Position Announcement
Head, Department of Computer Science

Mississippi State University invites applications and nominations for the position of head of the Department of Computer Science. A successful candidate must have (1) an earned doctorate in computer science or related field, an (2) faculty experience in a doctoral granting program. In addition, candidates should have demonstrated leadership and a successful record of teaching, research, and grant procurement. The appointment will be at the rank of professor with a highly competitive salary. The anticipated starting date is July 1, 1990.

As one of the 100 largest research universities (expenditures) in the country and the largest university in the state, MSU offers a broad range of undergraduate and graduate programs. The Department of Computer Science offers a CSAB-accredited undergraduate program and graduate study leading to the MCS, MS and PhD degrees. In cooperation with electrical engineering, the department also offers programs of study leading to the BS and MS degrees in computer engineering.

Screening of candidates will begin February 15, 1990 and will continue until the position is filled. Nominations and applications with curriculum vita should be sent to: Dr. George S. Rent, Chairperson, Search Committee for Head of Computer Science, College of Arts and Sciences, P.O. Box AS, Mississippi State, MS 39762. MSU is an equal opportunity affirmative action employer.

FLORIDA INTERNATIONAL UNIVERSITY
The State University of Florida at Miami

The Department of Mathematics announces two junior tenure track positions beginning August 1990. Candidates must have a Ph.D. in Mathematics and a commitment to research and quality teaching. Preferred areas of specialization include harmonic analysis, logic, representation theory, complex variables, and differential geometry. Qualified candidates in other areas will be considered.

Teaching load consists of 15 semester hours per academic year. Send resume and 3 letters of recommendation to Recruitment Committee, Department of Mathematics, Florida International University, Miami, FL 33199.

Florida International University is the State University of Florida at Miami. The university is an equal opportunity/affirmative action employer.

THE VIRGINIA MILITARY INSTITUTE
Mathematics/Computer Science

Applications are invited for a tenure-track position in the Mathematics and Computer Science Department beginning August, 1990. The applicant should have a strong interest in teaching and participating in the continued development of the computer science degree program. VMI began offering a B.S. in computer science in 1987 and now has 57 students either as majors or minors. The computer science laboratory contains a Data General MV/7800 with 20 terminals. VMI also has a Burroughs A9 and approximately 200 IBM PC's for student and faculty use.

Preference will be given to an applicant with a Ph.D. in a computer-related field such as Computer Science, Mathematics, Operations Research, or Management Information Systems. If the degree is not in Computer Science, the applicant must have significant formal education or experience in Computer Science. Duties include teaching both mathematics and computer science courses. Salary and rank are commensurate with degrees, qualifications, and experience.

VMI is a quality undergraduate military college of engineering, liberal arts, and science, with an enrollment of 1300 students, located in an attractive college town. Faculty wear uniforms but have no other assigned military duties.

The deadline for applications is March 1, 1990. Candidates should send resumes with at least three references to Thomas C. Lominac, Department of Mathematics and Computer Science, Virginia Military Institute, Lexington, VA 24450

AA/EEO Employer.

UNIVERISTY OF CALIFORNIA
IRVINE
DEPARTMENT OF MATHEMATICS
IRVINE, CALIFORNIA

The Department of Mathematics announces possible temporary positions for lecturers for the academic year 1990-91. These positions are generally for one quarter at a time and at varying percentages depending on the number and nature of courses assigned to be taught. Masters degree in Mathematics and a good teaching record are required. Send enquiries to Chair, Department of Mathematics, University of California, Irvine, CA 92717.

UCI is an equal opportunity/affirmative action employer.

POSITIONS AVAILABLE

RUTGERS UNIVERSITY-NEWARK DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE SENIOR POSITION PROFESSOR OF MATHEMATICS SEARCH EXTENDED

The Department of Mathematics and Computer Science anticipates an opening at the full professor level beginning Fall 1990. Rutgers University has two levels of full professorships and the appointment will either carry the rank of Professor I or Professor II. Candidates should exhibit outstanding research accomplishments and should be able to play a leadership role in the department. Salary and teaching load are negotiable. Applicants from all fields are invited. Areas of research interest in the department include number theory, representation theory and automorphic forms, Lie algebras, transformation groups, low dimensional topology and Teichmuller theory. Applications including at least three letters of recommendation should be sent to: Jane Gilman, Chair, Department of Mathematics, Rutgers University, Newark, New Jersey 07102. The closing date for applications is 3/1/90 but applications will be considered until the position is filled.

AA/EOE.

THE UNIVERSITY OF MANITOBA ANNOUNCEMENT OF STATISTICS POSITION

The Department of Statistics, The University of Manitoba, invites applications for a term position at the assistant professor level. The appointment will be for a two year term, starting July 1, 1990 or September 1, 1990. The salary will be commensurate with qualifications and experience. A Ph.D. or near completion in statistics or probability theory is required, and duties will include research, teaching and consulting. Preference will be given to candidates who have a strong research potential.

Please send your application as soon as possible, but not later than February 15, 1990, to:

Dr. Lai K. Chan
Department of Statistics,
The University of Manitoba
Winnipeg, Manitoba, Canada
R3T 2N2

Your application should include an updated curriculum vitae and the names of three individuals who would be prepared to write letters of recommendation.

Both women and men are encouraged to apply. In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents.

RICE UNIVERSITY Mathematical Sciences Department P.O. Box 1892, Houston, Texas 77251

Applications are invited for a tenure-track assistant professor position to start August, 1989 in energy and environmental applications of mathematics. Applicants should demonstrate both breadth of interest and promise in research and teaching. We especially invite applications in numerical linear algebra, mathematical programming, and numerical solutions of partial differential equations.

Rice University is a private research university with a long tradition of excellence in undergraduate science and engineering education. The Mathematical Sciences Department also hosts an active and expanding graduate program, has superb computing facilities and ongoing research in Operations Research, Computational Mathematical Programming, and Optimal Design and Inverse Problems for Partial Differential Equations. The department has excellent relations with other departments at Rice and the University of Houston, with industrial and governmental research groups, and is actively involved in the Center for Research in Parallel Computation which is funded by the NSF Science and Technology Centers program.

Please furnish vita, transcripts, reprints, and three letters of recommendation to J. E. Dennis, Chair, Staffing Committee. Rice University is an Affirmative Action/Equal Opportunity Employer.

WORCESTER POLYTECHNIC INSTITUTE

The Department of Mathematical Sciences will have several tenure track positions at all levels for fall of 1990. These positions require a strong research record or potential and evidence of quality teaching. Fields of interest are numerical analysis, computational fluid mechanics, nonlinear PDE, optimization, control theory, optimal design, dynamical systems, applied discrete mathematics, operations research, and statistics/applied probability.

WPI, the nation's third oldest college of science and engineering, offers degrees through the Ph.D. The Mathematical Sciences Department currently offers an undergraduate and master's degree in applied mathematics. Worcester, Massachusetts is the second largest city in New England, approximately 40 miles west of Boston.

Interested applicants should send a curriculum vita to: Samuel M. Rankin, III, Head, Department of Mathematical Sciences, 100 Institute Rd., Worcester, MA 01609. Applications will be accepted until the positions are filled. EOE/AA.

WESTERN CAROLINA UNIVERSITY

Nominations and applications are invited for the position of Head, Department of Mathematics and Computer Science. The department has eighteen full time faculty members and offers programs leading to the B.S., B.S. Ed., M.S., and M.A. Ed. degrees with majors in mathematics, and the B.S. degree with a major in computer science. Western Carolina University has an enrollment of 6200 and is a member of the University of North Carolina system. The successful candidate should have a terminal degree, a sustained record of quality teaching, research, and service, and an interest in both undergraduate and graduate program development, as well as administrative experience and/or potential.

Applicants should send a resume, graduate transcripts, and three letters of reference to: Dr. James H. Horton, Chair, Mathematics and Computer Science Search Committee, School of Arts and Sciences, Western Carolina University, Cullowhee, NC 28723. WCU is an Equal Opportunity/Affirmative Action Employer. Closing date for receipt of applications is March 1, 1990.

UNITED STATES AIR FORCE ACADEMY DEPARTMENT OF MATHEMATICAL SCIENCES VISITING PROFESSOR

The Department of mathematical Sciences of the United States Air Force Academy invites nominations and applications for a Visiting Professor position. We seek a Professor with extensive experience teaching undergraduate mathematics, statistics or operations research and a strong record of scholarly activity. Duties will include reviewing our academic programs, teaching undergraduate courses and promoting our research programs. Applicants should have a demonstrated commitment to undergraduate research and education. The appointment is usually for one year and will begin in July 1991. Inquiries are welcome for Visiting Professor positions for subsequent years. Salary is commensurate with qualifications. To apply, please send nominations (to include resume and references) by 1 May 1990 to: Chairman, Department of Mathematical Sciences, United States Air Force Academy, CO 80840-5701.

POSITIONS AVAILABLE

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM DEPARTMENT OF MATHEMATICS

Applications are invited for one or more anticipated tenure or tenure-track positions. Preference will be given to strong candidates whose research interests are compatible with those of our current faculty; this includes numerical PDE/Scientific computation, mathematical physics, partial differential equations, nonlinear analysis, dynamical systems, including topological dynamics, and differential geometry. Faculty members have access to the Alabama Super Computer (using a Sun Station and a T-1 line to a Cray X-MP/24). Rank and salary will be subject to qualifications, but applicants for senior positions must have demonstrated excellence in research, while applicants for junior positions must exhibit the promise of excellence. Send as soon as possible a curriculum vita, selected reprints, and three letters of reference (candidates for senior positions may choose to submit a list of references instead) to Search Committee, Department of Mathematics, University of Alabama at Birmingham, Birmingham, AL 35294. UAB is an Affirmative Action/Equal Opportunity Employer.

HANOVER COLLEGE

Mathematics: Tenure track position beginning Sept., 1990. The Mathematics Department of Hanover College offers standard courses for majors and a large number of classes for science, economics and business students and for candidates for teacher certification. The department will also oversee a mathematics "learning center" now being organized. Candidates should thus be skilled at communicating mathematical ideas to students for varying sophistication in the field. They should also be committed to teaching in the tradition of the liberal arts at a selective, independent, Presbyterian college. Rank and salary dependent on qualifications and experience. Applications, vitae, transcripts, and at least three letters of reference to Charles L. Flynn, Dean of the College, Hanover College, Hanover, Indiana 47243. EEO/AA employer committed to building a culturally pluralistic faculty and student body.

MURRAY STATE UNIVERSITY Department of Mathematics & Statistics

Applications are invited for tenure-track positions at the Assistant/Associate Professor level beginning August 1990. Preference will be given the applicants in statistics, numerical analysis, and mathematics education, but candidates in all areas of mathematics will be considered.

Responsibilities will include a maximum three course teaching load of a wide variety of undergraduate and graduate level courses, continuing research/scholarly activities, and university/departmental service. A Ph.D. in mathematics or statistics is required or expected before the starting date. Salary will be competitive. Screening will begin February 1, 1990 and continue until positions are filled.

Applicants who are not U.S. citizens must provide their visa status and any other information relevant to their ability to accept employment. Send letter of application with vita, graduate transcript or list of courses, and direct three letters of recommendation to:

Screening Committee
Department of Mathematics & Statistics
Murray State University
Murray, Ky. 42071

MSU is an EO/AA employer.

STANFORD UNIVERSITY Department of Mathematics and Statistics

We invite applications for a tenure-track position in probability at the Assistant Professor level beginning Autumn Quarter 1990 to 1991. The position is a joint appointment in the Department of Mathematics and Statistics. Excellent research potential in probability and stochastic processes, strong interests in applications, and commitment to quality teaching are required. Outstanding candidates at higher ranks will also be considered. Please submit applications, curriculum vitae and letters from three professional references to: Yitzhak Katznelson, Chairman of Search Committee, Department of Mathematics, Stanford University, Stanford, CA 94305-2125, U.S.A.

Stanford University is an Equal Opportunity, Affirmative Action Employer, and welcomes applications from women and minorities.

AMERICAN UNIVERSITY OF BEIRUT TEACHING OVERSEAS

The Department of Mathematics at the American University of Beirut in Beirut, Lebanon (AUB) invites applications for faculty positions at the level of Assistant Professor or above, available October 1, 1990. Candidates are sought in the fields of Analysis, Mathematical Statistics, and Topology.

Applicants should hold the Ph.D. degree and would be expected to teach undergraduate and graduate courses and to be committed to research. Post-doctoral experience is preferred.

Appointments are normally made for a three-year period. AUB is an EO/AA employer.

Interested persons may send their curriculum vitae and three letters of recommendation before March 31, 1990 to the Dean of Arts and Sciences, c/o New York Office of the American University of Beirut, 850 Third Avenue, New York, New York 10022, USA.

U.S. passports are presently invalid for travel to, in or through Lebanon, and for residence in Lebanon, by order of the Department of State, and therefore applications from individuals who would travel to or reside in Lebanon on a U.S. passport cannot at this time be considered.

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY MATHEMATICAL PHYSICS

The Center for Transport Theory and Mathematical Physics at Virginia Tech anticipates a number of openings for visitors during academic year 1990-91. Applications in all areas of mathematical physics are invited for all or any parts of the year. There may also be possibilities of tenure-track appointments. Appointments may be made at any level, from postdoctoral up. Please send a curriculum vitae and a short description of research plans (for visiting positions only) and arrange for three letters of recommendation to be sent directly to Prof. P. F. Zweifel, Virginia Polytechnic Institute and State University, CTTMP-212A Robeson Hall, Blacksburg, VA 24061-0435, USA. VA Tech is an EO/AA employer. Women and minorities are encouraged to apply.

POSITIONS AVAILABLE

UNIVERSITY OF WYOMING
Department of Mathematics

Invites applications for the following positions:

One tenure-track position at the assistant professor level in the area of functional analysis, numerical linear algebra, dynamical systems theory, and algebraic/computational combinatorics.

Send resume and direct three letters of recommendation to:

Professor W. Bridges, Chairman
Mathematics Department
P.O. Box 3036 University Station
University of Wyoming
Laramie, WY 82071-3036
(307) 766-4222

Applications completed by January 31, 1990 will be given first consideration. The University of Wyoming is an Equal Opportunity/Affirmative Action Employer.

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
DEPARTMENT OF MATHEMATICS

We anticipate making several tenure-track appointments at the assistant professor level or above beginning with the academic year 1990-1991. Very strong research potential is required for junior-level appointments and a demonstrated outstanding record for senior-level appointments. A Ph.D. is required. Primary areas of interest are algebraic and differential geometry, discrete mathematics, dynamical systems, and computationally oriented mathematics. Exceptional candidates in other areas will be considered. Applications will be accepted until March 15, 1990, or until the positions are filled. Applicants should send vita and three letters of reference to: Chairman, Search Committee, Department of Mathematics, Virginia Tech, Blacksburg, VA 24016-0123. Women and minorities are encouraged to apply. Virginia Tech is an Equal Opportunity/Affirmative Action Employer.

THE UNIVERSITY OF SCRANTON
Mathematics Department

The University of Scranton is a Jesuit university with over 3,500 undergraduates. The Mathematics Department is newly formed from a split in a combined Mathematics/Computer Science Department. It has 15 full time faculty and about 50 majors.

Four tenure-track positions are available for Fall 1990 for faculty interested in a teaching environment where research is encouraged and supported. Individuals with expertise in any area of mathematics will be considered. Preferred areas include Applied Mathematics, Probability/Statistics, Actuarial Mathematics, Algebra, and Analysis. Rank and salary are open and competitive.

Submit a vita, transcripts, and three references to Mathematics Faculty Search Committee, University of Scranton, Scranton, PA, 18510 or phone (717) 961-7774. Screening will begin at once and applications will be considered until all positions have been filled. An AA/EO Employer and Educator.

UNIVERSITY OF NOTRE DAME
DEPARTMENT OF MATHEMATICS
NOTRE DAME, INDIANA 46556
ANDREW J. SOMMESE, CHAIRMAN

Several tenured or tenure-track positions. The Mathematics Department is eager to found a group in Applied Mathematics. Outstanding candidates in applied mathematics are encouraged to apply, particularly in dynamical systems/ordinary differential equations, numerical analysis, statistics/probability. Rank and salary depend on experience and qualifications. Applications should demonstrate accomplishment and potential in teaching and research, and should include vita, a few selected reprints or preprints, and 3 or 4 letters of recommendation. Notre Dame is an Equal Opportunity/Affirmative Action Employer. Women and minorities are particularly encouraged to apply.

JOHNS HOPKINS UNIVERSITY

The Mathematical Sciences Department invites applications for the 1990-91

ELIEZER NADDOR POSTDOCTORAL FELLOWSHIP.

The Fellow is to be an outstanding graduating doctoral student in mathematics, statistics, or operations research, who plans an academic research center. The fellowship provides a $29,000 stipend plus fringe benefits, to fully support 12 months of postdoctoral study at the department in an area of interest to some department faculty member, free from teaching and administrative duties. Selection is made without discrimination on the basis of race, color, religion, sex, or national origin. Applicants should provide a current vita, a letter describing career aspirations and a research plan for the fellowship year, and transcripts, and should arrange for three letters of recommendation to be sent, by February 28, 1990, to:

Professor John C. Wierman, Chairman
Mathematical Sciences Department
220 Maryland Hall
The Johns Hopkins University
Baltimore, Maryland 21218

EOE/AA

UNIVERSITY OF SOUTHERN COLORADO
DEPARTMENT OF MATHEMATICS
PUEBLO, CO 81001-4901

Applications are invited for several tenure-track assistant professor positions for Fall 1990. Doctorate in Mathematics required. Evidence of commitment to teaching excellence necessary. Active research desirable. Send letter of application, resume, graduate transcripts, and three letters of reference to Search and Screen Committee. Evaluation of applications will begin 7 February 1990 and continue until positions are filled. USC is an AA/EO employer.

MATHEMATICAL REVIEWS

ASSOCIATE EDITOR

Applications and recommendations are invited for a two-year appointment as an Associate Editor of *Mathematical Reviews* (*MR*), to commence no later than the summer of 1990. Applications will be welcomed from persons taking leave from other positions, and in particular from tenured faculty members who can take leave to come to *MR* for two years.

The *MR* office of the American Mathematical Society is located in Ann Arbor, Michigan, not far from the campus of the University of Michigan, and the editors (although employees of the AMS) enjoy many privileges at the university. At present *MR* employs fourteen mathematical editors, about ten consultants, and over sixty nonmathematicians. It produces *Mathematical Reviews*, *Current Mathematical Publications*, various indexes, the online service MathSci, and MathSci Disc. The responsibilities of an Associate Editor fall primarily in the day-to-day operations of selecting articles and books suitable for review, classifying these items, assigning them to reviewers, editing the reviews when they are returned, and correcting galley proof. At this time an individual with considerable breadth in applied mathematics is sought (such as in differential equations, optimization, operations research, systems theory, control theory, information theory, etc.). The ability to write good English is essential, and the ability to read mathematics in major foreign languages is important. (The ability to read mathematical articles in Russian or Chinese is especially desirable.)

Persons interested in combining a sabbatical or other leave with a part-time appointment as an Associate Editor should write (or telephone) for further details. The twelve-month salary is negotiable, and will be commensurate with the experience the applicant brings to the position. Salary and fringe benefits are similar to those in universities. Of special importance is a policy providing termination pay of three months full pay for an editor serving full time for two years.

Applications (including curriculum vitae, bibliography, and names and addresses of at least three references) and recommendations should be sent to Dr. R. G. Bartle, Executive Editor, *Mathematical Reviews*, P. O. Box 8604, Ann Arbor, MI 48107-8604. (Telephone: 313-996-5255; FAX: 313-996-2916; INTERNET: RGB@MATH.AMS.COM.) Persons who may be interested in applying for this position are urged to inquire without delay.

The American Mathematical Society is an equal opportunity employer.

OPEN POSITION

American Mathematical Society

OPEN POSITION

MATHEMATICAL REVIEWS EXECUTIVE EDITOR

Applications and nominations are invited for the position of Executive Editor of Mathematical Reviews (MR).

The Executive Editor is the chief executive officer at MR and is responsible for all phases of its operations. These duties include:

- **direction of the editorial and consulting staff and the administration of the non-editorial staff**
- **relations with reviewers and authors**
- **maintaining scientific and editorial standards**
- **budget planning and control**

The Executive Editor is assisted in administration by an Associate Executive Editor and a Managing Editor; the Executive Editor reports to the Executive Director of the American Mathematical Society. The MR Editorial Committee provides Society overview and support in maintaining the scientific and editorial standards of MR.

The MR editorial office is located in Ann Arbor, Michigan, near the campus of the University of Michigan, and the editors enjoy many faculty privileges at the University. MR employs eleven associate editors, several consultants, and over sixty-five other full-time personnel. It publishes *Mathematical Reviews*, *Current Mathematical Publications*, special *Review* volumes and various *Indexes*. The major activity is the creation and maintenance of the MR database from which these publications and the online and CD-ROM service, MathSci, are produced.

The appointment will be for a negotiable period of from two to five years and should commence by September 1, 1990. The appointment has the possibility of renewal. Applications are welcomed from individuals taking leaves of absence from other positions; however, the Executive Editor position is full-time. Salary is negotiable and will be commensurate with experience. Generous benefits are available including study leave.

Nominations and applications (including curriculum vitae, bibliography, data on experience and names and addresses of at least three references) should be sent on or before **March 1, 1990** to:

Dr. William Jaco, Executive Director
American Mathematical Society
P.O. Box 6248
Providence, RI 02940

The American Mathematical Society/Mathematical Reviews is an equal opportunity employer.

NATIONAL UNIVERSITY OF SINGAPORE

DEPARTMENT OF MATHEMATICS

Applications are invited for teaching appointments from candidates who are able to teach in one or more of the following areas:

Pure Mathematics
Applied Mathematics
Operational Research
Statistics

Candidates should possess a PhD degree in Mathematics or its equivalent.

Gross annual emoluments range as follows:

Lecturer	S$50,390 - 64,200
Senior Lecturer	S$58,680 - 100,310
Associate Professor	S$88,650 - 122,870

(US $1.00 = S$1.96 approximately)

The commencing salary will depend on the candidate's qualifications, experience, and the level of appointment offered.

Leave and medical benefits will be provided. Depending on the type of contract offered, other benefits may include: provident fund benefits or an end-of-contract gratuity, a settling-in allowance of S$1,000 or S$2,000, subsidised housing at nominal rentals ranging from S$100 to S$216 p.m., education allowance for up to three children subject to a maximum of S$10,000 per annum per child, passage assistance and baggage allowance for the transportation of personal effects to Singapore. Staff members may undertake consultation work, subject to the approval of the University, and retain consultation fees up to a maximum of 60% of their gross annual emoluments in a calendar year.

The Department of Mathematics is a department in the Faculty of Science. There are 8 faculties in the National University of Singapore with a current student enrolment of some 14,000. All departments are well-equipped with a wide range of facilities for teaching and research.

All academic staff have access to the following computer and telecommunication resources: an individual microcomputer (an IBM AT-compatible or Apple Macintosh); an IBM mainframe computer with 16 MIPS of computing power; departmental laser printers; a wide spectrum of mainframe and microcomputer software; voice-mail; BITNET to access academic institutions world-wide. In addition, a proposed campus network based on state-of-the-art optical fibre technology will be installed by 1990 to facilitate resource sharing and electronic communication for the academic community.

Application forms and further information on terms and conditions of service may be obtained from:

The Director
Personnel Department
National University of Singapore
10 Kent Ridge Crescent
Singapore 0511

The Director
North America Office
National University of Singapore
780 Third Avenue, Suite 2403
New York, NY 10017, U.S.A.
Tel: (212) 751-0331

Enquiries may also be sent through BITNET to: **PERSDEPT @ NUSVM**, or through **Telefax: (65) 7783948**

Sandia National Laboratories

THEORETICAL COMPUTER SCIENCE RESEARCH FELLOWSHIP

Mathematical and Computational Science Department

Sandia National Laboratories is seeking outstanding candidates in the area of theoretical computer science to fill its 1990 Research Fellowship in Computational Science. The Fellowship is intended to provide an exceptional research opportunity for new graduates in theoretical computer science. Sandia is primarily interested in the areas of computational geometry and parallel computation, but other specialties will be considered as well. Sandia provides an excellent environment for research in theoretical computer science. Our strong applied research programs in robotics, parallel computing, and cryptology create a wealth of new problems in computational geometry, parallel computation, and computational number theory. In addition, several leading-edge massively parallel computers are available in the department.

The fellowship appointment is for a period of one year and may be renewed for a second year. It includes a highly competitive salary, moving expenses, and a generous professional travel allowance. The successful candidate must be a U.S. citizen, must have earned a Ph.D. degree or the equivalent, and should have a strong background in theoretical computer science or discrete mathematics. Applications from qualified candidates, as well as nominations for the Fellowship, should be addressed to **Robert H. Banks, Division 3531-23B, Sandia National Laboratories, PO Box 5800, Albuquerque, NM 87185.** Applications should include a resume, a statement of research goals, and the names of three references. The closing date for applications is April 30, 1990. The position will commence during 1990. Further inquiries can be made by calling (505) 846-7564 or by sending Email to EFBRICK@SANDIA.GOV.

Sandia National Laboratories is pleased to announce that the 1989 Sandia Research Fellowship in Computational Science has been awarded to Dr. Steven J. Plimpton of Cornell University to carry out research in parallel methods for the atomistic simulation of solids.

APPLIED MATHEMATICAL SCIENCES RESEARCH FELLOWSHIP

Mathematics and Computational Science Department

Sandia National Laboratories is seeking outstanding candidates in the areas of numerical mathematics or symbolic computing to fill its 1990 Applied Mathematical Sciences Research Fellowship. The Fellowship is supported by a special grant from the Applied Mathematical Sciences Research Program at the U.S. Department of Energy.

The Fellowship is intended to provide an exceptional opportunity for young researchers. Sandia's Mathematics and Computational Science Department maintains strong research programs in theoretical computer science, analytical and computational mathematics, computational physics and engineering, advanced computational approaches for parallel computers, graphics, and architectures and languages. Sandia provides a unique parallel computing environment, including a 1024-processor NCUBE 3200 hypercube, a 1024-processor NCUBE 6400 hypercube, a Connection Machine-2 and several large Cray supercomputers. The successful candidate must be a U.S. citizen, must have earned a Ph.D. degree or the equivalent, and should have a strong interest in advanced computing research.

The fellowship appointment is for a period of one year, and may be renewed for a second year. It includes a highly competitive salary, moving expenses, and a generous professional travel allowance. Applications from qualified candidates, as well as nominations for the Fellowship, should be addressed to **Robert H. Banks, Division 3531-24B, Sandia National Laboratories, PO Box 5800, Albuquerque, NM 87185.** Applications should include a resume, a statement of research goals, and the names of three references. The closing date for applications is April 30, 1990. The position will commence during 1990. Further inquiries can be made by calling (505) 844-2248 or by sending Email to RCALLEN@SANDIA.GOV.

Sandia National Laboratories is pleased to announce that the 1989 DOE Applied Mathematical Sciences Research Fellowship has been awarded to Dr. Raymond G. Tuminaro of Stanford University to continue his research in advanced iterative algorithms for parallel computation.

EQUAL OPPORTUNITY EMPLOYER M/F/V/H US CITIZENSHIP REQUIRED

XXIème ECOLE D'ETE DE CALCUL DES PROBABILITIES

SAINT-FLOUR (Cantal)

1er - 18 Juillet 1990

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  "Function Estimation and the White Noise Model"
- **M. FREIDLIN, Professeur à l'Université de MARYLAND (U.S.A.)**
  "Limit Theorems for Random Processes and Partial Differential Equations"
- **J. F. LEGALL, Professeur à l'Université PARIS VI**
  "Propriétés fines du Mouvement Brownien"

XXIème ECOLE D'ETE DE CALCUL DES PROBABILITIES

SAINT-FLOUR (Cantal)

18 Août - 4 Septembre 1991

CONFERENCIERS INVITES

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  "Measure Valued Processes"
- **B. MAISONNEUVE, Professeur à l'Université de GRENOBLE**
  "Processus de Markov"
- **J. SPENCER, Professeur au Courant Institute à NEW-YORK (U.S.A.)**
  "Random Graphs"

INSCRIPTIONS et RENSEIGNEMENTS COMPLEMENTAIRES

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F63177 AUBIERE CEDEX

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RUTGERS UNIVERSITY DEPARTMENT OF MATHEMATICS

announces a

CONFERENCE ON NONLINEAR ANALYSIS AND PARTIAL DIFFERENTIAL EQUATIONS

May 14–18, 1990

This conference will be dedicated in honor of Professor Felix Browder

Invited speakers: A. Ambrosetti, H. Berestycki, K. C. Chang, M. Crandall, J. Douglas, C. Fefferman, D. G. de Figueiredo, A. Friedman, S. Hildebrandt, H. Hofer, L. Hörmander, T. Kato, C. Kenig, D. Kinderlehrer, M. Krasnoselskii, P. Lax. J. L. Lions, P. L. Lions, H. Matano, J. Mawhin, R. Nussbaum, J. Serrin, M. Struwe, R. Temam, M. Visik.

Organizing Committee: A. Bahri, H. Brezis, L. Caffareli, I. Ekeland, J. L. Lebowitz, L. Nirenberg, P. Rabinowitz.

For further information please contact: Ms. Helen F. Pirrello, Rutgers University, Dept. of Mathematics, Hill Center-Busch Campus, N.B., NJ 08903 Tele. (201) 932-3921 Fax (201) 932-5530, e-mail pirrello@math.rutgers.edu

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International Journal of Mathematics will publish original papers in mathematics in general, but giving a preference to those in the areas of mathematics represented by the editorial board. The journal will be published quarterly, or more frequently whenever necessary, to bring out new results without delay. Occasionally, expository papers of exceptional value may be also published.

Published quarterly. ISSN: 0129-167X. Subscription rates for 1990, Institutions/Libraries US$185. Individuals, Institutions/Libraries from developing countries US$86 (add US$25 for airmail).

REVIEWS IN MATHEMATICAL PHYSICS (*RMP*)

Chief Editor
H Araki (RIMS, Japan)

REVIEWS IN MATHEMATICAL PHYSICS will fill the need for a review journal in the field. The review papers - introductory and survey papers - will be of interest not only to mathematical physicists, but also to mathematicians and theoretical physicists interested in interdisciplinary topics. The topics that will be covered by this journal will include, among others, gauge fields, quantum field theory, statistical mechanics, dynamical systems, functional analysis, and interactions between theoretical physics and pure mathematics.

Published quarterly. ISSN: 0129-055X. Subscription rates for 1990, Institutions/Libraries US$185. Individuals, Institutions/Libraries from developing countries US$75 (add US$25 for airmail).

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In the general area of computational science and computational engineering with special emphasis on:

- computational mathematics
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- computational physiology

POSTDOCTORAL MEMBERSHIPS are available. All requirements for a doctorate should be completed by September 1, 1990. The materials listed below must be submitted:

1. Personal statement of scientific interests, research plans, and reasons for wishing to participate in the Army High Performance Computing Research Center (AHPCRC).
2. Curriculum vitae and a list of publications.
3. Three (3) letters of recommendations, to be sent directly to the AHPCRC.

SENIOR MEMBERSHIPS are available. Preference will be given to supplementary support for those with sabbaticals, fellowships, or other stipends.

All materials should be submitted by February 16, 1990. All correspondence should be directed to:

University of Minnesota
Army High Performance Computing Research Center
Visiting Memberships
6-196 EE/CS Building
200 Union Street S.E.
Minneapolis, MN 55455

The University of Minnesota is an equal opportunity educator and employer and specifically invites and encourages applications from women and minorities.

University of Wyoming
Rocky Mountain Mathematics Consortium
Regional Summer School

ENRICHING DISCRETE MATHEMATICS COURSES WITH RECENT DEVELOPMENTS

July 16 – August 3, 1990

The course will address selected important and recent developments in discrete mathematics. The goal is to more quickly incorporate such modern discoveries in this rapidly expanding field into college courses at all grade levels. Many new advances are in fact highly suitable for enriching and modernizing basic courses. Both fundamental theoretical results and contemporary applications will be covered. Some of the topics to be included are: developments on the marriage problem and fair division schemes, Hamiltonian cycles for binary trees (the Catalan numbers), the famous labeling lemmas of Sperner and Tucker with applications to labeling and path following algorithms for finding equilibrium and fixed points, the combinatorial structure for power indices in political science, and combinatorial aspects of polytopes.

PREREQUISITES: Familiarity with basic linear algebra and some exposure to elementary discrete mathematics is desirable.

SPEAKERS: William F. Lucas, The Claremont Graduate School, will lecture during the three weeks. Carl W. Lee, The University of Kentucky, will lecture throughout one week. A few additional lectures will be presented by distinguished experts in the subject.

ADMISSION AND SCHOLARSHIPS: Entry into the summer school is restricted, but is without charge to those who are qualified and are admitted. National Science Foundation funding which consists of a stipend plus living costs is available for selected faculty. A limited number of scholarships, covering living costs, are available for qualitied graduate students. For further information and application forms, please write to:

Professor A. Duane Porter – Mathematics Department
Box 3036 – University of Wyoming
Laramie, Wyoming 82071

WEAK CONVERGENCE METHODS FOR NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS

Lawrence C. Evans

(CBMS Regional Conference Series, Number 74 • Supported by the National Science Foundation)

The purpose of this book is to explain systematically and clearly many of the most important techniques set forth in recent years for using weak convergence methods to study nonlinear partial differential equations. This work represents an expanded version of a series of ten talks presented by the author at Loyola University of Chicago in the summer of 1988.

The author surveys a wide collection of techniques for showing the existence of solutions to various nonlinear partial differential equations, especially when strong analytic estimates are unavailable. The overall guiding viewpoint is that when a sequence of approximate solutions converges only weakly, one must exploit the nonlinear structure of the PDE to justify passing to limits. The author concentrates on several areas that are rapidly developing and points to some underlying viewpoints common to them all. Among the several themes in the book are the primary role of measure theory and real analysis (as opposed to functional analysis) and the continual use in diverse settings of low amplitude, high frequency periodic test functions to extract useful information. The author uses the simplest problems possible to illustrate various key techniques.

Aimed at research mathematicians in the field of nonlinear PDEs, this book should prove an important resource for understanding the techniques being used at the forefront of this vital area of research.

1980 *Mathematics Subject Classifications*: 35, 46
ISBN 0-8218-0724-2, LC 89-27844,
ISSN 0160-7642
88 pages (softcover), January 1990
All Individuals $12, List price $19
To order, please specify CBMS/74NA

All prices subject to change. Shipment will be made by surface. For air delivery add, 1st book $5, each additional book $3, maximum $100. *Prepayment required.* **Order from** American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-321-4AMS (321-4267) in the U.S. and Canada to charge with VISA or MasterCard.

Application for Membership 1990

AMERICAN MATHEMATICAL SOCIETY

Date.....19.....

Please read the reverse side of this form to determine what membership category you are eligible for. Then fill out this application and return it as soon as possible. Your name will be added to our mailing lists upon our receipt of your completed application, and payment for member dues.

Subscriptions to the Notices *and the* Bulletin *(New Series) are included as part of your membership.*

.....
Family Name *First* *Middle*

Please indicate below the way your name should appear in the Combined Membership List.

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Family Name *First* *Middle or Initial*

Place of Birth.....
City *State* *Zip/Country*

Date of Birth.....
Day *Month* *Year*

If formerly a member of AMS, please indicate dates.....

Check here if you are now a member of either MAA ☐ or SIAM ☐

Degrees, with institutions and dates.....

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Present position.....

Firm or institution .....

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City *State* *Zip/Country*

Primary Fields of Interest (choose five from the list at right)

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All payments must be in U.S. Funds.

Send checks, money orders, UNESCO coupons to American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571

To use VISA or MasterCard, fill in information requested and mail to American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248.

For Foreign Bank Transfers: The name and address of the AMS bank is Rhode Island Hospital Trust National Bank, Account #000-753-111, One Hospital Trust Plaza, Providence, RI 02903, U.S.A.

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Fields of Interest

If you wish to be on the mailing lists to receive information about publications in fields of mathematics in which you have an interest, please consult the list of major headings of the 1980 Mathematics Subject Classification below. Select no more than five category numbers and fill in the numbers where indicated on the left. These categories will be added to your computer record so that you will be informed of new publications or special sales in the fields you have indicated.

00 General
01 History and biography
03 Mathematical logic and foundations
04 Set theory
05 Combinatorics
06 Order, lattices, ordered algebraic structures
08 General mathematical systems
11 Number theory
12 Field theory and polynomials
13 Commutative rings and algebras
14 Algebraic geometry
15 Linear and multilinear algebra; matrix theory
16 Associative rings and algebras
17 Nonassociative rings and algebras
18 Category theory, homological algebra
19 K-theory
20 Group theory and generalizations
22 Topological groups, Lie groups
26 Real functions
28 Measure and integration
30 Functions of a complex variable
31 Potential theory
32 Several complex variables and analytic spaces
33 Special functions
34 Ordinary differential equations
35 Partial differential equations
39 Finite differences and functional equations
40 Sequences, series, summability
41 Approximations and expansions
42 Fourier analysis
43 Abstract harmonic analysis
44 Integral transforms, operational calculus
45 Integral equations
46 Functional analysis
47 Operator theory
49 Calculus of variations and optimal control; optimization
51 Geometry
52 Convex sets and related geometric topics
53 Differential geometry
54 General topology
55 Algebraic topology
57 Manifolds and cell complexes
58 Global analysis, analysis on manifolds
60 Probability theory and stochastic processes
62 Statistics
65 Numerical analysis
68 Computer science
70 Mechanics of particles and systems
73 Mechanics of solids
76 Fluid mechanics
78 Optics, electromagnetic theory
80 Classical thermodynamics, heat transfer
81 Quantum mechanics
82 Statistical physics, structure of matter
83 Relativity
85 Astronomy and astrophysics
86 Geophysics
90 Economics, operations research, programming, games
92 Biology and behavioral sciences
93 Systems theory; control
94 Information and communication, circuits

Membership Categories

Please read the following to determine what membership category you are eligible for, and then indicate below the category for which you are applying.

*For **ordinary members** whose annual professional income is below $43,000, the dues are $70, for those whose annual professional income is $43,000 or more, the dues are $92.*

*The **CMS Cooperative Rate** applies to ordinary members of the AMS who are also members of the Canadian Mathematical Society and reside outside of the U.S. For members whose annual professional income is $43,000 or less, the dues are $60 and for those whose annual professional income is above $43,000, the dues are $78.*

*For a **joint family membership,** one pays ordinary dues, based on his or her income, and the other pays ordinary dues based on his or her income, less $20. (Only the member paying full dues will receive the* Notices *and the* Bulletin *as a privilege of membership, but both members will be accorded all other privileges of membership.)*

*Minimum dues for **contributing members** are $138.*

*For either **students** or **unemployed individuals,** dues are $23, and annual verification is required.*

*The annual dues for **reciprocity members** who reside outside the U.S. and Canada are $46. To be eligible for this classification, members must belong to one of those foreign societies with which the AMS has established a reciprocity agreement, and annual verification is required. Reciprocity members who reside in the U.S. or Canada must pay ordinary member dues ($70 or $92).*

*The annual dues for **external members,** those who reside in developing countries which do not have any mathematical society, are $49.*

*Members can purchase a **multi-year membership** by prepaying their current dues rate for either two, three, four or five years. This option is not available to either unemployed or student members.*

1990 Dues Schedule

For any category of membership where more than one dues level is given, see the above for descriptions of Members' Categories.

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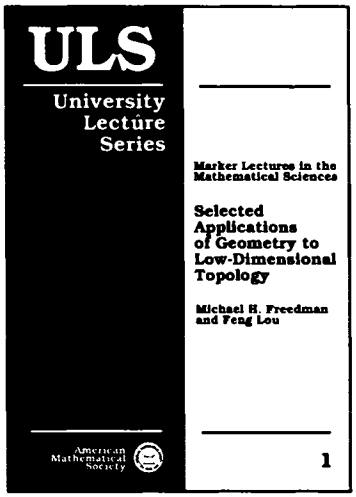

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