NOTICES AMER. MATH. SOC.

Program for the
Annual Meeting in Cincinnati
begins on page 20

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American Mathematical Society

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CALENDAR OF AMS MEETINGS

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

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

MEETING NUMBER	DATE	PLACE	ABSTRACT DEADLINE	ISSUE
793	March 16-17, 1982	Bryn Mawr, Pennsylvania	JANUARY 18	February
794	April 16-17, 1982	Madison, Wisconsin	FEBRUARY 22	April
795	June 16-17, 1982	Bellingham, Washington	APRIL 19	June
796	August 23-27, 1982 (86th Summer Meeting)	Toronto, Ontario, Canada	JUNE 7	August
	November 19-20, 1982	Monterey, California		
	January 5-9, 1983 (89th Annual Meeting)	Denver, Colorado		
	August 8-12, 1983 87th Summer Meeting)	Albany, New York		
	January 25-29, 1984 90th Annual Meeting)	Louisville, Kentucky		
	January 9-13, 1985 (91st Annual Meeting)	Anaheim, California		
	January 21-25, 1987 (93rd Annual Meeting)	San Antonio, Texas		

DEADLINES:			
	Advertising:	(*February issue*) **January 28**	(*April issue*) **March 4**
	News/Special Meetings:	(*February issue*) **January 11**	(*April issue*) **February 15**

OTHER EVENTS SPONSORED BY THE SOCIETY

April 12-15, 1982, AMS Symposium on Several Complex Variables, University of Wisconsin, Madison. This issue, page 68.

June 6-July 17, 1982, AMS Summer Research Conferences, University of New Hampshire, Durham. This issue, page 73.

June 28-July 16, 1982, AMS-ASL Summer Research Institute on Recursion Theory, Cornell University, Ithaca, New York. This issue, page 72.

July 6-16, 1982, AMS-SIAM Summer Seminar on Applications of Group Theory in Physics and Mathematical Physics, University of Chicago. This issue, page 72.

August 21-22, 1982, AMS Short Course: Statistical Data Analysis, Toronto, Canada.

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Notices
of the American Mathematical Society

Volume 29, Number 1, January 1982

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2 **Research Institutes and Alternative Modes of Support for Mathematics**
– NSF Review and Evaluation

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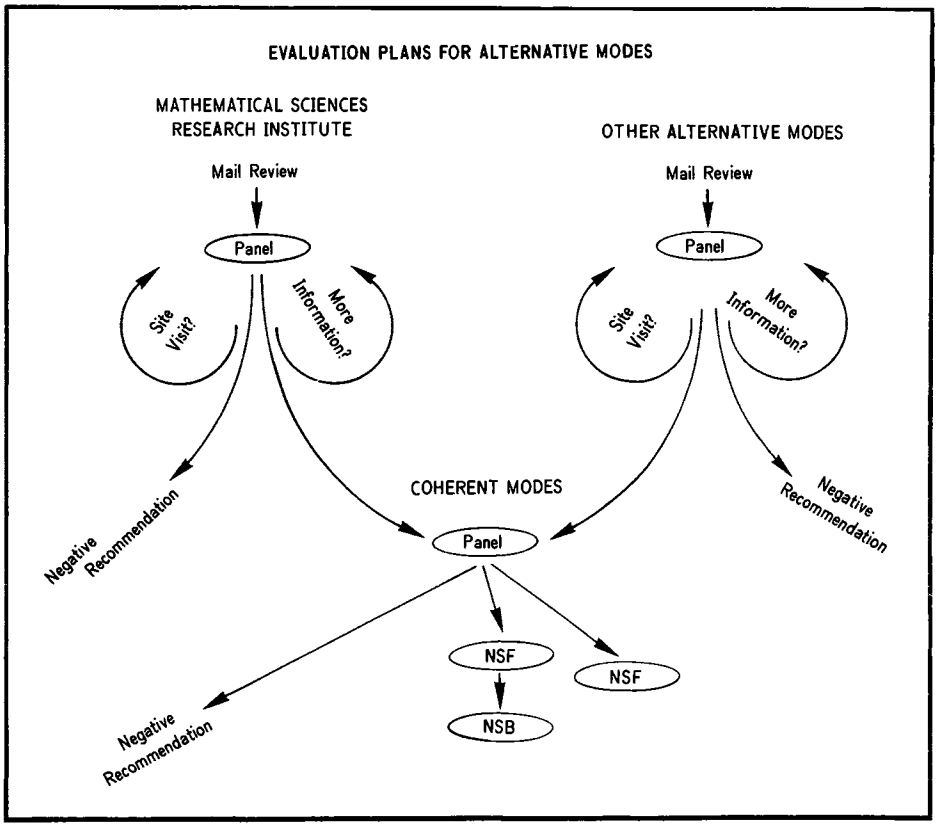
Mathematical Sciences Research Institutes
and other modes of support for the mathematical sciences
NSF Review and Evaluation Procedures

Introduction. Over the past few years as the review and evaluation process for the proposed mathematical sciences research institute and other alternative modes slowly unfolded, we at the National Science Foundation repeatedly said that we would go public as soon as we could and to the maximum extent possible. We hope that this article will serve that end. Our motivation is the belief that it is in the best interests of research in the mathematical sciences for there to be extensive exchange of information between mathematical scientists and the staff of the Foundation.

The scheme of the review and evaluation of proposals for establishing mathematical sciences research institutes and other alternative modes of support was designed during the spring of 1979 and is shown schematically below. The actual procedure followed the lines of this scheme quite closely. This scheme is introduced here in order to highlight the existence of three advisory panels so that I may emphasize for the first time (I shall do so repeatedly in the following) the importance of the reports of these panels. In essence this article is merely the vehicle for conveying these reports into print. The three panel reports follow. They have been edited to remove references to any specific proposals, formal or informal, which did not lead to positive recommendations and a detailed set of financial priority recommendations in a budgetary context which, because of the passage of time, is now no longer relevant.

In order to make this article have manageable length, I shall duplicate as little as possible anything that has appeared earlier and received general distribution, such as articles in the AMS *Notices*, Dr. Krumhansl's "Dear Colleague" letter of February 6, 1979, and so forth.

Brief History. In pursuing its goal of maintaining the continuing health and vitality of the Nation's research efforts in the mathematical sciences, the Mathematical Sciences Section staff has always tried to carry on a continuing dialogue with members of the community which it serves. That dialogue contains many references, some more definite and shaped than others, to establishing a mathematical sciences research



institute in one form or another. These were part of an ongoing discussion of appropriate mechanisms to support the mathematical sciences.

After discussions within the Section, with the Section's advisory panel, and with other individual mathematical scientists and groups of matheamtical scientists, a recommendation endorsing the mechanism of establishing a mathematical sciences research institute was presented to and approved by the National Science Board at its March 15–16, 1978, meeting; that is, the Board approved the establishment of an institute, the issuance of a project announcement, and the general plans for the institute described in the announcement.

The plan to issue the project announcement caused a certain amount of activity and discussion in the mathematical community. At the June 15–16, 1978, meeting of the advisory panel there was a lively discussion of general modes of support, with full participation of several visitors opposed to the proposed institute. At the conclusion of that discussion, the panel reaffirmed its support. On July 7, 1978, James A. Krumhansl, then Assistant Director for Mathematical, Physical Sciences, and Engineering, and Peter Lax, then incoming president of the American Mathematical Society, jointly convened a special meeting of seventeen prominent mathematical scientists specifically to discuss modes of support in the mathematical sciences, including but not limited to the proposed institute. At that meeting, Dr. Krumhansl decided that it would be wise to ask the mathematical sciences community to prepare proposals not only for an institute but also for other alternative modes of support. Consequently the project solicitation, which was distributed later in 1978, stated that proposals for an institute would be compared not only with each other but also with proposals for other options. Attention was further focused on this call for alternative options through the even wider distribution in [the *Notices*] February 1979 of Dr. Krumhansl's "Dear Colleague" letter. Also, the project solicitation and the text of the letter were discussed during the January 1979 Joint Mathematics Meetings in Biloxi, Mississippi.

At the closing date of August 1, 1979, the project solicitation had generated ten institute (MSRI) proposals and twenty-four other alternative modes (OAM) proposals.

Review and Evaluation. All thirty-four proposals were sent for review to *ad hoc* mail reviewers during the fall of 1979, each MSRI proposal to about ten reviewers and each OAM proposal to about seven.

Two evaluation panels were convened. The MSRI panel met on March 3–4, 1980, and selected Ronald G. Douglas of the State University of New York, Stony Brook as its chairman. Before the meeting, panel members had received the ten MSRI proposals, the mail reviews, and other correspondence concerning the proposed institute. Some of the last was in response to an item in the *Notices* announcing the convening of the MSRI panel and offering to transmit written comments to panel members.

The MSRI panel, in its report, separated the proposals into two classes: one consisting of five strong proposals, and the other of five proposals each of which was considerably weaker than any of those in the top group. The MSRI panel also raised questions about the level of priority to be given to any proposals to establish an institute, especially in the light of other pressing needs of the research community. The MSRI panel report was received by the Foundation in April 1980.

The OAM panel met initially in Washington on March 27 and 28, 1980; owing to the large set of diverse proposals, it was necessary for it to convene again at the O'Hare Hilton, on Sunday, April 13, 1980. At its initial meeting in Washington the panel selected R. H. Bing of the University of Texas as its chairman and subsequently prepared a report containing both specific and general recommendations. In addition to addressing the relative strengths and weaknesses of the proposals under consideration, the panel concluded that, in general, other alternative modes of support "should consist of nationwide rather than local programs." It went further and formulated some new options which it considered desirable for later consideration by the third panel. The OAM panel report was received in May 1980.

As a result of the recommendations of these two panels, it was decided to decline the five MSRI proposals in the lower grouping and nine of the OAM proposals (those involving institutionally-designated postdoctoral support). Declinations were prepared and mailed during the summer of 1980. In addition, one of the proposals, involving a relatively small dollar amount for a "special year," was judged to be highly

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The leading article in this issue of the *Notices* was prepared by WILLIAM G. ROSEN, Head of the Mathematical Sciences Section of the NSF's Division of Mathematical and Computer Sciences. It offers a comprehensive account of recent activities of the Section leading to the funding of two mathematical sciences research institutes and other new programs, as well as additions to some existing ones. This report completes a series of reports that has appeared in the *Notices* for some three years, beginning with the news that the Foundation was considering establishment of an institute, November 1978 issue, pages 481*ff*. Subsequent reports appeared in the February 1979 issue, page 118 and pages 120*ff*. Last summer and fall the grants for the two new institutes were announced (August 1981, pages 427*ff*) as well as the new series of week-long AMS Summer Research Conferences (October 1981, pages 527*ff*, and November 1981, pages 604*ff*) and the new NSF Postdoctoral Research Fellowships with research instructorship option (October 1981, page 533*ff*).

Dr. Rosen has held various positions on the NSF staff for over twenty years. He received his graduate education at the University of Illinois and was a member of the department of mathematics at the University of Maryland before joining NSF.

meritorious and was recommended for funding in fiscal 1980.

Sometime during the spring or summer of 1980 the entire array of ideas under consideration gradually came to be called "coherent modes of support," and so, in the fall of 1980, the Coherent Modes (CM) panel was formed and met on November 24 – 25, 1980. The material the panel members received before the meeting was formidable. It consisted of the project solicitation, copies of the five remaining MSRI proposals with their mail reviews and the MSRI panel report, the OAM announcement, copies of the remaining OAM proposals with their mail reviews and the OAM panel report, the letters received by the Section regarding institutes, and updated material on a separate idea referred by the Section's advisory panel; and it took up four bulky packages. Professors Bing and Douglas were selected co-chairmen of the CM panel.

The history of the third or CM panel itself is quite long and involved. The panel first met on November 24 and 25, 1980, and recommended that questions concerning the Berkeley and Minnesota proposals be resolved, through letters and site visits, and that the remaining three institute proposals be declined. Site visits to Berkeley and Minnesota were held on January 9 and 12, 1981, respectively; follow-up visits were made to Minnesota on January 23 and to Berkeley on March 10. The panel reconvened in Washington on February 2, to conclude its deliberations and to plan the structure of its final report.

The panel's ultimate decision to consider seriously recommending the funding of *two* Institute proposals was the result of the convergence of the November 25 discussion. This surprising tentative conclusion arose from the following observations:

i) the breadth and scope of mathematical coverage in traditional areas of mathematics at Berkeley, together with the well-conceived plan for operation of an institute there, made it clear that funding of that institute would have profound impact on the development and growth of mathematical research;

ii) the innovative nature of the Minnesota proposal, in the hands of the talented scientific leadership who prepared the proposal, could respond in a major way to the continuing critical problem of difficult-to-penetrate boundaries between core mathematical research activity and real-world and societal problems to which some of that activity could be applied;

iii) existence of these institutes would have a major impact on the developemnt of future generations of mathematical research leadership, in that each of them considers postdoctoral training a principal objective; and

iv) the budgetary contexts in which the panel was operating were such that funding of both institute proposals, for the amounts recommended (both scaled down from original budget requests) had sufficient priority and were consistent with recommendations for funding levels of other research support activity.

Summary. As I stated earlier, this report's main function is to disseminate the reports of the three panels. The final report, that of the third or Coherent Modes panel, is comprehensive both in its scope and in its array of recommendations. Since the recommendations vary in nature, they have received different treatments. However, the Section's concentration is on the set of recommendations as a whole, even as it acts on them individually.

- The postdoctoral research fellowship program for FY 1982 has been modified to include a research instructorship option.
- An award has been made to the AMS for short conferences, and items concerning these conferences have already appeared in the *Notices*.
- An award has been made to the Courant Institute of Mathematical Sciences for increased postdoctoral support.
- Mid-level fellowships were in both the Foundation's original FY 1982 budget submission to the Congress and the March 18 revision, but had to be dropped in the second revision.
- Recommendations for the research institutes at Berkeley and Minnesota were made to and approved by the National Science Board at its May 21 – 22 meeting and initial awards have been made to both institutions.

The process of supporting and encouraging research in the mathematical sciences is, of course, evolutionary. For example, in its section on priorities, the CM panel report says, "Neither do the above recommendations consider the demands for more equipment support, particularly in computers ··· " At its May 1981 meeting the Advisory Subcommittee for Mathematical Sciences spotlighted this demand and the Section has already designed procedures for increasing support of computer equipment.

Appreciation. A second important function of this report is to thank publicly all of the mail reviewers and panelists who devoted so much time and energy to giving the Foundation their best advice. Theirs was a difficult, sensitive, and time-consuming task. All approached it seriously and with good intentions. Their discussions were lively, exciting, and pertinent. The quality of their work is extremely high, as their reports testify. The experience of working with them through the entire review and evaluation procedure was stimulating and gratifying. We at the National Science Foundation — and, indeed, the entire U.S. mathematical sciences community — are in their debt.

William G. Rosen, Head
Mathematical Sciences Section

Panel Report on MSRI Proposals

March 4, 1980

The panel was charged with considering the ten proposals for a Mathematical Sciences Research Institute and recommending those which we thought

Members of the Evaluation and Review Panels

Mathematical Sciences Research Institute (MSRI)

Richard D. Anderson,
Louisiana State University
Ronald G. Douglas,
SUNY, Stony Brook
Robert D. Edwards,
University of California, Los Angeles
Wendell H. Fleming,
Brown University
Murray Gerstenhaber,
University of Pennsylvania
James G. Glimm,
Rockefeller University
John W. Milnor,
Institute for Advanced Study
Ronald Pyke,
University of Washington
Hartley Rogers,
Massachusetts Institute of Technology
William A. Veech,
Rice University

Other Alternative Modes (OAM)

R. H. Bing,
University of Texas, Austin
Jonathan P. Brezin,
Bell Laboratories
Ronald L. Graham,
Bell Laboratories
Peter E. Ney,
University of Wisconsin, Madison
Ronald Pyke,
University of Washington
Donald C. Rung,
Pennsylvania State University
Karen Uhlenbeck,
University of Illinois, Chicago Circle
Hans F. Weinberger,
University of Minnesota
Gail S. Young,
University of Wyoming

Coherent Modes of Support in the Mathematical Sciences

R. H. Bing, Co-chairman
University of Texas, Austin
Ronald G. Douglas, Co-chairman
SUNY, Stony Brook
Murray Gerstenhaber,
University of Pennsylvania
Friedrich Hirzebruch,
Mathematisches Institut, Bonn
Jacques-Louis Lions,
Collège de France
John W. Milnor,
Institute for Advanced Study
O. Timothy O'Meara,
University of Notre Dame
Raymond L. Orbach,
University of California, Los Angeles
Seymour Parter,
University of Wisconsin, Madison
Ronald Pyke,
University of Washington
Hartley Rogers,
Massachusetts Institute of Technology
Halsey Royden,
Stanford University
George B. Seligman,
Yale University
David Slepian,
Bell Laboratories

worthy and best in terms of the prospective impact on mathematical research. Before doing that, however, we feel obliged to make a few comments.

Mathematical research in this country is drastically underfunded. Travel is becoming more and more restricted, research and study leaves are more and more difficult to finance, and young researchers in positions of comparative isolation find it nearly impossible to fulfill their research potential. The funding of an institute must be considered in the context of these problems.

Some of the strengths of American mathematics have been its diversity and its decentralized character. An institute would put a large percentage of scarce resources into one place resulting in some centralization of mathematics in this country. Further, a thematic institute would channel support into restricted research areas.

Reflecting, we believe, the sentiment of the mathematical research community, most panel members are reluctant to recommend the funding of an institute until even more pressing financial needs have been addressed.

Of the ten proposals considered, the panel endorses that of Berkeley as the best. We feel that the chances of success for this MSRI are excellent, although

some technical improvements and clarification are recommended. This would be a conventional institute relying on the high quality of the Berkeley mathematics department for nurture. In fact, because a critical mass is already present in Berkeley we recommend consideration of a scaled-down institute with a ··· budget.

We endorse the ··· proposals for conventional institutes as excellent, although we feel that the Berkeley proposal is stronger. ···

We found the Minnesota proposal to be both interesting and innovative. But we feel that the Berkeley proposal is superior. The mathematical coverage of the Minnesota proposal is somewhat incomplete. However, we believe that a mini-institute at Minnesota might encourage interconnections between applied and pure mathematics. Therefore, the NSF may wish to consider asking Minnesota to prepare a scaled-down ··· budget for further consideration.

Finally, we urge that a site visit be made before any proposal is chosen for funding. ···

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Report of OAM Panel

May 15, 1980

The OAM Panel met in Washington, March 27–28, 1980 and in Chicago, April 13, 1980 to discuss twenty-four proposals for alternative modes of support of Mathematical Sciences. These proposals showed concern for the well-being of mathematical research and gave ideas for furthering it.

After studying the proposals for other alternative modes of support, the panel has come to the conclusion that such modes should consist of nationwide rather than local programs. Unfortunately, the standard proposal mechanism does not seem to work very well to generate such programs. Individual proposals sometimes have the appearance of being self-serving. Even the proposals from larger mathematical organizations raise the question whether another layer of administration should be interposed between the NSF and the grantees. One reason for including this management service is to give the organization "standing" to write a proposal.

The Panel has used the proposals partly to help it to identify problems for which national programs are needed.

I. Recommendations of OAM Panel

A. Research Instructorships. The OAM Panel favors a program for partial support of Research Instructorships.

These instructorships would each be for a period of two years with the university paying 50% of the cost for teaching a three-hour course and the NSF paying 50% for research. In general, the applicant would secure permission of the department where he wants to spend the instructorship, but if the university is unable or unwilling to hold open a position, the recipient could be considered a free agent and accept a position at any school willing to hire him on a half-time basis for two years.

It is suggested that either NSF appoint a panel for drawing up plans for such a Research Instructorship program or the staff of the Mathematical Sciences Section propose the details of such a program.

We suggest that the present programs of post-doctoral fellowships be modified by changing some or all of the awards to two-year half-time fellowships and increasing the number of such awards. The other half of the salary would be paid by a university in return for teaching no more than three hours per week. ···

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B. Mid-Level and Senior Fellowships. This proposal is a variation of one submitted ···· . However, the OAM Panel ··· suggested that the program should be administered directly by the NSF rather than through an intermediary organization. ···

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C. Courant Half-Time Fellowships. The Courant Institute is a unique national asset which should be encouraged and strengthened. NSF has an ongoing program of support for applied mathematics at Courant, so that what we are suggesting is an increase in the present support rather than a new alternative mode of support. ···

. . . . . .

It may be noted that, of the many universities requesting research instructorships, this is the only proposal we favored tying to one school. That is because of the importance we attached to the role of applied mathematics and of the unique position that Courant has in this country in training applied mathematicians.

D. AMS Short Institutes. The AMS proposal identifies a definite need. The OAM Panel believes it should be funded at least on an experimental basis ···

E. Special Years Programs. Special Years Programs have proved successful in the past in promoting mathematical research. ···

By a Special Year, we refer to a year of special emphasis, organized by a department or other academic unit in order to provide a focal point for research or a specific topic. It will entail the gathering of a sizeable number of researchers, both junior and senior, to study, survey, and work together in a stimulating atmosphere, conducive to productive research activity.

We do not see a good reason to fund a multi-year Special Years Program at one institution. It would make more sense to have an ongoing program of one or more special years at appropriate institutions each year.

II. Comments on Favored Modes:

The discussion of the OAM Panel contained suggestions of how the various programs should be run. Some of these suggestions went beyond the brief descriptions of proposed modes given in Section I and are included here.

A. Research Instructorships. Several of the proposals suggested that their particular university be

provided with funds to hire outstanding beginning Ph.D.'s. The university would pay a part of the salary of the researcher and for this the researcher would do some teaching. (What is a half-time teaching load at some schools is full-time at another.) NSF would pay for the research effort of the researcher.

Different universities requested different numbers of research instructors (and those at other ranks). Some of those requesting support had graduate programs inferior to some who put in no proposals. The panel felt there would be an advantage in having a bigger collection of possible homes for these research instructors. We considered preparing a list of leading centers but realized that strengths are shifting and that an opinion survey several years old might yield poor advice. Permitting the prospective researcher to select the school that he or she thinks has the best program for him or her seems a good approach.

The list of proposals for alternative modes contains nine which primarily are proposals for either a research instructorship program or a postdoctoral fellowship program for new Ph.D.'s. Of these proposals, only one was felt to be outstanding by the mail reviewers and panel members. This was the proposal from NYU. However, such programs in general are felt to be of vital importance by reviewers and panel members. Perhaps only graduate training is felt to be so important by the mathematics community. There are two arguments.

1. Postdoctoral training is an essential part of mathematicians' development, and it should take place in a center for mathematics.
2. The existence of young mathematicians in temporary positions is vital to the mathematics communities throughout the country. This is especially threatened now in the days of declining graduate school enrollments.

Negative reviews of the eight proposals contained two important points.

1. The individual proposals were random requests which in general cannot be justified at one school in comparison to others. (Our recommendation seems to meet this objection.)
2. There is a new NSF postdoctoral program. The need for additional support of a declining population of new Ph.D.'s in mathematics is unclear.

With regard to the first part of the second point, it was suggested that perhaps what we are proposing here should be made a part of the current NSF postdoctoral program and that the current program be changed so that recipients might either hold research instructorships for two years or pure fellowships for one. The OAM Panel favored a shift toward research instructorships to give more people research support at an impressionable age.

The OAM Panel suggests that the Mathematical Sciences Section of the NSF expand its Postdoctoral Fellowship Program as the need arises. We recommend that a modification be made in response to the requests for research instructorship support. We recommend the Fellowship stipend contain salary support for one nine-month academic year and four summer months, plus two years' travel money. The Fellow may request the nine-month academic year part of the stipend in two ways: as full-time support for any nine months or as half-time support over eighteen months (exclusive of summers). Finally, if the institution named in the application does not offer the Fellow a job (i.e., half-time academic support over two years at regular starting pay), the Fellow becomes a free agent to accept such a half-time job at any university, subject to NSF approval.

This scheme has the following positive aspects.

1. It provides for flexibility. The Mathematical Sciences Section can respond to recommendations from the community on need for support as this changes.
2. It provides for a national competition among both fellowship applicants and fellowship institutions.
3. It answers the argument that a research instructor is more integrated in his department and receives better training for his future career in teaching than a postdoctoral fellow.

The following disadvantages to this scheme over institutionally designated awards exist.

1. A university cannot depend on a fixed number of fellows to staff courses and fill seminars each year.
2. There is an overhead problem between the government and universities.
3. Recipients of NSF Fellowships must be American nationals. Some of the strengths of American mathematics rests on its ability to absorb from outside.
4. A fair number of Fellows will continue to apply to go to institutions with other forms of support, ···

. . . . . .

Finally, note that each listed disadvantage is a positive advantage to some group of people.

B. Mid-Level and Senior Fellowships. The ··· proposal is the result of extensive discussions ···· It is clearly based on much data and sifting of information by many highly knowledgeable mathematicians. It is safe to say that the above groups do speak for the "mathematical community," to whatever extent this is possible.

. . . . . .

C. Courant Half-Time Fellowhsips. While the Panel is recommending that most postdoctoral support be granted through a national competition, we believe that it is of sufficient national importance to acquaint young mathematicians with the content and spirit of first-rate applied mathematics that an exception should be made in this case. The Panel therefore recommends that this proposal be funded at a somewhat reduced level. ···

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D. AMS Short Institutes. The OAM Panel sees considerable merit in the AMS summer institutes proposal. While we support it as an experimental program, we regard it as an experimental program. ···

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We recommend that the proposal be carefully evaluated after its first summer of activity. The summer conferences should be viewed as part of the ongoing National Science Foundation program of conferences.

We hope that a pleasant and comfortable location will be chosen. It is further hoped that the American Mathematical Society might look for funding for a permanent year-round site to accommodate an expanded conference schedule.

We encourage experiments as to lengths of conference, topic selection, and travel budget. Some have suggested the Oberwolfach policy on funding travel might even be considered. (No foreign travel subsidy, minimal subsistence pay, interesting location.)

E. Special Years Program. Several of the proposals submitted to the Panel requested support for an academic year devoted to the concentrated study of some particular area of mathematics. The Panel recommends the funding by NSF of Special Years as an important means of strengthening mathematical research. There can be several advantages to such support. However, there are some necessary guidelines that should be followed if the advantages are to be maximized.

To insure the desired level of success, the home institution must have a strong nucleus of young and senior researchers in the area of emphasis. The library must be excellent, and the facilities must be such as to provide good working conditions for the visitors, for whom suitable accommodations must be available. The organizers must be able to attract many of the subject's leading researchers who would participate in the activities for varied periods of time. There should be a general openness to all interested persons, including graduate students, postdoctoral fellows, and qualified faculty. Whenever practical, written proceedings of appropriate lectures should be published. Possibly a related short term conference or symposium should be organized to serve as a means of disseminating to a wider group the results from the year's activity.

Special years are an alternative to the establishment of a single administrative apparatus. The Panel believes that each "Special Year" should be handled separately and that each application should be for no more than one year's activity. The proposal should give a strong case for the importance and current interest of the chosen topic, adequate evidence to support the host institution's level of expertise in the area of emphasis, a list of the proposed visitors with indications of their ability to participate and the general format for the year's activities.

It is recommended that the proposals for the Special Years be submitted sufficiently early to ensure that potential visitors and participants could include NSF Postdoctoral Fellows and faculty on leave. This implies that the identification of Special Years must be announced by the early Fall of the preceding year.

There have been many successful Special Years in the past. Evidence indicates that they have been an effective, relatively inexpensive way of improving research, identifying and emphasizing important directions of research, and stimulating and directing young researchers into important areas of quality research. The impact on the faculty and students of the host institution is also great.

The budget of such proposals should place emphasis upon the organization, travel and living expenses of visitors and participants, and not upon salaries for released time of the host faculty. There should be strong evidence of financial support by the host institution.

In addition to the criteria implied above, the evaluation of such proposals by NSF should also be guided by the desire that the topics of emphasis after several years should reflect a broad and balanced coverage of the mathematical sciences. ···

. . . . . .

Report of the Coherent Modes Panel

November 25, 1980

The National Science Foundation is the federal agency charged with the preservation and strengthening of the nation's mathematical research. In 1978, in response to the growing realization that there were critical shortcomings in the support of mathematical research, the Foundation announced its intention to study these needs and to solicit proposals for other methods of support. Included specifically in the solicitation were proposals for the establishment of a Mathematical Sciences Research Institute (MSRI) whose primary purpose would be "to stimulate research in diverse problem areas among both able, mature mathematicians and promising young mathematicians from all parts of the country."

The increasingly serious consequences of the underfunding of mathematics have been recognized for some time by the Mathematical Sciences Advisory Sub-Committee and by important segments of the American mathematical-scientific community. By the fall of 1979, in response to the Foundation's announcements, the perceived needs had been dramatically manifested by the large number of proposals that were submitted, each containing carefully thought out solutions to one or more of the important needs.

In keeping with the dual nature of the solicitations, the proposals were separated into those for an MSRI and those for alternative modes of support. After an extensive peer review of all of the proposals had been made, two panels were formed to make preliminary recommendations. Both panels, one to evaluate proposals for an MSRI and another to evaluate proposals for other alternative modes of support, met in March and April of 1980. Their recommendations included suggested declinations, modifications, and transmittals to the final panel.

The deliberations of the third panel took place between November 1980 and March 1981 and included two meetings of the entire panel and two site visits each to the University of Minnesota and the University of California, Berkeley. Despite the diverse opinions

held by individual panelists at the outset, a broad consensus was obtained by the end of this process.

The details of the composition, meetings, and reports of the three panels are attached to this report. In summary, the recommendations that follow are the result of an intensive and careful three-year study of the present problems and the proposed solutions which relate to the Foundation's intention to "preserve and strengthen the intellectual vigor of the nation's current effort in the mathematical sciences."

NSF SUPPORT OF MATHEMATICS

The recommendations of this report concern the total support of American mathematical research by the National Science Foundation and are to be viewed in the light of (a) the mandate, responsibilities, and goals of the National Science Foundation and (b) the distinctive nature and needs of mathematics as well as the relationship of mathematics to other sciences and to society. We begin by considering these matters as background for the recommendations which will follow. We do not here argue the relative needs of mathematics as opposed to other areas of science. It is enough to note that major areas of current science and engineering, from computer technology to high energy physics, make use of mathematics and mathematical models as a basic medium for thought, discourse, and research. The healthy growth of the central areas of mathematics, as mathematics *per se*, is evidently essential to continuing development and innovation in the diverse mathematical models that derive from and depend upon these central areas.

We take the chief goal of the National Science Foundation in supporting mathematics to be the promotion and the fostering of significant American research in mathematics. In particular, the goal must be to promote continuing significant research, and hence actions that bolster the long-range health of American mathematical research must be a vital and major part of the National Science Foundation program. In considering the support of current and future research, certain distinctive features of mathematics as a science must be taken into account. We shall comment on some of these features, describing in general form the needs and essential components of an appropriate support program, and then offer our specific recommendations in summary form. Afterwards we present detailed arguments for the new programs. Finally, we discuss priorities for our recommendations and then give our negative recommendations. We conclude by discussing some of the principles which should guide any support program for mathematics.

Distinctive features of mathematics. We describe four special features of mathematics that, to a greater or lesser degree, distinguish it from other areas of science.

(1) *Younger mathematicians* play an especially prominent role in mathematical research. While major research accomplishments can occur throughout the career of a mathematician of the highest ability, these accomplishments often begin at an earlier age than in most other sciences. More importantly, the interests and activities of younger mathematicians have an especially significant influence on the evolution and growth of future areas of mathematical research. The visible central areas of research today came into prominence not primarily because leading senior mathematicians identified them, but rather they developed from the work of younger mathematicians striking out in new directions early in their careers. Thus the processes by which new areas of research come into prominence and through which the most able people are identified require a *free market* for ideas, speculations, and innovation — a market in which the young mathematicians can risk the exploration of a new idea or area free from undue pressure to conform with existing patterns of research interest.

(2) Mathematics, like the other sciences, is a *community* activity. An individual mathematician's decision to explore a given direction often derives directly or indirectly from the interest and stimulus of others. The individual's research activity itself usually involves the criticism, if not the participation, of others. Finally, judgments as to the importance of a result or of an area are reached by what is, in effect, a process of consensus within the mathematical community. For these reasons, the continuation of effective research in mathematics requires appropriate forms of communication and appropriate opportunities for consultation and travel.

(3) Mathematical research, to a greater degree than is the case with most other sciences, is located in *universities*, or in university-like settings. Reasons for this include the need for the participation of younger mathematicians and the occasion and stimulus that teaching activities provide for the development and refinement of new ideas. Thus support by the National Science Foundation of research in mathematics must concern itself with the relative health and well-being of mathematics departments in universities and other university-like institutions.

(4) The relation between the core of mathematical theory and the applications of mathematics is a constantly developing one, sometimes in surprising directions. On the one hand, core mathematics appears to explore abstract concepts and structural relationships for their own sake; on the other hand, the status of mathematics as a natural science appears to depend ultimately upon the applicability of mathematical results to other areas of science. These appearances are somewhat superficial and sometimes deceiving. The relationship between mathematics and the physical world *does* ultimately determine the form and significance of research in mathematics but the relationship is sometimes distant, and interaction times can be long. Geometry, for example, is important because it studies, as a form of pure mathematics, concepts that are fundamental in a wide variety of applied mathematical models. But it goes on to generalize the concepts of exisitng models in ways that eventually lead (as with modern differential geometry) to new ideas that can be used in new and richer models. This speculative and innovative relationship among the branches of mathematics, and with those who apply

mathematics, with interactions that often span decades, depends on the continued growth and development of the central body of mathematical theory. In turn, this relationship influences and invigorates that central body of theory.

Matters for special attention. Mathematics has shared fully in the unprecedented growth and vigor of American science since the second World War. The number of new Ph.D.'s in mathematics per year grew from about 200 in 1950 to about 1300 in 1973. Nearly 80 percent of those Ph.D.'s found positions in academia as the educational establishment expanded and as the need grew for more sophisticatd mathematical training.[1] Substantial investments on the parts of the federal government, universities, and especially of talented and hopeful young people have contributed to this vigorous growth.

This dramatic rate of growth of university mathematics could not continue indefinitely, and mathematics is now feeling the strains of adjusting to changed circumstances. No longer can the bright and able Ph.D. expect simply to follow the career path of his of her thesis advisor. The times, and the health of science, make more severe demands upon emerging mathematicians. They must be more flexible, more innovative, and more broadly aware than ever of the possibilities and interconnections of their discipline. They must have the resourcefulness and the self-confidence to launch independently chosen projects at new sites of activity, and to come to grips with problems arising in other areas of modern science and technology.

We believe that a postdoctoral setting, in circumstances encouraging to the generation of speculative initiatives and to the broadening of scientific awareness, affords the best opportunities for younger mathematicians to prepare to meet the demands of the future. It is our opinion that, along with sustaining the vigor of ongoing research of high quality and promise, and the vigor of the institutions where such research and predoctoral development takes place, the problem of providing the best of the young with postdoctoral opportunities deserves the highest priority.

A general program of support. We find that three general forms of support are essential components of a successful long-term support program for mathematical research:

(1) At the level of entry to the profession (graduate students, immediate postdoctoral mathematicians, and younger research mathematicians) support should be provided for the further practice and development of research abilities, for the opportunity to explore new interests, for the building of productive long-term research careers, and for convenient consultation with other mathematicians. Only in this way can mathematics continue to recruit individuals of high ability. Equally important, only in this way can these younger mathematicians play their special innovative role within mathematics.

(2) At the level of the broader existing research community (college and university professors, research investigators in industry and government) support should help to maintain good avenues of communication for the interchange and dissemination of mathematical ideas (such as special conferences, special years, summer institutes and the like) and to maintain forms of mobility (such as mid-career fellowships) that will assist in consultation and educational participation. An important type of support at this level is that of individual research projects. It should be recognized that such research support serves two distinct purposes. First, it supports research for the sake of the specific results that may be obtained. Second, equally valuably, it supports a broad base of research activity in the mathematics community for the sake of helping to maintain a critical level of research activity and research awareness. This activity and awareness play a major part in stimulating, encouraging, incubating, and assessing new mathematical work and exploration.

(3) Finally, in addition to supporting professional activity for younger mathematicians and the professional life and health of the larger mathematical community (as described in (1) and (2) above), it is desirable to support, for the sake of the specific scientific knowledge to be gained, research on particular important problems at the frontier of mathematical knowledge. Such support will seek to involve the best and most talented mathematicians (both senior and junior) in this research.

We believe that each of these three components is essential to an effective and balanced program of support by the National Science Foundation. To argue that support for one or even two of these components is enough is, we believe, fallacious and denies the special character of mathematical research.

SUMMARY OF RECOMMENDATIONS

The recommendations outlined below are directed toward solving the critical problems that face mathematical research today. Their formulation is based upon the general philosophy set down in the first sections of this report. When these recommendations are adopted, they will greatly improve the health and vigor of mathematical research and insure that such research is maintained at the high level of national and international leadership that is sought by the Foundation.

Detailed descriptions of the new programs recommended will follow in later sections. (New or significantly modified programs will be marked with an asterisk.) In this section we give brief summaries of the proposals to provide the reader first with an overview of the recommendations, with an emphasis upon their interrelations and total impact.

A. Support for Young Researchers

1. *Research Instructorships and Postdoctoral Fellowships.** ··· We recommend expansion and modification of the existing NSF Postdoctoral Fellowship Program to allow and encourage Fellows to

[1] See, for example, *Mathematicians in Academia: 1975–2000* by Charlotte V. Kuh and Roy Radner, Conference Board of the Mathematical Sciences, 1980.

hold either Research Instructorships for two years or Fellowships for one year. The former should provide half-time salary support for two academic years plus full support for four summer months. ···

2. *Courant Institute Research Instructorships.** ··· We recommend the annual support of six Research Instructorships, attached to the Courant Institute. This is a unique national resource of outstanding expertise in many areas of applied mathematics. This recommendation is for increased support by the Foundation to be designated for the training of young researchers whose interests and expertise are in applied mathematics. ···

B. **Mid-Level and Senior Fellowships***

We recommend the introduction of a new Fellowship program designed specifically to address the serious need for National Science Foundation support of study leaves for qualified researchers at least five years beyond their Ph.D. The early training of mathematicians is extremely and uniquely important. However, this national resource of well-trained researchers will not be utilized wisely if the present situation is allowed to continue in which the mid-level and senior researchers are seriously discouraged from taking sufficient time for concentrated study and research. ···

C. **Communication**

1. *Special Years' Programs.** ··· We recommend the expanded support by the National Science Foundation of special years of concentrated study at academic institutions. This is an effective, relatively inexpensive means of improving research and its dissemination, of identifying and emphasizing important directions for research, and of stimulating and directing young researchers in important areas of quality research. ···

2. AMS *Short Conferences.** We recommend the funding of short (one- or two-week) conferences throughout the year to provide for the continuing gathering together of researchers, focusing upon selected important topics for intensive study and research. This program, to be viewed as part of the Foundation's ongoing support of conferences should be administered by the American Mathematical Society. ···

3. *Conferences — General.* We recommend the continued funding of various types of conferences in the mathematical sciences along lines presently employed by the National Science Foundation. ···

D. **Research Institutes**

1. *Mathematical Sciences Research Institute at Berkeley.** We recommend the establishment and funding of this Institute (MSRI) at the University of California, Berkeley. This Institute, as described more fully below, will provide a desirable focus of young through senior mathematicians upon selected areas of concentration for the purpose of stimulating and expediting research thereon, in an atmosphere conducive to significant progress. ···

2. *The Institute for Mathematics and its Applications at the University of Minnesota.** We recommend the establishment and funding of this Institute (IMA) at the University of Minnesota. This Institute will provide a unique, highly innovative program of interdisciplinary research bringing together researchers from different disciplines, both in academia and industry, in areas of significant importance to mathematics. ···

3. *The Institute for Advanced Study at Princeton.* We recommend that the National Science Foundation continue and expand its partial support of the traditional program of this Institute in Princeton. ···

4. *The Mathematics Research Center in Madison.* We recommend that the National Science Foundation continue and expand its partial support of the applications oriented program of this Institute in Madison. ···

E. **Regular Grants**

We recommend that the National Science Foundation continue the support of individual researchers in the mathematical sciences through Scientific Research Proposals. This is undoubtedly the single most effective way of maintaining the critical level of mathematical research necessary for the continued health of the science. Individual grants must be sufficient to allow the proposers to devote full-time during a part of the year to intensive study and to allow effective communication through travel, consulting, and publication. ··· Although the above recommendations have been grouped to address the specific needs outlined at the start of this report, there are very definite cross effects among them. The two new Institutes will have considerable effect on the support and training of young researchers as well as, to a lesser extent, on the support and encouragement of those at the middle and senior levels. The new Institutes will also have considerable effect on communication of mathematics through related conferences and publications. In turn, the new program of mid-level and senior postdoctoral fellowships will contribute to the success of the Special Years Programs and the Short Conferences through the participation of those Fellows with the relevant interests.

DETAILED RECOMMENDATIONS FOR NEW MODES OF SUPPORT

A. 1. **Research Instructorships and Postdoctoral Fellowships**

Two years ago the National Science Foundation with the strong support of the mathematical community reinstituted a program of Postdoctoral Fellowships. It plans to award a total of thirty such fellowships for 1981-1982.This program has been very successful and the panel hesitates to tamper with it. However, we feel that the Foundation should offer the choice of another option, that of a Research Instructorship.

A Research Instructorship would have a two-year tenure with half-time academic year support plus full support for four summer months. In general, the applicant would secure from the department where he wants to spend the instructorship the intent to offer

him or her half-time academic support for teaching one three-hour course each semester. If the university is then unable to offer such a position, the recipient would be considered a free agent and could accept a position at any school willing to hire him or her on a half-time basis for two years.

It is suggested that either the National Science Foundation appoint a panel for drawing up plans for such a Research Instructorship program or the staff of the Mathematical Sciences Section propose the details of such a program.

The proposed joint Postdoctoral Fellowship-Research Instructorship Program allows maximum flexibility and provides for a national competition among both fellowship applicants and fellowship institutions. Moreover, a research instructor would have two years of relatively free time to launch his career and would not be burdened almost at the outset with the task and worry of finding a position for the following year. Moreover, a research instructor would be better integrated in his department and receive better training for his future career in teaching than a postdoctoral fellow.

The proposed budget ··· is expected to allow for thirty awards at a competitive stipend including summer support for the research instructorships.

The Second Panel (OAM) supported such a program as is stated in its report, which contains additional discussion.

2. **Courant Institute Research Instructorships**

The Courant Institute is a unique national resource of outstanding expertise in many areas of applied mathematics. Since it is of national importance to acquaint young mathematicians with the content and spirit of first-rate applied mathematics, we recommend the funding of six Research Instructorships attached to the Courant Institute. We encourage the Courant Institute to perfect the program possibly involving recipients in industrial and government work. Because this is intended as a national program, selection of the recipients should not favor local people.

The Second Panel (OAM) supported such a program as is stated in its report, which contains additional discussion.

B. **Mid-Level and Senior Fellowships**

The proposal to fund a program of mid-level and senior fellowships has widespread support in the mathematical community and indeed was given a very high priority by the Council of the American Mathematical Society and an ad hoc AMS Committee on this subject. The need for such a program is well-established. Such a program will enable mathematicians who have already had five or more years in which to demonstrate their superior ability in mathematical research to have time entirely free of other responsibilities to capitalize on the development they have already experienced, at periods which are likely to be crucial in their research careers.

There should be two kinds of awards:

(i) The first is a "matching award" for one-half of the regular academic salary of the applicant for the period of leave, this period not to consist of more than one academic year, and the amount not to exceed $18,000 (this amount to be adjusted yearly). For this kind of award the applicant must obtain half-time support from another source. Since the purpose of the award is to free the recipient for full-time research, it is assumed that the applicant will demonstrate that the other half of his or her funding will not impose other obligations.

(ii) The second kind of award is to be about $27,000 (this amount to be adjusted yearly) to be regarded as full-time support for an academic year. In this case the applicant must certify that he or she has no other salary support.

The selection panel should use a variety of criteria in their award decisions. In addition to the obvious principal consideration of absolute quality, they should strive for reasonable balance in subject matter, geography, and types of institutions. Preference should be given to those who are not recent holders of major fellowships or of similar academic year support. The purpose of the program is to secure research time for good research faculty and not to solve problems of the mathematical job market.

The initial funding for this program should be ··· [such] that about twenty Fellowships would be awarded.

The [OAM] Panel supported such a program as is stated in its report, which contains additional information.

C. 1. **Special Years Programs**

The Panel recommends the regular and expanded funding by the National Science Foundation of Special Years as an important means of strengthening mathematical research. There have been many successful Special Years in the past and evidence indicates that they have an effective, relatively inexpensive way of improving research, identifying and emphasizing important directions for research and stimulating and directing young researchers into important areas of quality research. The impact on the faculty and students of the host institutions is also great.

The budget of such proposals should place emphasis upon the organization, travel and housing expenses of visitors and participants, and not upon salaries for released time of the host faculty. There should be strong evidence of financial support by the host institution. The evaluation of such proposals by the Foundation should be guided by the desire that the topics of emphasis after several years should reflect a broad and balanced coverage of the mathematical sciences.

An intitial funding ··· should allow two or three proposals to be supported.

The Second Panel [OAM] also supported this program as is stated in its report, which contains additional discussion.

2. **AMS Short Conferences**

The conferences, seminars, and summer institutes funded by the National Science Foundation have played a very important role in enabling mathematicians to keep abreast of new developments and to locate and to interact with colleagues having similar interests.

However, mathematics has grown to such an extent and mathematicians have spread so far away from the centers that the need is even greater today. Moreover, the work associated with organizing many conferences effectively prevents the organizers from taking an active part in the actual conference. Finally, for this reason and others, the topics on which conferences are held are not always the best. Most of these difficulties would be solved by the AMS proposal to run ten one-week summer conferences at a fixed location.

A committee formed by the AMS for the purpose would select ten relatively narrow themes from diverse areas that the committee feels ripe. For example, they might pick an area in which breakthroughs seem likely. Younger mathematicians would figure importantly in these conferences, as would all active mathematicians, but especially those away from the major centers.

Although there were some problems indicated in the report of the [OAM] Panel with the specific proposal, we are confident that the American Mathematical Society can work these out. Thus we recommend along with the [OAM] Panel that the American Mathematical Society be asked to run a series of Short Conferences along the lines proposed · · · .

D. **Mathematical Sciences Research Institute**

The outstanding success of the Institute for Advanced Study at Princeton and its importance in the maturation of American mathematicians in the middle of the century have caused many in the mathematical community to call for the founding of additional institutes. Moreover, the success of the more recently established institutes at Bonn and Paris, as well as that of the Mathematics Research Center in Madison, has strengthened this call. On the other hand, voices have been raised in opposition. Both views were represented on this panel, and it was not accepted at the outset that we would recommend the funding of even one institute, let alone two. During our deliberations, however, a clear consensus emerged.

American mathematics has enjoyed tremendous development in recent decades, growing in depth, breadth, and diversity. Constant synthesizing, integrating, and even pruning are required to maintain the vigorous growth. The resources of existing centers are simply not adequate. The proposed MSRI at Berkeley would significantly improve the situation. Topics would be chosen from the mathematical sciences based on their importance, relevance, and timeliness to mathematics.

The proposed IMA at Minnesota would meet a different need. Until this century, most mathematicians were also scientists, a fact which was of inestimable value to both science and mathematics. Today, interaction between science and mathematics needs constant and careful nurture. The IMA proposal offers a truly unique opportunity for such interaction.

In summary, the proposed Institutes at Berkeley and Minnesota would meet different but compelling needs, and complement each other perfectly. Neither alone will suffice. We now comment on each proposal in detail. · · ·

We strongly recommend that the [Berkeley] Insitute be funded · · · provided that the problems mentioned are satisfactorily resolved. That done, there is a high chance of success and with it also the possibility of attracting non-Federal funds. These could establish the Institute as a West Coast center of mathematical research analogous to the Institute for Advanced Study at Princeton, on which it would to some extent be modeled. This could be part of a project to create (ultimately self-sustaining) centers of mathematical research in the major geographical areas of the country.

The First Panel also strongly endorsed the MSRI at Berkeley as stated in its report, which contains additional discussion. · · · We strongly recommend that the Institute be funded · · · by the National Science Foundation which, together with funding guaranteed by other sources, should provide the critical mass of mathematicians needed during the first normal year of operation.

The First Panel expressed strong interest in the IMA at the University of Minnesota as stated in its report, which contains additional discussion. · · ·

PRIORITIES

Since the precise level of funding [for Fiscal Year 1982] for the Mathematical Sciences Section of the National Science Foundation is unknown at this time, it is necessary to recommend for various contingencies. Moreover, it might be useful to give some indication of the Third Panel's thoughts on the relative merits of the various parts of its recommendations.

In order to address priorities, it is essential to consider the total package of the Foundation's support of mathematical research. In particular, it is imperative that the support of individual researchers through Scientific Research Proposals (SRP) be stressed. The unique character and nature of mathematics, as has been outlined in early sections of this report, necessitates that the largest proportion of support should be directed toward the provision of research time. For the university mathematician this is best done through the support of two months' summer research free from teaching and administrative responsibilities.

· · · It must be stressed in these discussions that the above proposals address specific critical shortcomings in the necessary support of the mathematical sciences and have not addressed specifically the present low level of SRP support. Neither do the above recommendations consider the demands for more equipment support, particularly in computers, and increased support for computing time.

SUMMARY

Before concluding the recommendations of the Third Panel we sound a note of caution. There are several issues and hazards associated with a program of support for mathematical research. To what extent should support be consciously used to influence the direction of research? In particular, should there be a decision to promote certain branches, possibly at the expense of others? We believe that the entire history of mathematics and its applications speaks a loud warning *against* such a decision. Support for individual research

projects by the National Science Foundation necessarily implies some measure of recognition of specific research topics. However, first, emphasis must be put on *quality* of researcher and of research, and the National Science Foundation must tie its choice to the free market of mathematical ideas by maintaining a strong and broad peer review process as at present. In addition, programs of support must recognize the central importance of facilitating communication and must encourage interaction among mathematicians in different fields and with the users of mathematics in other fields. In particular, in connection with emerging directions of research, the central role of younger mathematicians must be kept well in mind. To encourage and catalyze the action of the free market in mathematical ideas, appropriate provision must be made for mobility and communication among mathematicians, and especially among younger mathematicans.

The specific role of the National Science Foundation in supporting research in mathematics must include an awareness that other agencies are available to sponsor research in the applications of mathematics, while only the National Science Foundation has responsibility for the nourishment of central basic theory. Likewise, established senior mathematicians and established areas of research are relatively secure. Patterns of Foundation support must recognize the continuing renewal that mathematics gains from the participation of younger mathematicians who must be free to pursue their own mathematical interests.

We offer these principles against which the Foundation should test prospective research programs:

(1) the future of mathematics depends on the young and the very gifted, and they deserve the most supportive attention;

(2) the central core of mathematical theory must flourish if there is to be vitality in the branches of mathematics;

(3) care should be taken not to channel support, intentionally or unintentionally, in directions that limit independence or innovation; and

(4) the easy flow of information and the accessibility of other researchers are essential to the common enterprise of mathematics, and should be promoted.

In conclusion, we believe our recommendations adhere to these principles and urge most strongly their adoption.

QUERIES

Edited by Hans Samelson

QUESTIONS WELCOMED from AMS members regarding mathematical matters such as details of, or references to, vaguely remembered theorems, sources of exposition of folk theorems, or the state of current knowledge concerning published or unpublished conjectures.

REPLIES from readers will be edited, when appropriate, into a composite answer and published in a subsequent column. All answers received will ultimately be forwarded to the questioner.

QUERIES and RESPONSES should be typewritten if at all possible and sent to Professor Hans Samelson, American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940.

QUERIES

251. B. V. Limaye (Department of Mathematics, Indian Institute of Technology, Bombay 400 076, India). Is the following statement equivalent to the Axiom of Choice: There exists a discontinuous linear functional on an infinite-dimensional Banach space.

252. George M. Bergman (Department of Mathematics, University of California, Berkeley, California 94720). The most general sort of formal power series ring over a nontopologized base ring which I have seen in the literature is that of Mal'cev and Neumann, which consists of formal sums $\sum a_g g$, where g ranges over an *ordered group* G, and the coefficients a_g are required to be such that $\{g | a_g \neq 0\}$ is *well-ordered* in G. If we write $\{t^i | i \in \mathbf{Q}\}$ for the basis of the group ring of the additive group of the rational numbers $\mathbf{Q}$, we see that the well-orderedness condition excludes series like $\sum_{i=-\infty}^{\infty} t^{p^i}$ (p a prime). However, some work I have done (preprint available) required just this series, and I have found that one can set up a formal power series ring (generally with zero-divisors) containing such elements. I would be grateful for references to any other constructions of "formal power series" or the like admitting nonwell-ordered supports.

PROCEEDINGS OF THE STEKLOV INSTITUTE

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by *A. G. Postnikov*

This monograph is devoted to the classical version of Tauberian theory. The principal role is played by Tauberian theorems with remainder terms for power series. Some applications of the theory are presented. The book is divided into 29 sections and progresses from the Laplace-Stieltjes transform through theorems of Tauber, Littlewood, Hardy, Fatou, Subhankulov, Onishi, and Ikehara.

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LETTERS TO THE EDITOR

Matematičeskiĭ Sbornik

Having recently been asked by a colleague to withhold dues from the Society because of its continued translation of *Matematičeskiĭ Sbornik*, I want to present here (as I have before the Council, Business Meeting and a special panel) my views of this difficult matter. Unfortunately, the most significant issue is that least discussed: our professional responsibility as mathematicians.

The Society publishes over its own copyright but under contract with the Soviet state publishing company, a full translation of *Matematičeskiĭ Sbornik*. There is overwhelming statistical evidence, generally accepted by the Trustees of the Society, that *Sbornik* has adopted a policy of refusing to publish articles submitted by Jewish authors. Together with others I have urged the Society to discontinue this particular publication.

Unfortunately, most discussions within the Society have focussed on whether Russian violation of human rights could effectively be punished by suspending publication, particularly when the gap would immediately be filled by a private house. The real issue is not punishing the Russians but promulgating standards for ourselves. I do not believe that any learned society should publish over its own copyright a journal in which the primary criterion for publication is something other than the quality of the work in the area which the journal covers. For, no learned society can maintain the shared standards of the profession while engaging in an activity which abuses those standards. The issue is not whether suspending translation of *Sbornik* would punish the Russians, which is unlikely, but that continuing it surely diminishes us professionally.

The more difficult question is what a person of conscience who is a member of the Society now should do. As a former chairman of the Society's Committee on Academic Freedom, Tenure and Employment Security, and as a sometime member also of the Committees on Legal Aid and Human Rights, I have, from time to time, been chagrined when the Council (recognizing perhaps the sentiments of the membership) would not agree to actions which I viewed as morally imperative. On the other hand, the Society certainly has not denied its responsibilities in the areas of discrimination, tenure, unfair employment practices, and civil rights, as they affect members of the mathematical community. It has directly aided a small number of individuals and, by demonstrating its willingness to stand against abuses, has almost certainly indirectly aided many more. Moreover, the Society still effectively serves its primary purpose, the promotion and dissemination of research. There can be, therefore, no question of my continued support, even while I call for the Society to correct this serious professional lapse.

I hope that those who are, in effect, willing to resign over the matter of *Sbornik* will reconsider. It is not that *Sbornik* is a minor matter; in fact it goes to the heart of how a professional society should conduct itself. Rather, the Society only recently has begun to accept its essential role as a keeper of professional standards, and, with *Sbornik*, has found itself, for the first time, with a serious dilemma as to what constitutes appropriate professional conduct. At such a time, while not yielding on the issue, we should also not threaten to withdraw our support.

Murray Gerstenhaber
University of Pennsylvania

Refuseniks

The Israel Mathematical Union, acting on a proposal raised by Professor Piatecki-Shapiro, calls upon all mathematical organizations and mathematicians to assist in the plight of several of our colleagues. These colleagues, mathematicians in the USSR, are suffering, both humanly and professionally, solely because they wish to leave the Soviet Union. The list includes: (1) Scharansky, and (2) Brailovsky. The first has already been in prison for a long period of time under inhuman conditions. The second has been sentenced to deportation to a remote place in the Soviet Union. This is the first time in world history that a person has been prosecuted and convicted for conducting a scientific seminar. We must use all ways to influence the Soviet authority to correct the wrong done to Scharansky and Brailovsky.

Two more senior mathematicians, Lerner and Maimon, have been waiting for many years for a visa. They have been retired for a long period of time and have not had access to classified information for many years. Nevertheless the Soviet government refuses to grant them exit visas. The list of refuseniks includes: Alber, Koghan, Dikki, Ioffe, Freidlin, Schanowski, Esses, Freiman, Rosenstein, Kimelpheld, Kamburd, Rodin, Leonov, Eliyasheberg, and Herloviz. There are many others in the provinces whose names we do not know.

The Israel Mathematical Union asks you to give your maximum help and support to these people in their extremely difficult situation:

(1) Please keep in touch with them and help them with professional information and support them morally. In certain cases financial support may also be necessary.

(2) Please pressure in every possible way officials of the USSR as well as Soviet scientific organizations.

(3) We further call on you to address the representatives of your government and parliament for support and help.

Yakar Kannai, Chairman
Israel Mathematical Union

José Luis Massera

The enclosed petition [has been] signed by 86 members of the AMS Summer Research Institute in

Singularities; the signers are from 11 countries, and 40 universities or research organizations.

I enclose a copy of the cover letter sent to the president of the Supreme Military Tribunal in Uruguay.

It should be noted that the petition was circulated only in the last days of the seminar; participants who left before then did not see it.

Anthony Iarrobino
Northeastern University

. . . . . .

El 1 octubre, 1981

Sr. Presidente del Supremo Tribunal Militar
Coronel Federico Silva Ledesma
Canelones 2335, Montevideo, Uruguay
Sr. Presidente,

Las personas, matématicos de once paíces, que han firmado esta petición, le piden a usted y al gobierno de Uruguay que liberen al Professor José Luis Massera, nuestro colega eminente, para que él pueda sequir trabajando problemas de matématicas en Uruguay, o aceptar un puesto fuera de Uruguay.

Puedo enviar a estos matématicos una respuesta de usted.

Anthony Iarrobino

Copias a
Comandante en Jefe del Ejercito
El Embajador del Republico de Uruguay
American Mathematical Society *Notices*
Gazette des Mathématiciens de la Société Mathématique de France

. . . . . .

The following mathematicians, participants in the American Mathematical Society's Summer Research Institute in Singularities held from July 20 to August 8, 1981, note their concern over the physical condition, and the continued detention since 1975 of their colleague, the eminent Uruguayan mathematician Professor José Luis Massera who is 65 years old.

We petition the Uruguayan government, that Professor Massera *either* be released immediately to take up his mathematical work in Uruguay, or so that he might accept a position offered him outside Uruguay, *or* at the least have a public trial, publicly announced in advance, in which he can conduct his own defense, with outside observers from the American Mathematical Society Committee on Human Rights of Mathematicians, and from the Comité de Mathématiciens Français.

Women Speakers at ICM

The Association for Women in Mathematics has noted the correspondence in the August issue of the *Notices* regarding women speakers at the ICM. The consensus of the Executive Committee of the AWM, which met at Pittsburgh in August, regarding this matter was as follows.

AWM has previously relayed its concerns on this matter to Professor Lipman Bers, since he chairs the U.S. National Committee for Mathematics. Professor Bers then, as now, cited his letter to Professor Lennart A. E. Carleson which was in response to the latter's request to the USNCM for suggestions for Fields Medalists, and only incidentally mentioned ICM speakers.

It has not been the position of AWM that any guidance by a National Committee to the Consultative Committee of the ICM contain an exclusive listing of speakers, but rather that our National Committee could make the affirmative effort to seek out women as speakers. Professor Bers has said in his correspondence: "All members of USNCM would be happy if the list of the invited speakers for Warsaw would include women, blacks and Hispanics." We feel that at the very least these general sentiments could have been expressed by him to the Consultative Committee via Professor Carleson.

Bhama Srinivasan
President, AWM

Policy on Letters to Editor

Readers who wish to respond to letters published in this issue are urged to do so before March 1, 1982. Responses received by that date may be edited to reduce repetition and will be considered for publication in the June 1982 issue.

Letters submitted for publication in the *Notices* are reviewed by the Editorial Committee, whose task is to determine which ones are suitable for publication. The publication schedule requires from two to four months between receipt of the letter in Providence and publication of the earliest issue of the *Notices* in which it could appear.

Publication decisions are ultimately made by majority vote of the Editorial Committee, with ample provision for prior discussion by committee members, by mail or at meetings. Because of this discussion period, some letters may require as much as seven months before a final decision is made.

The committee reserves the right to edit letters.

The *Notices* does not ordinarily publish complaints about reviews of books or articles, although rebuttals and correspondence concerning reviews in the *Bulletin of the American Mathematical Society* will be considered for publication.

Letters should be mailed to the Editor of the *Notices*, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940, and will be acknowledged on receipt.

Joel E. Cohen and David E. Pingree named MacArthur Fellows

Joel E. Cohen of Rockefeller University and David E. Pingree of Brown University have been awarded five-year fellowships by the MacArthur Foundation. These awards are two of nineteen announced in November; they are made with no restrictions on the use of the funds, which range from $24,000 to $60,000 per year, depending on the recipient's age. Forty such awards were made during 1981; the first twenty-one were announced last May (see the August *Notices*, page 430), the second group of nineteen were announced in November.

Joel Ephraim Cohen received five degrees from Harvard: B.A. (1965), M.A. (1967), Ph.D. (Applied Mathematics, 1970), M.P.H. (1970), and Dr.P.H. (1973). He was an assistant professor and associate professor of biology at Harvard from 1971 to 1975 and, since 1975, he has been professor of populations at Rockefeller University. His research is concerned with molecular and cellular populations, demography, social groups and ecology, stochastic processes, combinatorics, statistics and computing. He gave an invited hour address at the 1978 Annual Meeting in Atlanta entitled *Ergodic theorems in demography*, and has served as a member of the AMS-SIAM Committee on Mathematics in the Life Sciences since 1980.

David Pingree received a bachelors degree (in classics and Sanskrit) in 1954 and a Ph.D. in 1960, both from Harvard. He was a Junior Fellow at Harvard from 1960 to 1963, when he became an assistant professor at the University of Chicago's Oriental Institute. In 1971 he moved to Brown University, where he is professor of the history of mathematics. His research has been concerned with the transmission of scientific knowledge from early civilizations through the Middle Ages. He has recently concentrated on ancient astronomy and astrology in the Middle East and on ancient mathematics in India and has extensively studied the influence of Indian astronomy and astrology on Greek, Arabic and Babylonian cultures.

AMS Research Fellowship Fund
Request for Contributions

The AMS Research Fellowship Fund was established in 1973. From this fund AMS Research Fellowships are awarded annually to individuals who have received the Ph.D. degree, who show unusual promise in mathematical research, and who are citizens or permanent residents of a country in North America.

Twenty-five Research Fellowships have been awarded including two granted for 1981-1982 (see the announcement in the April 1981 *Notices*, page 256). The number of fellowships awarded depends on the contributions the Society receives. The Society contributes a minimum of $9,000 to the Fund each year, matching one-half of the funds in excess of $18,000 raised from other sources, up to a total contribution by the Society of $20,000. Each member of the Society is requested to contribute to the Fund.

Contributions to the AMS Research Fellowship Fund are tax deductible. Checks should be made payable to the American Mathematical Society, clearly marked "AMS Research Fellowship Fund," and sent to the American Mathematical Society, P. O. Box 1571, Annex Station, Providence, Rhode Island 02901.

The awards for 1982-1983 are expected to be announced in the February or April 1982 *Notices*.

800 Number for Members' Problems with Orders, Subscriptions, etc.

The Society has a toll-free 800 telephone number which members in the continental United States are invited to use if they have problems in connection with book orders, subscription fulfillment, dues billing, or other matters related to membership services. The number is **800-556-7774**.

Members with such problems may use this number during ordinary working hours (8:00 a.m. to 4:15 p.m., eastern time, Monday through Friday). Carol-Ann Blackwood, of the Membership and Sales Department, will be happy to handle requests for assistance in the correction of mistakes or misunderstandings, and will see to it that solutions are found to problems encountered by members in their communications with the Membership and Sales Department of the AMS office. Mrs. Blackwood has attended the Joint Mathematics Meetings for several years and has assisted at the AMS Book Sale Desk. Members who attend the Joint Meetings may bring their questions to her in person. If there are any problems which she cannot resolve immediately, she will report back as soon as possible.

This 800 number is the same one which has been used for several months by members and other customers to order AMS books. The extension of its use as described above has been made in recognition of the fact that it has become increasingly difficult to respond satisfactorily to members' problems as rapidly as desired using other means of communication.

Fulbright Scholars Available for Short-Term Visits

More than 150 Fulbright scholars from all regions of the world, in the United States for college and university teaching and advanced research, are available for occasional lectures, seminars and special programs. The Council for International Exchange of Scholars (CIES), which administers the Senior Scholar Fulbright Program, announced that limited funds would be

available to facilitate travel to interested institutions, particularly those which have had little opportunity to participate in the Fulbright Scholar Exchange Program.

The Council has prepared a brochure describing the Occasional Lecturer Program and listing by discipline Fulbright scholars who welcome short-term invitations. The entries include proposed topics, home and U. S. affiliations. A copy of the brochure is available from Mary W. Ernst, Council for International Exchange of Scholars, 11 Dupont Circle, N.W., Department N, Washington, D.C. 20036, 202-833-4979. Also available upon request is the 1981-1982 Directory of Visiting Fulbright Scholars, a by-discipline list of more than 700 scholars, indexed by home country and by state of host institution.

First Class or Airmail Delivery of *Abstracts* and *Notices*

In order to assure that information about meetings will arrive in time, arrangements may be made for first class or airmail delivery of *Abstracts* and *Notices*. In 1982, first class delivery in the U. S. or Canada may be obtained by paying a subscription surcharge of $7 for *Abstracts* or $8 for *Notices*. Information on air mail rates for other countries, and information on the costs for first class or airmail delivery of other AMS journals, may be obtained from the Membership and Sales Department, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940 (401-272-9500).

The assertion made in the October 1981 *Notices* that *Abstracts* and *Notices* must be sent by the same class of mail no longer applies. Beginning in January 1982, members may choose to receive either journal by ordinary post (at no subscription surcharge), by first class (in North America), or by airmail (in the rest of the world).

NSF NEWS

Positions Open in NSF

NSF's Division of Mathematical and Computer Sciences is seeking qualified applicants for positions in the Mathematical Sciences which periodically become available. The positions are filled on a one- or two-year rotational basis and are excepted from the competitive civil service. Annual salaries are negotiable and range from $37,871 to $50,112 (GS-14/15 equivalent). Applicants should have a Ph.D. or equivalent experience and training in an appropriate field, plus six years of successful scientific research experience. A broad general knowledge of the field and some administrative experience are also required.

Applicants for these positions should submit résumés to NSF, Personnel Administration Branch, Room 212, 1800 G Street, N.W., Washington, D.C. 20550. Attn: E. Paul Broglio, 202-357-7840. NSF is an Equal Opportunity Employer.

NSF Pool of Reviewers

The Mathematical Sciences Section of the National Science Foundation is interested in enlarging its pool of reviewers for proposals in the mathematical sciences.

NSF reviewers are requested, from time to time, to evaluate a research proposal and prepare written comments on it for use by program directors in the Section. Normally, each proposal is reviewed by several people and their comments form an extremely important source of information for NSF in making decisions concerning recommendations. Although the Foundation does not compensate reviewers, it considers reviewing to be one of the more important contributions individuals can make to the future of science. A large pool of active mathematical sciences researchers, industrial, academic, men, women, and minorities, is needed. Persons with research experience who are interested in participating in this activity are invited to send a copy of their curriculum vita, including a list of publications, to the Mathematical Sciences Section, Division of Mathematical and Computer Sciences, National Science Foundation, 1800 G Street, N.W., Washington, D.C. 20550.

MATHEMATICAL REVIEWS
ASSOCIATE EDITORS

The *Mathematical Reviews* Editorial Committee invites applications and recommendations for positions as Associate Editor of **MR**, to commence during the summer of 1982. Applications will be welcomed from persons taking leave from other positions, and in particular from tenured faculty members who could take leave to come to **MR** for two years.

The **MR** office is located in Ann Arbor, Michigan, adjacent to the campus of the University of Michigan, and the editors enjoy many faculty privileges at the university. At present, **MR** employs eleven editors, about twenty consultants, and over fifty non-editorial personnel. It publishes *Mathematical Reviews* and *Current Mathematical Publications* and various indexes. The responsibilities of Associate Editors fall primarily in the day-to-day operations of classifying articles and books, assigning these items to reviewers, and editing the reviews when they are returned. Other responsibilities evolve in accordance with the individual's experience and capabilities. At this time, no particular area of mathematical specialization is sought, although strength in applied areas or statistics is desirable. Considerable breadth in mathematics rather than special skill is sought. A reading knowledge of two main foreign languages is important, but not essential. (Russian is especially desirable.)

Persons interested in combining a sabbatical or other leave with a part-time or full-time appointment as an Associate Editor should write for further details. The twelve-month salary is negotiable, and will be commensurate with the experience applicants bring to the position. Retirement and insurance plans and other fringe benefits are similar to those in universities; of special importance is a policy providing a study leave after at least two years. This amounts to three months of full pay for each two years spent as Editor.

Applications (including curriculum vitae, bibliography, data on experience, and names and addresses of three references) and recommendations should be sent to Dr. John L. Selfridge, Executive Editor, *Mathematical Reviews*, P.O. Box 8604, Ann Arbor, Michigan 48107 (telephone 313-764-7228). Persons interested in applying for this position are urged to inquire immediately.

Mathematical Reviews is an equal opportunity/affirmative action employer.

CINCINNATI MEETINGS, January 11–17, 1982

Program for the 88th Annual Meeting

The January 1982 Joint Mathematics Meetings, including the 88th Annual Meeting of the AMS and the 65th annual meeting of the Mathematical Association of America, will be held January 13–17 (Wednesday–Sunday), 1982, in Cincinnati, Ohio. The meetings will be preceded by the AMS Short Course on January 11–12 (Monday–Tuesday), 1982. Sessions will take place in the Cincinnati Convention-Exposition Center, Stouffer's Cincinnati Towers, and the Westin Hotel.

The members of the Local Arrangements Committee are Frank T. Birtel (ex officio), S. Elwood Bohn, Thomas J. Bruggeman, Milton D. Cox, Robert M. Dieffenbach, Richard G. Laatsch, William J. Larkin III, William J. LeVeque (ex officio), Maita Levine (publicity director), H. David Lipsich, Edward P. Merkes (chairman), Raymond H. Rolwing, and David P. Roselle (ex officio).

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IMPORTANT DEADLINES

Abstracts,	
For consideration for special sessions	**Expired**
Of contributed papers	**Expired**
Employment Register (Applicants only)	**Expired**
Employment Register (Employers)	**Expired**
Preregistration and Housing	**Expired**
Preregistration cancellations (50% refund)	**January 8**
Second-hand Book Exchange	**January 6**
Dues credit for nonmembers/students	**February 17**

88TH ANNUAL MEETING OF THE AMS

January 13–16, 1982

Fifty-fifth Josiah Willard Gibbs Lecture

The 1982 Gibbs lecture will be presented at 8:30 p.m. on Wednesday, January 13, by ELLIOTT W. MONTROLL of the Institute for Physical Science and Technology of the University of Maryland, College Park. Professor Montroll will speak on *The dynamics and evolution of some socio-technical systems.*

Colloquium Lectures

There will be a series of four Colloquium Lectures presented by DENNIS SULLIVAN of City University of New York, Graduate School and University Center. The title of the lecture series is *Geometry, iteration, and group theory.* The lectures will be given at 1:00 p.m. daily, Wednesday through Saturday, January 13–16.

Cole Prize

The 1982 Frank Nelson Cole Prize in Number Theory will be awarded at 4:30 p.m. on Thursday, January 14.

Invited Addresses

By invitation of the Program Committee, there will be eight invited one-hour addresses. The names of the speakers, their affiliations, the titles and times of their talks follow:

DAVID C. BRYDGES, University of Virginia, *What is a quantum field theory?*, 3:20 p.m. Friday.

LUIS A. CAFFARELLI, New York University, Courant Institute of Mathematical Sciences, *Variational problems with geometric constraints*, 11:20 a.m. Thursday.

EDWARD GEORGE EFFROS, University of California, Los Angeles, *C*-algebraic structure and noncommutative geometry*, 2:10 p.m. Friday.

E. GRAHAM EVANS, JR., University of Illinois, Urbana-Champaign, *Linear algebra over $K[X_1, \ldots, X_n]$ 1890 to 1980*, 2:10 p.m. Wednesday.

JUN-ICHI IGUSA, Johns Hopkins University, *Arithmetic of polynomials*, 10:10 a.m. Wednesday.

ROBERT P. LANGLANDS, Institute for Advanced Study, *Applications of the trace formula*, 10:10 a.m. Thursday.

JOSEPH NEISENDORFER, Ohio State University, Columbus, *Exponents in homotopy theory*, 11:20 a.m. Wednesday.

RICHARD P. STANLEY, Massachusetts Institute of Technology, *Log-concave and unimodal sequences in algebra, combinatorics, and geometry*, 3:20 p.m. Wednesday.

Special Sessions

By invitation of the same committee, there will be fourteen special sessions of selected twenty-minute

American Mathematical Society Short Course Series

Computed Tomography

January 11–12, 1982

The American Mathematical Society will present a one and one-half day short course entitled "Computed Tomography" on Monday and Tuesday, January 11 and 12, 1982, in the Cincinnati Convention and Exposition Center (Room 3) in Cincinnati, Ohio.

Computed tomography has had an enormous impact on diagnostic radiology and is essentially based on mathematical inversion of the Radon transform. Many further developments are expected.

The course will discuss the future possibilities of computed tomography and open problems as well as the limitations of each of the techniques presently used and of the method itself.

The speakers reflect the wide spectrum of possible philosophical approaches to the basic mathematics problem both in the degree of abstraction used in choosing their basic model and in the level of rigor maintained. This is as it should be.

Included in the course will be a discussion of: the physics and medical background for the various aspects of computed tomography; the mathematical theory based on rigorous models; the limitations of these models; algorithmic aspects of the reconstruction procedure in actual practice; computational hardware and software design considerations in implementation of computed tomography techniques for Monte-Carlo simulations of the performance of various algorithmic and physical design aspects.

Synopses of the talks and accompanying reading lists appear on pages 497-499 of the October issue of the *Notices*. Some knowledge of the following areas will be presumed: calculus, Fourier transforms, numerical integration, and programming.

Those who wish to get the most benefit from the course should familiarize themselves with Radon's formula for recovering a function in the plane from a knowledge of all its line integrals; see for example: "Computerized tomography: the new medical X-ray technology," L. A. Shepp and J. B. Kruskal, *American Mathematical Monthly*, 1978, volume 85, pages 420–439, and references there.

The course will consist of six lectures, and will conclude with a panel discussion. The speakers are: Allan M. Cormack, Nobel laureate (Department of Physics, Tufts University); F. Alberto Grünbaum (Department of Mathematics, University of California, Berkeley); Sigurdur Helgason (Department of Mathematics, Massachusetts Institute of Technology); Lawrence A. Shepp (Bell Laboratories, Murray Hill); Kennan T. Smith (Department of Mathematics, Oregon State University); and Oleh J. Tretiak (Department of Electrical and Computer Engineering, Drexel University).

L. A. Shepp will begin with an overview of the pure and applied mathematics and physics of X-ray transmission computed tomography (reconstruction of an X-ray density $f(x, y)$ from line integrals), nuclear magnetic resonance computed tomography (reconstruction of a spin density $f(x, y, z)$ from plane integrals), and emission computed tomography (reconstruction of an emission density $f(x, y, z)$ from line integrals). A. M. Cormack will follow; he will present a brief history of computed tomography and describe some of its recent developments. Next, the limited angle reconstruction problem and a host of open mathematical problems suggested by X-ray and NMR tomography will be discussed by F. A. Grünbaum, and O. J. Tretiak will describe inversion and identification problems in emission tomography using attenuated and exponential Radon transforms. Reconstruction formulas in computed tomography will be the topic of K. T. Smith's lecture, and S. Helgason will speak on the ranges of Radon transforms.

The short course is open to all who wish to participate upon payment of the registration fee. There are reduced fees for students and unemployed individuals. Please refer to the section entitled PREREGISTRATION AND HOUSING and REGISTRATION AT THE MEETINGS for details.

The program is under the direction of Lawrence A. Shepp of Bell Laboratories. The short course was recommended by the Society's Committee on Employment and Educational Policy (CEEP), whose members are Lida K. Barrett (chairman), Donald C. Rung, Hans Schneider, Robert J. Thompson, Barnet M. Weinstock, and William P. Ziemer. The short course series is under the direction of the CEEP Short Course Subcommittee, whose members are Stefan A. Burr, Ronald L. Graham (chairman), Robert M. McKelvey, Cathleen S. Morawetz, Barbara L. Osofsky, and Philip D. Straffin, Jr.

papers. The titles of these special sessions, the names and affiliations of the mathematicians arranging them, the dates and times they will meet, and tentative lists of speakers are as follows:

Rings of continuous function, CHARLES E. AULL, Virginia Polytechnic Institute, 2:10 p.m. Wednesday and 8:00 a.m. and 2:10 p.m. Thursday. Paul Bankston, Robert L. Blair, W. W. Comfort, Frederick K. Dashiell, Jr., Alan Dow, William A. Feldman, Leonard Gillman, Anthony W. Hager, Melvin Henriksen, Meyer Jerison, Ronnie Levy, S. Mrowka, James F. Porter, M. D. Rice, R. M. Stephenson, Jr., Mary Anne Swardson, Eric K. Van Douwen, and R. Grant Woods.

Multivariate spline functions and piecewise polynomial approximation, ALFRED S. CAVARETTA, JR., Kent State University, 2:10 p.m. Wednesday and 2:10 p.m. Thursday. Wolfgang Dahmen, Carl de Boor, Ronald DeVore, Richard Franke, Charles A. Hall, Klaus Höllig, Lois Mansfield, Charles A. Micchelli, Gregory M. Nielson, I. J. Schoenberg, Larry L. Schumaker, and A. Sharma.

Commutative ring theory, E. GRAHAM EVANS, JR. and PHILLIP GRIFFITH, University of Illinois, Urbana-Champaign, 8:00 a.m. Wednesday. Kaan U. Akin, Sankar P. Dutta, Craig Huneke, Andrew R. Kustin, Barbara R. Peskin, Judith D. Sally, and Wolmer V. Vasconcelos.

Algebraic combinatorics, IRA M. GESSEL, Massachusetts Institute of Technology, 8:00 a.m. Wednesday, 8:00 a.m. and 2:10 p.m. Thursday. George E. Andrews, David J. Anick, Kenneth Baclawski, Emden R. Gansner, Adriano M. Garsia, Ira M. Gessel, Curtis Greene, Phil Hanlon, David M. Jackson, Victor G. Kac, David A. Klarner, Joseph Kung, James Lepowsky, S. C. Milne, Robert A. Proctor, Bruce E. Sagan, Louis Solomon, and Dennis Stanton.

Dynamical systems, HARVEY B. KEYNES, University of Minnesota, Minneapolis, and NELSON G. MARKLEY, University of Maryland, 8:00 a.m. and 2:10 p.m. Wednesday. Paul Blanchard, Louis Block, Michael G. Branton, Michael Brin, Andrés Del Junco, Robert L. Devaney, Marlies Gerber, Russell A. Johnson, Brian Marcus, Doug McMahon, R. Moeckel, Mahesh G. Nerurkar, Susan Mary Rees, Daniel J. Rudolph, and M. Sears. This session does include a problem session.

Algebraic topology, CHARLES A. MCGIBBON, Indiana University, 1:00 p.m. Friday and 1:00 p.m. Saturday. Ralph L. Cohen, Morton L. Curtis, Mark Feshback, Zbigniew Fiedorowicz, David Copeland Johnson, Richard M. Kane, Nicholas J. Kuhn, David J. Pengelley, David L. Rector, Paul Selick, R. W. Thomason, and Frank Williams.

Topics in complex analysis, C. DAVID MINDA, University of Cincinnati, 2:10 p.m. Wednesday and 8:00 a.m. and 2:10 p.m. Thursday. Albert Baernstein II, L. Brickman, Barbara A. Brown, Johnny E. Brown, Douglas M. Campbell, Joseph A. Cima, Carl C. Cowen, Jr., David Drasin, Peter Duren, Carl H. FitzGerald, F. W. Gehring, D. H. Hamilton, James A. Jenkins, Daniel H. Leucking, Y. J. Leung, Abdallah K. Lyzzaik, A. Marden, Thomas A. Metzger, Burton Rodin, John Rossi, Glenn Schober, Allen Weitsman, and Lawrence Zalcman.

Operator theory, CARL M. PEARCY, University of Michigan, 8:30 a.m. and 2:30 p.m. Wednesday. Sheldon Axler, H. Bercovici, Charles A. Berger, Richard W. Carey, John B. Conway, L. A. Fialkow, J. William Helton, C. M. Pearcy, C. R. Putnam, Peter Rosenthal, Norberto Salinas, Joseph Stampfli, and Joseph D. Ward.

Ordered algebraic structures, WAYNE B. POWELL, Oklahoma State University, and CONSTANTINE TSINAKIS, Vanderbilt University, 1:00 p.m. Friday and 1:00 p.m. Saturday. Marlow E. Anderson, Richard N. Ball, J. Patrick Bixler, Paul Conrad, John Dauns, Manfred Droste, Todd Feil, A.W.M. Glass, Pierre A. Grillet, Yuri Gurevich, W. Charles Holland, Justin T. Lloyd, Jorge Martinez, Stephen H. McCleary, F. D. Pedersen, Keith R. Pierce, Norman R. Reilly, Jo E. Smith, Stuart A. Steinberg, and Constantine Tsinakis.

Topics in scattering and spectral theory, ALEXANDER G. RAMM, Kansas State University, 1:00 p.m. Friday and 1:00 p.m. Saturday. Mark J. Ablowitz, Hans-Dieter Alber, Jules M. Combes, Jeffery Cooper, James S. Howland, Roger G. Newton, Ralph S. Phillips, A. G. Ramm, Mary Beth Ruskai, Walter Strauss, and Calvin H. Wilcox.

Summability and related topics, BILLY E. RHOADES, Indiana University, 7:50 a.m. Wednesday. David Borwein, F. Peter Cass, J. DeFranza, J. A. Fridy, Mark A. Kon, Mangalam R. Parameswaran, Louise A. Raphael, B. E. Rhoades, William H. Ruckle, Dennis C. Russell and B. L. R. Shawyer.

Quadratic forms, DANIEL B. SHAPIRO, Ohio State University, 1:00 p.m. Friday and 1:00 p.m. Saturday. Ricardo Baeza, James W. Benham, Ron Brown, Andrew G. Earnest, Robert W. Fitzgerald, David B. Leep, Murray A. Marshall, Jonathan L. Merzel, Carl Riehm, Alex Rosenberg, Winfried Scharlau, Olga Taussky-Todd, Roger Ware, and Joseph L. Yucas.

Fixed points, nonexpansive mappings and related topics, ROBERT C. SINE, University of Rhode Island, 8:00 a.m. and 2:10 p.m. Thursday. Ronald E. Bruck, Frank R. Deutsch, D. J. Downing, Michael Edelstein, W. A. Kirk, T. C. Lim, E. Odell, William O. Ray, Simeon Reich, Ricardo Torrejón, Barry Turett, and T. E. Williamson, Jr.

The interaction between contempory pure mathematics and engineering at the research level, GAIL S. YOUNG, University of Wyoming, and CLYDE MARTIN, Case Western Reserve University, 8:00 a.m. Thursday and 1:00 p.m. Friday. Melvyn S. Berger, Roger W. Brockett, Christopher I. Byrnes, Irwin W. Sandberg, Alwyn C. Scott, Gilbert Strang, and H. S. Witzenhausen.

October 9 was the **deadline** for submission of abstracts for consideration for inclusion in these special sessions.

Contributed Papers

There will be sessions for contributed papers Wednesday morning and afternoon, Thursday morning

TIMETABLE

All sessions are at the Convention Center, unless noted as follows:
ST - Stouffer's

(Eastern Standard Time)

AMERICAN MATHEMATICAL SOCIETY SHORT COURSE SERIES

MONDAY, January 11	COMPUTED TOMOGRAPHY
11:00 a.m. - 4:00 p.m.	REGISTRATION - Outside Room 3
	ROOM 3
2:00 p.m. - 3:15 p.m.	Scope of pure and applied computed tomography Lawrence A. Shepp
3:30 p.m. - 4:45 p.m.	Computed tomography: History and some recent developments Allan M. Cormack
TUESDAY, January 12	
8:00 a.m. - 2:00 p.m.	REGISTRATION - Outside Room 3
	ROOM 3
9:00 a.m. - 10:15 a.m.	The limited angle reconstruction problem F. Alberto Grünbaum
10:30 a.m. - 11:45 a.m.	Attenuated and exponential Radon transforms: Inversion and identification problems in emission tomography Oleh J. Tretiak
1:30 p.m. - 2:45 p.m.	Reconstruction formulas in computed tomography Kennan T. Smith
3:00 p.m. - 4:15 p.m.	Ranges of Radon transforms Sigurdur Helgason
4:15 p.m. - 5:00 p.m.	General discussion

JOINT MATHEMATICS MEETINGS

TUESDAY, January 12	American Mathematical Society	
2:00 p.m. - 10:00 p.m.	COUNCIL MEETING Room 23	
4:00 p.m. - 8:00 p.m.	REGISTRATION - North Bay Exhibit Area	
4:00 p.m. - 8:00 p.m.	AMS BOOK SALE North Bay Exhibit Area	MAA BOOK SALE North Bay Exhibit Area
WEDNESDAY, January 13	**AMS**	
	SPECIAL SESSION	
7:50 a.m. - 12:20 p.m.	Summability and Related Topics Room 8	
8:00 a.m. - 5:00 p.m.	REGISTRATION - North Bay Exhibit Area (NBEA)	
8:00 a.m. - 5:00 p.m.	AMS BOOK SALE NBEA	MAA BOOK SALE NBEA
	SPECIAL SESSIONS	
8:00 a.m. - 11:20 a.m.	Algebraic Combinatorics I Room 24	
8:00 a.m. - 11:20 a.m.	Commutative Ring Theory Room 25	
8:00 a.m. - 12:20 p.m.	Dynamical Systems I Room 26	
	SESSIONS FOR CONTRIBUTED PAPERS	
8:00 a.m. - 11:55 a.m.	Ordered Algebraic Structures and Number Theory Room 13	
8:00 a.m. - 11:55 a.m.	Special Functions, Ordinary Differential Equations and Control Theory Room 10	
8:00 a.m. - 12:10 p.m.	Geometry, Convex Sets, and Differential Geometry Room 9	
	SPECIAL SESSION	
8:30 a.m. - 11:55 a.m.	Operator Theory I Room 23	

and afternoon, Friday afternoon, and Saturday afternoon. The **deadline** for submission of abstracts of contributed papers **was October 14. Late papers will not be accepted.**

Audio-Visual Equipment

Rooms where special sessions and contributed paper sessions will be held will be equipped with an overhead projector and screen. Blackboards will **not** be available.

Other AMS Sessions

AMS Committee on Employment and Educational Policy

The Society's Committee on Employment and Educational Policy (CEEP) will sponsor a panel discussion at 7:00 p.m. on Thursday, January 14, on *Mathematics and applications.* The purpose of this panel is to present, both to mathematicians and to nonacademic research institutions, a sampling of the broad spectrum of exciting mathematics being done outside of pure mathematics departments. Both communities should benefit from being drawn closer together: the mathematicians seeing new important areas for creativity, the institutions seeing an underutilized body of knowledge and talent. For more details see the box on this page.

A meeting of department heads will take place at 4:30 p.m. on Friday, January 15, to discuss *Problems facing undergraduate and graduate programs in mathematics.* WENDELL H. FLEMING will report on information obtained from the most recent CBMS Survey, and GAIL S. YOUNG will report on the findings of a conference on preparation in applied mathematics appropriate for industrial employment held last June under the auspices of the Sloan Foundation. LIDA K. BARRETT will serve as moderator.

Committee on the Agenda for Business Meetings

The Society has a Committee on the Agenda for Business Meetings. The purpose is to make Business Meetings orderly and effective. The committee does not have legal or administrative power. It is intended that the committee consider what may be called "quasi-political" motions. The committee has several possible courses of action on a proposed motion, including but not restricted to

(a) doing nothing;

(b) conferring with supporters and opponents to arrive at a mutually accepted amended version to be circulated in advance of the meeting;

(c) recommending and planning a format for debate to suggest to a Business Meeting;

(d) recommending referral to a committee;

(e) recommending debate followed by referral to a committee.

There is no mechanism that requires automatic submission of a motion to the committee. However, if a motion has not been submitted through the committee, it may be thought reasonable by a Business Meeting to refer it rather than to act on it without benefit of the advice of the committee.

The committee consists of Everett Pitcher (chairman), Marian B. Pour-El, David A. Sanchez, and Guido L. Weiss.

In order that a motion for the Business Meeting of January 14, 1982, receive the service offered by the committee in the most effective manner, it should be in the hands of the secretary by December 14, 1981.

Everett Pitcher, Secretary

Mathematics and Applications

A CEEP Panel Session on Mathematics and Applications is planned for 7:00 p.m. Thursday, January 14. Brief technical presentations and general discussion will center on:

1. "A branch of mathematics and its applications":

RICHARD C. DIPRIMA (Rensselaer Polytechnic Institute, Fluid Mechanics), research areas new (combustion, interfacial dynamics) and classical (transonic flow, boundary layer theory), modelling phenomena, mathematical techniques.

DANIEL J. KLEITMAN (Massachusetts Institute of Technology, Combinatorics), applied areas and results, *e.g.* genetic codes, VLSI circuits.

2. "An application and its mathematics":

KENNAN T. SMITH (Oregon State University, Computed Tomography), pure mathematics in practical CT problems, *e.g.* finding a brain tumor using the Ehrenpreis-Malgrange theorem on the existence of solutions of partial differential equations.

ROBERT DEHOFF (University of Florida, Quantitative Metallography), structural investigations in biological and materials sciences using statistics, algebraic topology, differential and integral geometry, stereology.

3. "An institution and its mathematical applications":

HENRY O. POLLAK (Director, Bell Laboratories Mathematics & Statistics Research Center), branches of mathematical sciences on which Bell Laboratories research concentrates, reasons for these choices, specific examples.

JOAN R. ROSENBLATT (Deputy Director, National Bureau of Standards Center for Applied Mathematics), mathematics and statistics used in collaboration with physical and engineering sciences, *e.g.* computational fluid dynamics, combinational algorithm (circuit testing), multivariate time series modelling (atomic clocks).

The session was planned by Charlotte Lin (Schlumberger-Doll Research) who will serve as moderator.

Council Meeting

The Council of the Society will meet at 2:00 p.m. on Tuesday, January 12 in Room 23 of the Convention Center.

Business Meeting

The Business Meeting of the Society will take place immediately following the award of the Cole Prize at 4:30 p.m. on Thursday, January 14. The secretary notes the following resolution of the Council: Each person who attends a Business Meeting of the Society shall be willing and able to identify himself as a member of the Society. In further explanation, it is noted that *each person who is to vote at a meeting is thereby identifying himself as and claiming to be a member of the American Mathematical Society.* For additional information on the Business Meeting, please refer to the box titled Committee on the Agenda for Business Meetings.

ACTIVITIES OF OTHER ORGANIZATIONS

The **Mathematical Association of America** (MAA) will hold its 65th annual meeting January

TIMETABLE

All sessions are at the Convention Center, unless noted as follows:
ST - Stouffer's

WEDNESDAY, January 13	American Mathematical Society
10:10 a.m. - 11:10 a.m.	INVITED ADDRESS Arithmetic of polynomials Jun-Ichi Igusa, North Meeting Room
11:20 a.m. - 12:20 a.m.	INVITED ADDRESS Exponents in homotopy theory Joseph Neisendorfer, North Meeting Room
1:00 p.m. - 2:00 p.m.	COLLOQUIUM LECTURES Lecture I: Geometry, iteration, and group theory Dennis Sullivan, North Meeting Room
1:00 p.m. - 5:00 p.m.	EXHIBITS - NBEA
	SPECIAL SESSIONS
2:10 p.m. - 6:30 p.m.	Dynamical Systems II Room 26
2:10 p.m. - 5:00 p.m.	Rings of Continuous Function I Room 3
2:10 p.m. - 5:30 p.m.	Multivariate Spline Functions and Piecewise Polynomial Approximation I Room 8
2:10 p.m. - 5:50 p.m.	Topics in Complex Analysis I Room 25
	SESSIONS FOR CONTRIBUTED PAPERS
2:10 p.m. - 6:05 p.m.	Ordinary and Partial Differential Equations Room 10
2:10 p.m. - 6:35 p.m.	General Topology Room 24
2:10 p.m. - 5:35 p.m.	Applied Mathematics Room 9
2:10 p.m. - 4:35 p.m.	GENERAL SESSION Room 4 POSTER SESSION Room 5
2:10 p.m. - 3:10 p.m.	INVITED ADDRESS Linear algebra over $K[K_1,\ldots,X_n]$ 1890 to 1980 E. Graham Evans, Jr., North Meeting Room
	SPECIAL SESSION
2:30 p.m. - 5:55 p.m.	Operator Theory II Room 23
3:20 p.m. - 4:20 p.m.	INVITED ADDRESS Log-concave and unimodal sequences in algebra, combinatorics, and geometry Richard P. Stanley, North Meeting Room
4:30 p.m. - 5:30 p.m.	The Budgetary Outlook William G. Rosen, NSF, North Meeting Room
8:30 p.m. - 9:30 p.m.	GIBBS LECTURE The dynamics and evolution of some socio-technical systems Elliott W. Montroll, North Meeting Room

THURSDAY, January 14	AMS	
8:00 a.m. - 4:00 p.m.	REGISTRATION - NBEA	
8:00 a.m. - 4:00 p.m.	AMS BOOK SALE NBEA	MAA BOOK SALE NBEA
	SPECIAL SESSIONS	
8:00 a.m. - 10:50 a.m.	Algebraic Combinatorics II Room 24	
8:00 a.m. - 11:40 a.m.	Topics in Complex Analysis II Room 25	
8:00 a.m. - 11:10 a.m.	The Interaction Between Contemporary Pure Mathematics and Engineering at the Research Level I Room 23	
8:00 a.m. - 11:20 a.m.	Rings of Continuous Function II Room 3	
8:00 a.m. - 11:20 a.m.	Fixed Points, Nonexpansive Mappings and Related Topics I Room 26	

15–17 (Friday–Sunday). The Business Meeting of the MAA will take place at 10:00 a.m. on Sunday, January 17, at which the 1982 Award for Distinguished Service will be presented.

The MAA is planning two minicourses. Minicourse #1 on *Mathematical models in political science* is being organized by SOLOMON A. GARFUNKEL of the University of Connecticut and COMAP, and SANFORD L. SEGAL of the University of Rochester; and presented by STEVEN J. BRAMS, Professor of Politics, New York University, and PHILIP D. STRAFFIN, JR., Professor of Mathematics, Beloit College.

This course will introduce several types of combinatorial, game-theoretic, and axiomatic models which have proved important in moder political science. There will be four semi-independent lectures: Models of voting power (Straffin), More equilibrium concepts for non-zero sum games and their applications (Brams), Axiomatic analysis of voting systems (Straffin), and Mathematical properties of approval voting (Brams). Suggested readings are S. Brams, *Paradoxes in politics*, Free Press, 1976; S. Brams, *The presidential election game*, Yale University Press, 1978; and P. Straffin, *Topics in voting theory*, Birkhauser, Boston, 1980. All of these paperbacks and copies will be available at the meeting.

Minicourse #2 on *The use of computers to teach mathematics* is being presented by KLAUS E. ELDRIDGE and DONALD O. NORRIS both of Ohio University, Athens. This course will include a brief introduction to BASIC programming, and discussions of how computers can be used in a variety of courses. Microcomputers will be available for the use of the participants.

The minicourses are open only to persons who have registered for the Joint Mathematics Meetings and paid the registration fee. The minicourses have separate registration fees of $15 each, and each is limited to 30 participants. Since the minicourses run concurrently, it will not be possible to register for both.

For a more detailed listing of the activities of the MAA, see the Timetable.

The **Association for Women in Mathematics** (AWM) will sponsor a Centennial Symposium on *Emmy Noether: Historical context* at 11:15 a.m. on Thursday, January 14, to be immediately followed by the AWM Business Meeting. I. N. HERSTEIN will moderate the symposium; speakers are JEANNE LA DUKE and UTA MERZBACH. The third annual AWM Emmy Noether Lecture will be given at 10:00 a.m. on Friday, January 15. JULIA B. ROBINSON will speak on *Functional equations in arithmetic.*

The **Conference Board of the Mathematical Sciences** (CBMS) and the **Rocky Mountain Mathematics Consortium** (RMMC) will cosponsor a symposium on Mathematics in Natural Resources Management at 2:00 p.m. on Friday, January 15. The symposium has been organized and will be moderated by ROBERT W. MCKELVEY of the University of Montana. Speakers are YAKOV HAIMES of Case Western Research University; GORDON MUNRO of the University of British Columbia; MAUREEN CROPPER of the University of Maryland; and RALPH d'ARGE of the University of Wyoming.

The CBMS Council will meet from 9:00 a.m. to 4:00 p.m. on Saturday, January 16.

The **National Science Foundation** (NSF) will be represented at a booth in the exhibit area. NSF staff members will be available to provide counsel and information on NSF programs of interest to mathematicians from 9:00 a.m. to 5:00 p.m., Thursday through Saturday, January 14–16.

WILLIAM G. ROSEN, head of the Mathematical Sciences Section of NSF will speak on *The budgetary outlook* at 4:30 p.m. on Wednesday, January 13.

The Board of Directors of the **Rocky Mountain Mathematics Consortium** will meet at 2:00 p.m. on Thursday, January 14.

OTHER EVENTS OF INTEREST

Book Sales

Books published by the AMS and MAA will be sold for cash prices somewhat below the usual prices when these same books are sold by mail. These discounts will be available only to registered participants wearing the official meeting badge. VISA and MASTERCARD credit cards will be accepted for book sale purchases at the meeting. The book sales will be open the same days and hours as the Joint Mathematics Meetings registration desk, and are located in the North Bay Exhibit Area of the Convention Center.

Exhibits

The book and educational media exhibits are located in the North Bay Exhibit Area of the Convention Center, and will be open from Wednesday, January 13, through Saturday, January 16. The exhibits will be open from 1:00 p.m. to 5:00 p.m. on Wednesday; from 9:00 a.m. to 5:00 p.m. on Thursday and Friday; and from 9:00 a.m. to noon on Saturday. All participants are encouraged to visit the exhibits during the meeting.

Second-hand Book and Journal Exchange

At the Joint Books and Journals display in the exhibit area, notebooks will be available with lists of books on mathematics for sale or being sought. There will be separate notebooks of books for sale and books wanted, with names and addresses of the owners (or seekers). The details of the transactions themselves are to be arranged by the participants, and the AMS will not accept responsibility for settling disputes if arrangements go awry.

It is necessary to charge a small fee to cover the cost of preparing the notebooks. Each person participating is asked to pay $2 for the first page, and $1 for each additional page (one side is one page). Books for sale must be listed on separate pages from books wanted (as many of either per page as one wishes), and the lists made up on 8.5 inch by 11 inch pages.

TIMETABLE

All sessions are at the Convention Center, unless noted as follows:
ST - Stouffer's

THURSDAY, January 14	American Mathematical Society	Other Organizations
	SESSIONS FOR CONTRIBUTED PAPERS	
8:00 a.m. - 12:10 p.m.	Algebraic Geometry, Linear Algebra and Associative Rings Room 8	
8:00 a.m. - 11:25 a.m.	Operator Theory Room 13	
8:00 a.m. - 12:10 p.m.	Algebraic Topology, Manifolds and Global Analysis Room 1	
9:00 a.m. - 4:00 p.m.		Mathematical Association of America BOARD OF GOVERNORS MEETING Bronze Ballroom A, ST
9:00 a.m. - 5:00 p.m.	EXHIBITS - NBEA	
9:00 a.m. - 9:30 a.m.	EMPLOYMENT REGISTER ORIENTATION - Grand Ballroom, ST	
9:30 a.m. - 4:00 p.m.	EMPLOYMENT REGISTER REGISTRATION - Grand Ballroom, ST	
10:10 a.m. - 11:10 a.m.	INVITED ADDRESS Applications of the trace formula Robert P. Langlands, North Meeting Room	
11:15 a.m. - 12:15 p.m.		Association for Women in Mathematics A CENTENNIAL SYMPOSIUM Emmy Noether: Historical context Jeanne LaDuke I. N. Herstein (moderator) Uta Merzbach Room 23
11:20 a.m. - 12:20 p.m.	INVITED ADDRESS Variational problems with geometric constraints Luis A. Caffarelli, North Meeting Room	
12:15 p.m. - 12:55 p.m.		AWM - BUSINESS MEETING Room 23
1:00 p.m. - 2:00 p.m.	COLLOQUIUM LECTURES Lecture II: Geometry, iteration, and group theory Dennis Sullivan, North Meeting Room	
	SPECIAL SESSIONS	
2:10 p.m. - 4:10 p.m.	Algebraic Combinatorics III Room 24	
2:10 p.m. - 4:10 p.m.	Topics in Complex Analysis III Room 25	
2:10 p.m. - 4:10 p.m.	Rings of Continuous Function III Room 3	
2:10 p.m. - 4:35 p.m.	Fixed Points, Nonexpansive Mappings and Related Topics II Room 26	
2:10 p.m. - 4:10 p.m.	Multivariate Spline Functions and Piecewise Polynomial Approximation II Room 8	
	SESSIONS FOR CONTRIBUTED PAPERS	
2:10 p.m. - 3:50 p.m.	Algebraic Number Theory, Polynomials and Commutative Algebra Room 9	
2:10 p.m. - 4:25 p.m.	Classical and Quantum Mechanics Room 13	
2:10 p.m. - 3:35 p.m.	Mathematical Education Room 1	
2:00 p.m. - 4:00 p.m.		Rocky Mountain Mathematics Consortium BOARD OF DIRECTORS MEETING Room 10
	SESSION FOR CONTRIBUTED PAPERS	
3:45 p.m. - 4:25 p.m.	Tomography and the Radon Transform Room 1	
4:30 p.m. - 6:00 p.m.	PRIZE SESSION AND BUSINESS MEETING North Meeting Room	
6:15 p.m.		AWM - Open Party Cash Bar Ivory Rooms A and B, ST

Please include the information below:

Books Offered: Name, address, telephone, will or will not be at the meeting. Author, title, publisher, year of publication, condition of book (for example slightly used, annotated lightly or heavily, like new), price or books wanted in trade.

Books Wanted: Name, address, telephone, will or will not be at the meeting. Author, title, publisher, edition, price one is willing to pay.

Lists may be sent to the Promotion Department of the Society until January 6, 1982, or may be brought to the meeting. If brought to the meeting, two copies of each page should be supplied so that duplicate notebooks can be maintained.

Please send your lists to: Promotion Department, AMS, Post Office Box 6248, Providence, Rhode Island 02940. Make checks payable to the AMS. If you have any questions, call Phoebe Murdock, 401-272-9500, extension 237.

INFORMATION FOR PARTICIPANTS

Hotel Accommodations

The rates listed below are subject to a 10.1 percent city hotel tax if the hotel is in Cincinnati. Please note that this tax increased from 9 percent. If the hotel is in Kentucky, the tax is 7.625 percent. The number after the name of the hotel is the number it carries on the map. The estimated walking distance from the hotel to the Convention Center is given in parentheses following the telephone number. The Greater Cincinnati Convention and Visitors Bureau will provide free shuttle bus service to participants staying at the hotels in Kentucky.

In all cases "single" refers to one person in one bed; "double" refers to two persons in one bed; "twin" refers to two persons in two single beds; and "twin double" refers to two persons in two double beds. A rollaway cot for an extra person can be added to double or twin rooms only.

Stouffer's Cincinnati Towers (1)
Headquarters Hotel
141 West Sixth Street
Cincinnati, Ohio 45202
Telephone: 513-352-2100
(adjacent to Convention Center)

Singles $39	Doubles $49
Twins $49	Twin Doubles $49
Triples $55	Quads $61

Cincinnati Club (7)
30 West Garfield Place
Cincinnati, Ohio 45202
Telephone: 513-352-5400 (10 minutes)

Singles	$30, $31, $33, $34, $36, $41, $42
Doubles	$39, $40, $42, $43, $45, $50, $51
Twins	$39, $40, $42, $43, $45, $50, $51
Triples	$46, $47, $49, $50, $52, $57, $58
	$7 extra for cot

Holiday Inn Downtown (5)
800 West 8th Street, Cincinnati, Ohio 45203
Telephone: 513-241-8660 (20 minutes)

Singles	$37, $41, $43
Doubles $47	Twin Doubles $47
Triples $53	Quads $59

Holiday Inn Riverfront (6)
Third and Philadelphia, Covington, Kentucky 41011
Telephone: 606-291-4300

Singles	$36, $39, $42
Doubles	$45
Twin Doubles	$45
Triples	$51
Quads	$57

Quality Inn – Riverview (2)
666 Fifth Street, Covington, Kentucky
Telephone: 606-491-1200

Singles	$45
Doubles	$55
Twins	$55
Twin Doubles	$55
Triples	$60
Quads	$65

Terrace Hilton (3)
6 West Sixth Street, Cincinnati, Ohio 45201
Telephone: 513-381-4000 (5 minutes)

Singles	$45
Twins	$57
Twin Doubles	$57
Triples	$69

Westin Hotel (4)
Fountain Square, Cincinnati, Ohio 45202
Telephone: 513-621-7700 (5 minutes)

Singles	$55
Twin Doubles	$55
Triples	$70
Quads	$85

Registration at the Meetings

Meeting preregistration and registration fees only partially cover expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register, and should be prepared to show their meeting badge, if so requested. The fees for registration at the meeting are 30 percent more than the preregistration fees, and are listed below:

Joint Mathematics Meetings

Member of AMS, MAA	$48
Emeritus Member of AMS, MAA	$12
Nonmember	$74
Student/Unemployed	$12

Employment Register

Employer	$30
Applicant	No charge

AMS Short Course

Student/Unemployed	$10
All Other Participants	$30
One-day Fee (Second Day Only)	$15

MAA Minicourses

All Participants, #1 or #2	$15

Registration fees may be paid at the meetings in cash, by personal or travelers' checks, or by VISA or MASTERCARD credit cards. Canadian checks must be marked for payment in U.S. funds.

There is no extra charge for members of the families of registered participants, except that all professional mathematicians who wish to attend sessions must register independently.

TIMETABLE

All sessions are at the Convention Center, unless noted as follows:
ST - Stouffer's

THURSDAY, January 14	American Mathematical Society	Other Organizations
7:00 p.m. - 7:50 p.m.		MAA - SPECIAL SESSION Video tapes for review and supplementary instruction John B. Monroe Cynthia P. Yang North Meeting Room
7:00 p.m. - 9:00 p.m.		MAA - MINICOURSE Mathematical models in political science Room 14
7:00 p.m. - 9:00 p.m.		MAA - MINICOURSE The use of computers to teach mathematics Room 15
7:00 p.m. - 9:00 p.m.		MAA - SECTION OFFICERS MEETING Bronze Ballroom A, ST
7:00 p.m. - 10:00 p.m.	Committee on Employment and Educational Policy - PANEL DISCUSSION: Mathematics and applications Robert DeHoff Richard C. DiPrima Daniel J. Kleitman Charlotte Lin (moderator) Henry O. Pollak Joan Rosenblatt Kennan T. Smith Room 2	
8:00 p.m. - 9:30 p.m.		MAA - PANEL DISCUSSION: The CBMS Undergraduate Survey Results North Meeting Room Universities and four-year colleges Wendell H. Fleming Two-year institutions Donald J. Albers

FRIDAY, January 15	AMS	Other Organizations
8:00 a.m. - 4:00 p.m.	REGISTRATION - NBEA	
8:00 a.m. - 4:00 p.m.	AMS BOOK SALE NBEA	MAA BOOK SALE NBEA
9:00 a.m. - 5:00 p.m.	EXHIBITS - NBEA	
9:00 a.m. - 9:50 a.m.		MAA - INVITED ADDRESS Iterated maps of the interval John W. Milnor, North Meeting Room
9:00 a.m. - 10:50 a.m.		MAA - PANEL DISCUSSION: Articulation efforts between universities and schools Henry L. Alder (presider) Philip C. Curtis Joan P. Leitzel Franklin P. Wilbur Room 2
9:00 a.m.	EMPLOYMENT REGISTER DISTRIBUTION OF SCHEDULES - Grand Ballroom, ST	
9:30 a.m. - 5:30 p.m.	EMPLOYMENT REGISTER INTERVIEWS - Grand Ballroom, ST	
10:00 a.m. - 10:50 a.m.		MAA - PANEL DISCUSSION: NSF Research Institutes: Current status and expectations Richard D. Anderson (presider) Calvin C. Moore William G. Rosen Hans F. Weinberger North Meeting Room
10:00 a.m. - 11:00 a.m.		AWM - EMMY NOETHER LECTURE Functional equations in arithmetic Julia B. Robinson, Room 23
11:00 a.m. - 11:50 a.m.		MAA - RETIRING PRESIDENTIAL ADDRESS Mathematical expectations Dorothy L. Bernstein, North Meeting Room
1:00 p.m. - 2:00 p.m.	COLLOQUIUM LECTURES Lecture III: Geometry, iteration, and group theory Dennis Sullivan, North Meeting Room	

All **full-time** students currently working toward a degree or diploma qualify for the student registration fees, regardless of income.

The unemployed status refers to any person currently unemployed, actively seeking employment, and who is not a student. It is not intended to include persons who have voluntarily resigned or retired from their latest position.

Persons who qualify for emeritus membership in either the Society or the Association may register at the emeritus member rate.

Nonmembers who register at the meetings and pay the $74 nonmember registration fee are entitled to a discount of the difference between the member registration fee of $48 and the nonmember registration fee of $74 as a $26 credit against dues in either the AMS or MAA or both, provided they join before February 17, 1982.

Nonmember students who register at the meetings and pay the $12 registration fee are entitled to a discount of the difference between the student preregistration fee of $8 and the registration fee of $12 as a $4 credit against dues in either the AMS or MAA or both, provided they join before February 17, 1982.

Nonmembers and nonmember students who thus qualify may join at the meetings, or by mail afterwards up to the deadline.

Registration Dates and Times

AMS Short Course
Outside Room 3,
Cincinnati Convention & Exposition Center

Monday, January 11	11:00 a.m. to 4:00 p.m.
Tuesday, January 12	8:00 a.m. to 2:00 p.m.

Joint Mathematics Meetings
[and MAA Minicourses (until filled)]
North Bay Exhibit Area,
Cincinnati Convention & Exposition Center

Tuesday, January 12	4:00 p.m. to 8:00 p.m.
Wednesday, January 13	8:00 a.m. to 5:00 p.m.
Thursday, January 14, through Saturday, January 16	8:00 a.m. to 4:00 p.m.

Assistance and Information Desk
Outside the North Meeting Room,
Cincinnati Convention & Exposition Center

Sunday, January 17	8:30 a.m. to 1:30 p.m.

Please note that the Joint Mathematics Meetings registration desk **will not be open on Sunday, January 17**, and that the telephone message center will not be in operation. Other services provided during the meeting at the registration desk will also no longer be available (see section below on Registration Desk Services). There will, however, be a small desk set up outside the North Meeting Room, Cincinnati Convention & Exposition Center, where local information will be available and where a staff member will provide limited assistance to participants. No registration or cash transactions will be possible at this desk.

REGISTRATION DESK SERVICES

AMS/MAA Information

Information on the publications and activities of both organizations may be obtained at this section of the registration desk.

Assistance, Comments and Complaints

A log for registering participants' comments or complaints about the meeting is kept at the Transparencies Section of the registration desk. All participants are encouraged to use this method of helping to improve future meetings. Comments on all phases of the meeting are welcome. If a written reply is desired, participants should furnish their name and address.

Participants with problems of an immediate nature requiring action at the meeting should see the meeting manager, who will try to assist them.

Audio-Visual Aid

A member of the AMS/MAA staff will be available to advise or consult with speakers on their audio-visual requirements.

Baggage and Coat Check

Participants may leave baggage, parcels or coats in the Convention Center checkroom. A fee of 25 cents per article will be charged.

Check Cashing

The meeting cashier will cash personal or travelers' checks up to $50, upon presentation of the official meeting registration badge, and provided there is enough cash on hand. Canadian checks must be marked for payment in U.S. funds.

Local Information

This section of the desk will be staffed by members of the Local Arrangements Committee and other volunteers from the Cincinnati mathematical community.

Lost and Found

See the meeting cashier or check at the Security Office at the south end of the first floor lobby of the Convention Center.

Mail

All mail and telegrams for persons attending the meetings should be addressed to the participant, c/o Joint Mathematics Meetings, Greater Cincinnati Convention and Visitors Bureau, 200 West Fifth Street, Cincinnati, Ohio 45202. Mail and telegrams so addressed may be picked up at the mailbox in the registration area during the hours the registration desk is open. U.S. mail not picked up will be forwarded after the meeting to the mailing address given on the participant's registration record.

Personal Messages

Participants wishing to exchange messages during the meeting should use the mailbox mentioned above. Message pads and pencils are provided. It is regretted

TIMETABLE

All sessions are at the Convention Center, unless noted as follows:
ST - Stouffer's

FRIDAY, January 15	American Mathematical Society	Other Organizations
	SPECIAL SESSIONS	
1:00 p.m. - 3:20 p.m.	The Interaction Between Contemporary Pure Mathematics and Engineering at the Research Level II Room 23	
1:00 p.m. - 3:50 p.m.	Algebraic Topology I Room 3	
1:00 p.m. - 5:50 p.m.	Ordered Algebraic Structures I Room 24	
1:00 p.m. - 5:00 p.m.	Topics in Scattering and Spectral Theory I Room 26	
1:00 p.m. - 4:20 p.m.	Quadratic Forms I Room 8	
	SESSIONS FOR CONTRIBUTED PAPERS	
1:00 p.m. - 6:25 p.m.	Foundations, Set Theory and Combinatorics I Room 10	
1:00 p.m. - 6:25 p.m.	Category Theory, Group Theory, Lie Groups Room 9	
1:00 p.m. - 5:55 p.m.	Finite Differences, Summability and Harmonic Analysis Room 1	
1:00 p.m. - 6:10 p.m.	Functional Analysis and Operator Theory Room 25	
2:00 p.m. - 5:00 p.m.		Conference Board of the Mathematical Sciences/Rocky Mountain Mathematics Consortium - SYMPOSIUM on mathematics in natural resources management Maureen Cropper Ralph d'Arge Yakov Haimes Robert W. McKelvey (moderator) Gordon Munro Room 2
2:10 p.m. - 3:10 p.m.	INVITED ADDRESS C*-algebraic structure and noncommutative geometry Edward George Effros, North Meeting Room	
3:20 p.m. - 4:20 p.m.	INVITED ADDRESS What is a quantum field theory? David C. Brydges, North Meeting Room	
4:30 p.m. - 6:00 p.m.	Committee on Employment and Educational Policy Meeting of Department Heads Room 23	
5:30 p.m.	NO-HOST COCKTAIL PARTY Bronze Ballroom A, ST	
7:00 p.m. - 8:00 p.m.		MAA - OPEN MEETING Secondary school lectureship programs Room 5
7:00 p.m. - 9:00 p.m.		MAA - MINICOURSE Mathematical models in political science Room 14
7:00 p.m. - 9:00 p.m.		MAA - MINICOURSE The use of computers to teach mathematics Room 15

SATURDAY, January 16	AMS	Other Organizations
8:00 a.m. - 4:00 p.m.	REGISTRATION - NBEA	
8:00 a.m. - 4:00 p.m.	AMS BOOK SALE NBEA	MAA BOOK SALE NBEA
9:00 a.m. - noon	EXHIBITS - NBEA	
9:00 a.m.	EMPLOYMENT REGISTER DISTRIBUTION OF SCHEDULES - Grand Ballroom, ST	
9:00 a.m. - 9:50 a.m.		MAA - INVITED ADDRESS What do I know? Current states of one's knowledge in the mathematical field Philip J. Davis, North Meeting Room
9:00 a.m. - 9:50 a.m.		MAA - INVITED ADDRESS Luzitania: The birth of Soviet topology Douglas E. Cameron, Room 2

that such messages left in the box cannot be forwarded to participants after the meeting is over.

Telephone Messages

A telephone message center is located in the registration area to receive incoming calls for participants. The center is open from January 12 through 16 only, during the same hours as the Joint Mathematics Meetings registration desk. Messages will be taken and the name of any individual for whom a message has been received will be posted until the message has been picked up at the message center. The telephone number of the message center is 513-721-6227.

Transparencies

Speakers wishing to prepare transparencies in advance of their talk will find the necessary materials and copying machines at this section of the registration desk. A member of the staff will assist and advise speakers on the best procedures and methods for preparation of their material. There is a modest charge for these materials. Please note that this service will **not** be available on Sunday, January 17.

Visual Index

An alphabetical list of registered participants, including local addresses and arrival and departure dates, is maintained in the registration area.

MISCELLANEOUS INFORMATION

Child Care

Arrangements for child care in hotel rooms may be made by calling Family Care, Inc., Rock-a-bye Sitters Registry, at 513-721-7440 from 9:00 a.m. to 5:00 p.m., Monday through Friday. Contacts should be made prior to evenings or the weekend for service at those times. At the Stouffer's Cincinnati Towers, arrangements for child care can be made by calling the hotel's Hospitality Center at 513-352-2134.

Local Information

The Cincinnati Art Museum features permanent collections that encompass almost every major civilization over the last 5,000 years. The Cincinnati Zoo features more than 600 species in open natural exhibits. Other points of interest include the Taft Museum, the Krohn Conservatory, the Planetarium and Natural History Museum.

The Cincinnati Symphony and the Cincinnati Ballet will be performing during the meeting period.

The Avon Women's Championship Tennis tournament will be at the Riverfront Coliseum (C on the Map) in Cincinnati while the mathematics meetings are taking place. The promotors of the tournament (which is sponsored by the Junior League) have agreed to make available to participants a limited number of discount coupons worth $2.50 against the regular prices of tickets for the Friday, January 15, evening matches. These matches are the quarter-final round, and will begin at 6:00 p.m. Regular ticket prices are $10, $7.50, and $5. Children 12 years of age and under are charged $1.50 less. Players such as Martina Navratilova, Tracy Austin, and Chris Evert Lloyd have participated in previous Avon tournaments held in Cincinnati. Interested parties should inquire at the Local Information section of the meeting registration desk.

Taxis presently cost $1.45 for the first mile and 70 cents each additional mile. Queen City Metro operates buses throughout the area. Fares range from 15 cents to 50 cents depending upon distance traveled.

Parking

Throughout the downtown area there are numerous inexpensive parking garages operated by the city or the department stores. Additional long-term parking is available at the Riverfront Stadium lot.

Social Events

The Local Arrangements Committee has arranged a no-host, cash-bar social at 5:30 p.m. on Friday, January 15. This event will take place at Stouffer's Cincinnati Towers.

Travel

In January, Cincinnati is on Eastern Standard Time. There is regular airline service to the Greater Cincinnati International Airport by several major airline carriers.

The airport in Cincinnati is 13 miles from the city center, and the trip takes about 20 minutes. The present cost of the limousine is $5.50 one way, and $9 round-trip. Taxis presently cost about $13.50 for one to five passengers. All major car rental agencies have desks at the airport.

River Road Station is served by Amtrak with daily trains east to Washington, DC, and northwest to Chicago.

Cincinnati can be reached via I-75 from Tampa, Atlanta, and Knoxville; via I-74 from Indianapolis; and via I-71 from Louisville.

Weather

The mean daily maximum and minimum temperature for January are respectively 40°F and 22°F. The evening temperature is below freezing most days in January.

Frank T. Birtel
New Orleans, Louisiana — Associate Secretary

Important information on the Employment Register immediately follows.

TIMETABLE

All sessions are at the Convention Center, unless noted as follows:
ST - Stouffer's

SATURDAY, January 16	American Mathematical Society	Other Organizations
9:00 a.m. - 4:00 p.m.		CBMS - COUNCIL MEETING Ivory Rooms A and B, ST
9:30 a.m. - 5:30 p.m.	EMPLOYMENT REGISTER INTERVIEWS - Grand Ballroom, ST	
10:00 a.m. - 10:50 a.m.		MAA - INVITED ADDRESS Answers needed yesterday: Computing in an industrial research setting Phyllis A. Fox, North Meeting Room
10:00 a.m. - 10:50 a.m.		MAA - INVITED ADDRESS How computer animation changes my views of teaching and research Thomas F. Banchoff, Room 2
11:00 a.m. - 11:50 a.m.		MAA - INVITED ADDRESS A tale of Lanczos: Large and inexact matrix computations Jane K. Cullum, North Meeting Room
11:00 a.m. - 11:50 a.m.		MAA - INVITED ADDRESS Historical notes on the calculus V. Frederick Rickey, Room 2
1:00 p.m. - 2:00 p.m.	COLLOQUIUM LECTURES Lecture IV: Geometry, iteration, and group theory Dennis Sullivan, North Meeting Room	
	SPECIAL SESSIONS	
1:00 p.m. - 3:50 p.m.	Algebraic Topology II Room 3	
1:00 p.m. - 5:50 p.m.	Topics in Scattering and Spectral Theory II Room 26	
1:00 p.m. - 4:20 p.m.	Quadratic forms II Room 8	
1:00 p.m. - 5:50 p.m.	Ordered Algebraic Structures II Room 24	
	SESSIONS FOR CONTRIBUTED PAPERS	
1:00 p.m. - 5:55 p.m.	Foundations, Set Theory, and Combinatorics II Room 10	
1:00 p.m. - 6:10 p.m.	Measures and Complex Variables Room 25	
1:00 p.m. - 5:10 p.m.	Probability, Statistics, Numerical Analysis and Computer Science Room 9	
7:00 p.m. - 10:00 p.m.		MAA - SPECIAL SESSION Computers in the undergraduate mathematics curriculum: Experiments, project reports, and the National Consortium on Uses of Computers in Mathematical Sciences Education Ronald H. Wenger (presider) North Meeting Room Computer-based calculus and simulation models for the study of sustained harvest policies John G. Bergman Intelligent CAI in pre-calculus mathematics Eugene H. Herman Integrating computing into the mathematics curriculum: A report on the St. Olaf College CAUSE program Lynn A. Steen and J. Arthur Seebach
SUNDAY, January 17		Mathematical Association of America
8:30 a.m. - 1:30 p.m.	ASSISTANCE AND INFORMATION DESK - Outside North Meeting Room	
9:00 a.m. - 9:50 a.m.		INVITED ADDRESS Recent solutions of problems posed by J. E. Littlewood and N. N. Lusin O. Carruth McGehee, North Meeting Room
9:00 a.m. - 9:50 a.m.		INVITED ADDRESS Putting calculus in its place—a new curriculum for the first two years of college mathematics Anthony Ralston, Room 2

MATHEMATICAL SCIENCES EMPLOYMENT REGISTER

January Meeting in Cincinnati

The Mathematical Sciences Employment Register, held annually at the Joint Mathematics Meetings in January, provides opportunities for mathematical scientists seeking professional employment to meet employers who have positions to be filled. Job listings (or descriptions) and résumés prepared by employers and applicants are displayed for the participants so that members of each group may determine which members of the other group they would like to have an opportunity to interview. A computer program assigns the appointments, matching requests to the extent possible using an algorithm which maximizes the number of interviews which can be scheduled subject to constraints determined by the number of time periods available, the numbers of applicants and employers, and the pattern of requests. The report below outlines the operation of the register, indicating some of the procedures involved for the benefit of those not familiar with its operation.

The Mathematical Sciences Employment Register is apparently unique among employment services offered by professional organizations in the sciences, engineering and the humanities. The computer programs used are constructed around a matching program, devised by Donald R. Morrison and based on an algorithm described in his paper "Matching Algorithms" in *Journal of Combinatorial Theory*, volume 6, pages 20 to 32, 1969; see also "Matching Algorithms" (abstract) *Notices*, August 1967, page 630. The number of interviews arranged by the program is significantly greater than the number possible at the employment registers of other organizations, in many cases greater by an order of magnitude.

1982 Employment Register in Cincinnati

The Employment Register at the Cincinnati meeting will take place in the Grand Ballroom of Stouffer's Cincinnati Towers on Thursday, Friday, and Saturday, January 14, 15, and 16, 1982. A short (optional) orientation session will be conducted by the AMS-MAA-SIAM Committee on Employment Opportunities at 9:00 a.m. on Thursday, January 14. Interviews between applicants and employers will be scheduled for Friday and Saturday, January 15 and 16. The purpose of the orientation session is to familiarize participants with the operation of the Register and with the various forms involved.

Fifteen-minute intervals are allowed for interviews, including two or three minutes between successive interviews. The interviews are scheduled in half-day sessions: Friday morning and afternoon, and Saturday morning and afternoon, amounting to four half-day sessions for interviews. There are ten periods in which interviews can be scheduled in the morning sessions and fourteen periods in the afternoon sessions. It is possible that an applicant or employer may be scheduled for the maximum number of interviews in a session, but the interview scheduling program can accomodate only six requests per session for each participant. The scheduling program does not have a provision allowing participants to specify particular times for interviews beyond the choice of session (day, and morning or afternoon). No interviews will be scheduled for the first of the three days, Thursday, January 14.

Requests for interviews to take place during the two sessions on Friday should be submitted on Thursday between 9:30 a.m. and 4:00 p.m.; requests for interviews to take place during the Saturday sessions should be submitted on Friday before 4:00 p.m.

On Friday and Saturday mornings at 9 a.m. all schedules for applicants and employers for the day (both the morning and afternoon sessions) will be available for distribution in the Grand Ballroom of Stouffer's Cincinnati Towers.

The Saturday afternoon session is the annual "employers' choice" session. For this session interviews will be scheduled on the basis of requests made by employers. Applicants do not submit specific interview requests for this session; but, in order to participate they must indicate their availability for the session by filing the Interview Request Form for Saturday, indicating that they will attend the afternoon session that day. Request Forms for the "employers' choice" session must be submitted by 4:00 p.m. on Friday in order for the interviews to be scheduled for Saturday afternoon.

Applicants should be aware of the fact that interviews arranged by the Employment Register represent only an initial contact with employers, and that hiring decisions are not ordinarily made during or immediately following such interviews. Applicants are advised to bring a number of copies of their vitae or résumés so that they may leave them with prospective employers.

All participants in the Employment Register are required to register for the Joint Mathematics Meetings. For applicants there is no additional fee for participation in the Employment Register.

For employers, additional fees for participation in the Employment Register are $20, if paid before the December 15 deadline for Joint Meeting preregistration, or $30 if paid at the meeting.

Employers who wish to participate in the Register and who have neither preregistered nor paid the Employment Register fee must go to the Joint Mathematics Meetings registration desk in order to complete their registration. (No provision will be made this year to handle cash transactions at the site of the Employment Register.)

Employers who have completed registration for the Employment Register, and applicants who have preregistered, may pick up their MSER material after 9:30 a.m. on Thursday, January 14, in the Grand Ballroom of Stouffer's Continental Towers where the Employment Register will be held. All who wish to have interviews scheduled for Friday or Saturday, must submit their Interview Request Forms on the preceding

TIMETABLE

All sessions are at the Convention Center.

SUNDAY, January 17		Mathematical Association of America
10:00 a.m. - 10:50 a.m.		BUSINESS MEETING North Meeting Room
11:00 a.m. - 11:50 a.m.		INVITED ADDRESS Noncomputability in models of physical phenomena: Computable differential equations with no computable solution Marian B. Pour-El, North Meeting Room
11:00 a.m. - 11:50 a.m.		INVITED ADDRESS Mathematics service courses can be fun—for students and for you! Ronald M. Davis, Room 2
1:00 p.m. - 3:50 p.m.		SESSION - Dedicated to the mathematics of Martin Gardner Doris W. Schattschneider (presider) North Meeting Room
1:00 p.m.		The game of dots and boxes Elwyn R. Berlekamp
2:00 p.m.		Algebraic theory of Penrose's nonperiodic tilings of the plane N. G. deBruijn
3:00 p.m.		My life among the polyominoes David A. Klarner

day by 4:00 p.m.; those who fail to do so cannot be included in the pool of available participants when the matching program which schedules the interviews is run on the computer that night.

The MSER registration fee for employers covers the cost of a copy of the Special December Issue of *Employment Information in the Mathematical Sciences*. This publication will contain printed copies of the résumés of applicants who preregistered prior to the printer's deadline for the issue; it will also contain a copy of the summary Winter List of Applicants. The résumés themselves will be posted at the site of the Register. Additional copies of both the Special December Issue of EIMS and the summary Winter Lists of Applicants and Employers will be available for sale at the AMS Book Sale at the meeting, as long as supplies last. Prices at the meeting are $2 each for the summary lists and $3 for the December issue. Any copies remaining after the meeting will be available from the Providence office of the Society for $3 and $6, respectively. (Attention is called to the fact that the December issue of EIMS will contain the Winter List of Applicants. It will not contain the Winter List of Employers.)

The Winter List of Employers consists of summaries of the position listings submitted by the employers who preregistered for the meeting; it will be distributed without charge to the applicants participating in the Register. Others may purchase the Winter List of Employers at the AMS Book Sale at the meeting or from the Providence office later, as long as the supplies last. (See previous paragraph for prices.)

The Mathematical Sciences Employment Register is sponsored by the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics; it is operated by members of the AMS staff under the general supervision of the joint AMS-MAA-SIAM Committee on Employment Opportunities.

THREE PAPERS ON DYNAMICAL SYSTEMS

by *A. G. Kušnirenko, A. B. Katok,* and *V. M. Alekseev*

The literature on smooth dynamical systems is substantial. In selecting material for their lectures the authors have set themselves a twofold aim. On the one hand they have tended to give a more or less connected account of a number of contemporary results associated with general problems of the classification of dynamical systems, by describing "rough" and "typical" properties, etc. On the other hand they wish to emphasize that the general constructions arising here are connected with ideas going back to the classics, and they permit one to obtain new information on qualitative properties of some long known problems.

A. G. Kušnirenko, *Problems in the general theory of dynamical systems on a manifold*

A. B. Katok, *Dynamical systems with hyperbolic structure*

V. M. Alekseev, *Quasirandom oscillations and qualitative questions in celestial mechanics*

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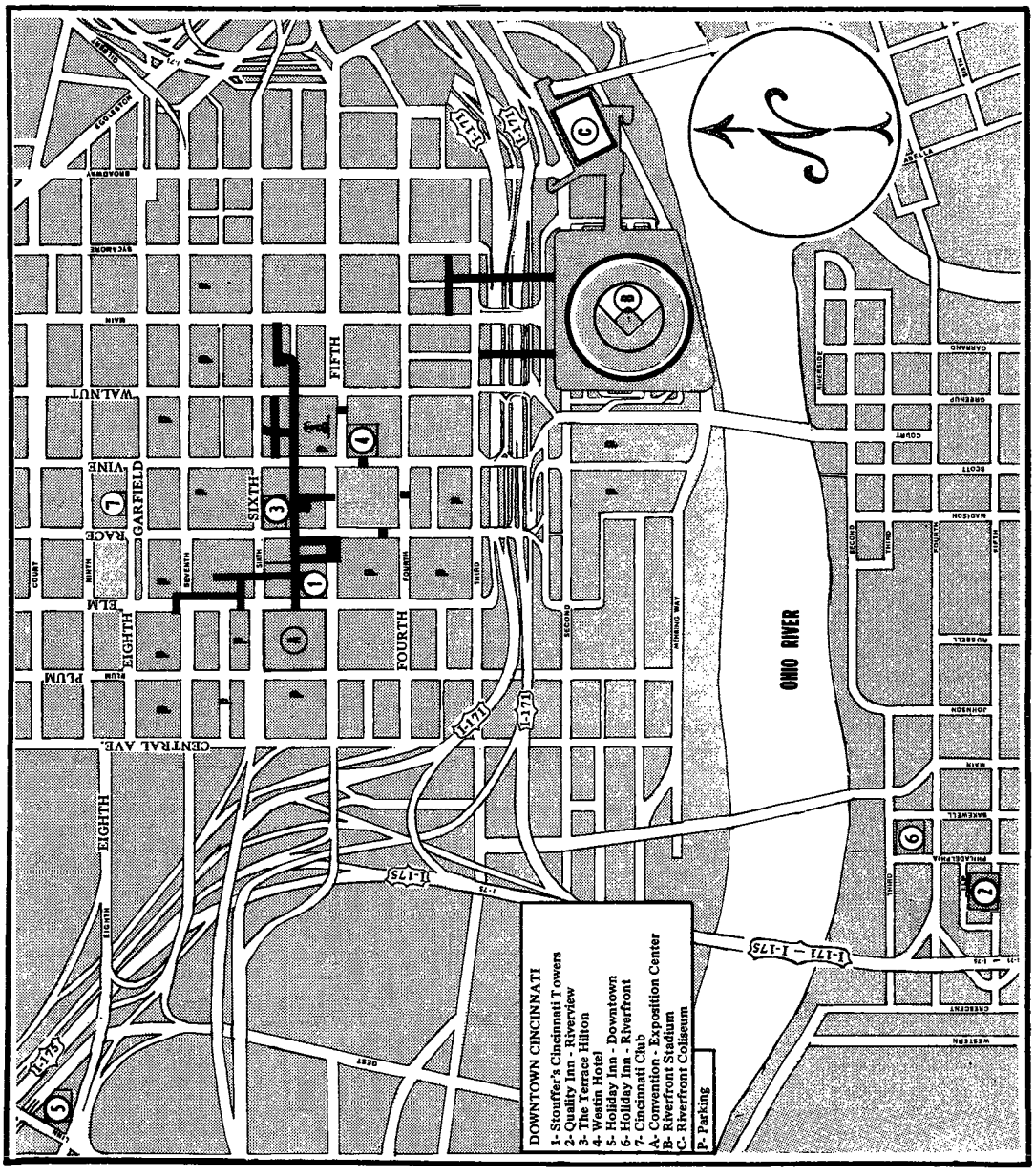

Please note that the heavy black lines represent the "SKYWALK", a system of covered walkways one floor above city traffic, connecting some of the hotels with the Cincinnati Convention & Exposition Center, area theaters, and restaurants.

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PROGRAM OF THE SESSIONS

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

Abstracts for papers presented in AMS sessions at this meeting will be found in the January 1982 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.

WEDNESDAY, 7:50 A. M.

Special Session on Summability and Related Topics, Convention Center, Room 8

7:50– 8:10 (1) *The generalized Hausdorff moment problem.* Professor DAVID BORWEIN*, University of Western Ontario, and Professor AMNON JAKIMOVSKI, Tel-Aviv University, Israel (792-40-41)

8:15– 8:35 (2) *A Tauberian theorem for Hausdorff methods and its converse.* Professor BRIAN KUTTNER, University of Birmingham, England, and Professor MANGALAM R. PARAMESWARAN*, University of Manitoba (792-40-2) (Introduced by Professor Henry C. Finlayson)

8:40– 9:00 (3) *The Banach algebra of conservative triangular matrices.* Preliminary report. Dr. J. DeFRANZA*, Youngstown State University, and Dr. D. FLEMING, St. Lawrence University (792-40-11)

9:05– 9:25 (4) *Diagonally dominant matrices in summability theory.* Preliminary report. Professor J. A. FRIDY, Kent State University (792-40-101)

9:30– 9:50 (5) *Best approximation of alternating power series.* Professor B. L. R. SHAWYER, University of Western Ontario (792-41-8) (Introduced by Professor B. E. Rhoades)

9:55–10:15 (6) *The fine spectra for weighted mean operators.* Professor B. E. RHOADES, Indiana University, Bloomington (792-40-21)

10:20–10:40 (7) *New multiplier methods for convergence of eigenfunction expansions.* Dr. HARVEY DIAMOND, West Virginia University, Dr. MARK A. KON*, Boston University, and LOUISE A. RAPHAEL, Howard University (792-40-419)

10:45–11:05 (8) *The Stieltjes kernel and summing Sturm-Liouville expansions.* Preliminary report. Professor LOUISE A. RAPHAEL, Howard University (792-40-6)

11:10–11:30 (9) *An extension of Wiener's lemma to Banach algebra valued functions.* Professor F. PETER CASS*, University of Western Ontario, and Professor ROLF TRAUTNER, University of Ulm, West Germany (792-41-13) (Introduced by Professor B. E. RHOADES)

11:35–11:55 (10) *The application of spline functions to Riesz means.* Preliminary report. Professor AMNON JAKIMOVSKI, Tel-Aviv University, Israel, and Professor DENNIS C. RUSSELL*, York University (792-40-19)

12:00–12:20 (11) *Absolutely divergent series and classes of Banach spaces.* Professor WILLIAM H. RUCKLE, Clemson University (792-46-212)

WEDNESDAY, 8:00 A. M.

Special Session on Algebraic Combinatorics. I, Convention Center, Room 24

8:00– 8:20 (12) *Iterations of additive number theory and statistical mechanics.* Preliminary report. Professor GEORGE E. ANDREWS, Pennsylvania State University, University Park (792-05-51)

8:30– 8:50 (13) *Non-commutative graded algebras and their Hilbert series.* Dr. DAVID J. ANICK, University of California, Berkeley (792-16-361)

9:00– 9:20 (14) *Lexicographic straightening algorithms.* Professor KENNETH BACLAWSKI, Haverford College (792-05-365)

9:30– 9:50 (15) *Acyclic digraphs, Young tableaux and nilpotent matrices.* EMDEN R. GANSNER, Bell Laboratories, Murray Hill (792-05-360)

10:00–10:20 (16) *Group actions on Stanley-Reisner rings and the construction of invariants.* ADRIANO M. GARSIA*, University of California, San Diego, and DENNIS STANTON, University of Minnesota, Minneapolis (792-05-524)

10:30–10:50 (17) *Congruences for exponential generating functions.* Preliminary report. Professor IRA M. GESSEL, Massachusetts Institute of Technology (792-05-256)

11:00–11:20 (18) *On the Möbius function of the lattice of partitions ordered by majorization.* Professor CURTIS GREENE, Haverford College (792-05-482)

WEDNESDAY, 8:00 A. M.

Special Session on Commutative Ring Theory, Convention Center, Room 25

8:00– 8:20 (19) *On rings of invariants with rational singularities.* Dr. BARBARA R. PESKIN, University of Illinois, Urbana-Champaign (792-14-170)

8:30– 8:50 (20) *Deformation theory of codimension* 4 *Gorenstein varieties.* ANDREW R. KUSTIN*, University of Kansas, and MATTHEW MILLER, University of Tennessee, Knoxville (792-13-85)

9:00– 9:20 (21) *Cohen-Macaulay local rings of embedding dimension* $e + d - 2$. Professor JUDITH D. SALLY, Harvard University (792-13-368)

9:30– 9:50 (22) *Finite generation of symbolic blow-ups.* Preliminary report. Dr. CRAIG HUNEKE, University of Illinois, Urbana-Champaign (792-13-382)

10:00–10:20 (23) *Koszul homology and blowing-up rings.* Professor WOLMER V. VASCONCELOS, Rutgers University, New Brunswick (792-13-106)

10:30–10:50 (24) *Intersection multiplicities of modules.* Preliminary report. SANKAR P. DUTTA, University of Pennsylvania (792-13-129)

11:00–11:20 (25) *Schur complexes and natural free resolutions.* Preliminary report. Dr. KAAN U. AKIN, Massachusetts Institute of Technology (792-13-418)

WEDNESDAY, 8:00 A. M.

Special Session on Dynamical Systems. I, Convention Center, Room 26

8:00– 8:20 (26) *Dynamical invariants of random maps.* Preliminary report. MICHAEL G. BRANTON, University of North Carolina, Chapel Hill (792-60-367)

8:30– 8:50 (27) *A family of counter-examples in ergodic theory.* Professor ANDRÉS DEL JUNCO, Ohio State University, Columbus (792-28-31)

9:00– 9:20 (28) *Continuous ergodic skew product actions of amenable groups.* Preliminary report. MAHESH G. NERURKAR, University of Minnesota, Minneapolis (792-58-180) (Introduced by Professor Harvey B. Keynes)

9:30– 9:50 (29) *Stable and unstable sets for flows.* Preliminary report. Professor H. B. KEYNES, University of Minnesota, Minneapolis, and Professor M. SEARS*, University of the Witwatersrand, South Africa (792-54-257)

10:00–10:20 (30) *Two theorems on the nonwandering set and homoclinic points of maps of the circle.* Preliminary report. LOUIS BLOCK*, University of Florida, Gainesville, ETHAN M. COVEN and IRENE MULVEY, Wesleyan University, and ZBIGNIEW NITECKI, Tufts University (792-54-251)

10:30–10:50 (31) *Simple arcs between Morse-Smale diffeomorphisms of surfaces.* PAUL BLANCHARD, Boston University (792-58-434)

11:00–11:20 (32) *On distal flows of finite codimension.* Preliminary report. Dr. ED IHRIG and Dr. DOUG McMAHON*, Arizona State University (792-54-87)

11:30–11:50 (33) *Hyperbolic billiards and continued fractions.* Preliminary report. R. MOECKEL, University of Minnesota, Minneapolis (792-34-79)

12:00–12:20 Problem Session

WEDNESDAY, 8:00 A. M.

Session on Ordered Algebraic Structures and Number Theory, Convention Center, Room 13

8:00– 8:10 (34) *The least fixed point property for* ω*-chain continuous functions.* JOE D. MASHBURN, University of Dayton (792-06-258)

8:15– 8:25 (35) *A fixed point theorem for partially ordered sets with infinite cutsets.* Professor HARTMUT F. W. HÖFT*, University of Michigan, Dearborn (792-06-311)

8:30– 8:40 (36) *The closed socle of an order.* Professor F. R. DEMEYER, Colorado State University, and Dr. C. B. NIKOLOPOULOS*, Louisiana State University, Baton Rouge (792-06-467)

8:45– 8:55 (37) *Centers of nilpotent l-groups.* Professor HERBERT A. HOLLISTER, Bowling Green State University (792-06-475)

9:00– 9:10 (38) *Algebraic envelopes of abelian lattice-ordered groups.* Preliminary report. A. W. HAGER and J. J. MADDEN*, Wesleyan University (792-06-321)

9:15– 9:25 (39) *Primitive newforms of weight* 3/2. Professor THOMAS R. SHEMANSKE, Dartmouth College (792-10-185)

9:30– 9:40 (40) *On the generalized Euclidean algorithm in the ring of integral matrices.* Professor JAU-SHYONG SHIUE, Southern Illinois University, Carbondale (792-10-268)

9:45– 9:55 (41) *Some remarks on the number of solutions to* $f(X_1) + \cdots + f(X_n) = 0$. Preliminary report. Dr. DAVID R. RICHMAN, University of Illinois, Urbana-Champaign (792-10-325)

10:00–10:10 (42) *An elliptic analogue to the Gelfond-Feldman measure of algebraic independence.* Dr. ROBERT E. TUBBS, Pitzer College (792-10-326)

10:15–10:25 (43) *On a generalization of Fibonacci-Lucas sequences via difference equation.* Preliminary report. Professor SADANAND VERMA, University of Nevada, Las Vegas (792-10-374) (Introduced by Professor L. J. Simonoff)

10:30–10:40 (44) *Hypocycloids and continued fractions.* Professor NORMAN RICHERT, Marquette University (792-10-406)

10:45–10:55 (45) *On the 1st homology with compact supports of Weierstrass Family.* GORO C. KATO, California Polytechnic State University (792-10-465)

11:00–11:10 (46) *Hamiltonian path graphs.* Dr. G. CHARTRAND* and Dr. S. F. KAPOOR, Western Michigan University, and Dr. E. A. NORDHAUS, Michigan State University, East Lansing (792-05-390)

11:15–11:25 (47) *Arrays of strength and balance.* Professor JUDITH Q. LONGYEAR, Wayne State University (792-05-192)

11:30–11:40 (48) *Extremal results for paths in bipartite graphs.* Preliminary report. Professor A. GYÁRFÁS, Hungarian Academy of Science, Professor C. C. ROUSSEAU and Professor R. H. SCHELP*, Memphis State University (792-05-495)

11:45–11:55 (49) *On a class of degenerated extremal graph problems.* Professor RALPH J. FAUDREE*, Memphis State University, and Professor MIKLÓS SIMONOVITS, Eötvös Loránd University, Budapest, Hungary (792-05-520)

WEDNESDAY, 8:00 A. M.

Session on Special Functions, Ordinary Differential Equations and Control Theory, Convention Center, Room 10

8:00– 8:10 (50) *A unification of the Bell functions.* Preliminary report. Dr. GLORIA OLIVE, University of Otago, Dunedin, New Zealand (792-33-32)

8:15– 8:25 (51) *Some q-analogues of the* ${}_2F_1$ transformations. Preliminary report. Dr. DANIEL S. MOAK, Michigan Technological University (792-33-312)

8:30– 8:40 (52) *Chopped orthogonal polynomial expansions—some discrete cases.* Preliminary report. MARCI PERLSTADT, Georgia Institute of Technology (792-33-500)

8:45– 8:55 (53) *Existence and uniqueness of solutions of k-point boundary value problems for ordinary differential equations.* JOHNNY HENDERSON*, University of Missouri, Rolla, and Professor LLOYD JACKSON, University of Nebraska, Lincoln (792-34-10)

9:00– 9:10 (54) *On competing populations, predation and stable equilibrium.* Dr. ANNE HUGHES, St. John's University, Jamaica, New York (792-34-86)

9:15– 9:25 (55) *An invariance principle for functional differential equations.* Preliminary report. JOHN R. HADDOCK*, Memphis State University, and J. TERJÉKI, Bolyai Institute, Hungary (792-34-166)

9:30– 9:40 (56) *On the structure of magnetohydrodynamic shock waves.* Preliminary Report. MAHMUD HESAARAKI, University of Michigan, Ann Arbor (792-34-183)

9:45– 9:55 (57) *Two point connection problem for a certain nth order differential equation in the vicinity of an irregular singular point of arbitrary rank.* Professor T. K. PUTTASWAMY, Ball State University (792-34-190)

10:00–10:10 (58) *Multiparameter bifurcation problems for second order ordinary differential equations.* Dr. ROBERT S. CANTRELL, Southwest Texas State University (792-34-197)

10:15–10:25 (59) *Perturbations of the periodic boundary conditions.* Dr. LAWRENCE TURYN, University of Calgary (792-34-255)

10:30–10:40 (60) *Periodic solutions in abstract cones.* Professor V. LAKSHMIKANTHAM, University of Texas, Arlington, and Professor A. S. VATSALA*, Bishop College, Dallas (792-34-275)

10:45–10:55 (61) *Perturbations of $x^{(n)} = 0$ under milder integral smallness conditions.* Professor WILLIAM F. TRENCH, Drexel University (792-34-276)

11:00–11:10 (62) *Sublinear perturbations of the differential equation $y^{(n)} = 0$ and of the analogous difference equation.* ATTILA MÁTÉ*, Brooklyn College, and PAUL G. NEVAI, Ohio State University, Columbus (792-34-330)

11:15–11:25 (63) *The determining set in the infinite horizon problem of optimal control.* Preliminary report. Dr. LYNNELL E. STERN, Simmons College (792-49-358)

11:30–11:40 (64) *Inverse systems and reducibility of optimal control systems.* Preliminary report. Dr. JOHN JONES, Jr.*, and Lt. CHARLES LEW, Air Force Institute of Technology, Dayton (792-49-400)

11:45–11:55 (65) *On control systems with exponentially-decreasing performance index.* Preliminary report. Professor EMILIO O. ROXIN, University of Rhode Island (792-49-410)

WEDNESDAY, 8:00 A. M.

Session on Geometry, Convex Sets, and Differential Geometry, Convention Center, Room 9

8:00– 8:10 (66) *The structure of an N-dimensional permutahedron.* Professor GERALD R. CHACHERE, Howard University (792-52-457)

8:15– 8:25 (67) *Focus and directrix theory of conic sections in l^p.* RICHARD LAATSCH, Miami University, Oxford (792-51-168) (Introduced by Mark A. Smith)

8:30– 8:40 (68) *Dirichlet tessellations.* Dr. PETER F. ASH*, Wheaton College, Massachusetts, and Dr. ETHAN D. BOLKER, University of Massachusetts, Boston (792-51-235) (Introduced by Professor J. Marshall Ash)

8:45– 8:55 (69) *Packing convex bodies in the plane with density greater than* 3/4. Professor WLODZIMIERZ KUPERBERG, Auburn University, Auburn (792-52-140)

9:00– 9:10 (70) *The numbers of faces of polytope pairs and unbounded polyhedra.* Dr. CARL W. LEE, University of Kentucky (792-52-289)

9:15– 9:25 (71) *Creative blocking.* Professor BRUCE REZNICK, University of Illinois, Urbana-Champaign (792-52-334)

9:30– 9:40 (72) *Riemannian foliations with parallel curvature.* Professor ROBERT A. BLUMENTHAL, St. Louis University (792-53-42)

9:45– 9:55 (73) *Lorentzian distance and manifold topology.* Professor JOHN BEEM and Professor PAUL EHRLICH*, University of Missouri, Columbia (792-53-56)

10:00–10:10 (74) *Some surfaces with pointwise planar normal sections.* Preliminary report. C. S. HOUH* and G. Q. WANG, Wayne State University (792-53-191)

10:15–10:25 (75) *An inequality for the rank of a web and webs of maximum rank with respect to abelian 1-equations on a differentiable manifold x^{2r}.* Preliminary report. Professor VLADISLAV V. GOLDBERG, New Jersey Institute of Technology (792-53-224)

10:30–10:40 (76) *Local differential geometry of transverse metric singularities.* Preliminary report. MAREK B. KOSSOWSKI, University of North Carolina, Chapel Hill (792-53-290)

10:45–10:55 (77) *Decomposability preserving curvature operators in dimension* 4. Professor M. R. GABEL and Professor S. M. ZOLTEK*, George Mason University (792-53-310)

11:00–11:10 (78) *Exterior Dirichlet problem for minimal surface equations in general dimensions.* Professor S. WALTER WEI, University of Hawaii, Honolulu (792-53-344)

11:15–11:25 (79) *On knots and the constant curvature sphere.* LEE WHITT, Daniel H. Wagner Associates, Hampton, Virginia (792-53-369)

11:30–11:40 (80) *Klein-Gordon solvability and the geometry of geodesics.* JOHN K. BEEM and PHILLIP E. PARKER*, University of Missouri, Columbia (792-53-409)

11:45–11:55 (81) *Timelike geodesic Incompleteness of Lorentzian warped products.* Preliminary report. THOMAS G. POWELL, University of Missouri, Columbia (792-53-416) (Introduced by Professor John K. Beem)

12:00–12:10 (82) *Isometry groups of solvmanifolds.* Preliminary report. Dr. CAROLYN GORDON*, Lehigh University, and Dr. EDWARD N. WILSON, Washington University (792-53-422)

WEDNESDAY, 8:30 A. M.

Special Session on Operator Theory. I, Convention Center, Room 23

8:30– 8:55 (83) *Toeplitz operators on the circle—A survey of the last five years.* SHELDON AXLER, Michigan State University, East Lansing (792-47-119)

9:00– 9:25 (84) *Elementary operators and norm ideals.* Preliminary report. Professor L. A. FIALKOW, Western Michigan University (792-47-120)

9:30– 9:55 (85) *A survey of some lifting results.* Professor JOSEPH D. WARD, Texas A&M University, College Station (792-47-121)

10:00–10:25 (86) *Generalized Bergman kernels and the Cowen-Douglas Theory.* Professor RAUL CURTO, University of Iowa, and Professor NORBERTO SALINAS*, University of Kansas (792-47-122)

10:30–10:55 (87) Withdrawn

11:00–11:25 (88) *A Beurling-Lax-Halmos representation using various Lie groups which has many applications.* Professor J. WILLIAM HELTON*, University of California, San Diego, and Professor J. BALL, Virginia Polytechnic Institute (792-47-114)

11:30–11:55 (89) *Structure of operators.* Preliminary report. Professor JOSEPH STAMPFLI, Indiana University, Bloomington (792-47-115)

WEDNESDAY, 10:10 A. M.

Invited Address, Convention Center, North Meeting Room

(90) *Arithmetic of polynomials.* Professor JUN-ICHI IGUSA, Johns Hopkins University (792-12-443)

WEDNESDAY, 11:20 A. M.

Invited Address, Convention Center, North Meeting Room

(91) *Exponents in homotopy theory.* JOSEPH NEISENDORFER, Ohio State University, Columbus (792-55-259)

WEDNESDAY, 1:00 P. M.

Colloquium Lectures: Lecture I, Convention Center, North Meeting Room

(92) *Geometry, iteration, and group theory.* Professor DENNIS SULLIVAN, City University of New York, Graduate School and University Center

WEDNESDAY, 2:10 P. M.

Special Session on Dynamical Systems. II, Convention Center, Room 26

2:10– 2:30 (93) *Almost periodic linear systems.* Professor RUSSELL A. JOHNSON, University of Southern California (792-34-250)

2:35– 2:55 (94) *Continuation of periodic points in the Henon mapping.* Professor ROBERT L. DEVANEY, Boston University (792-58-141)

3:00– 3:20 (95) *On local entropy.* Dr. MICHAEL BRIN* and Professor ANATOLE KATOK, University of Maryland, College Park (792-58-181)

3:25– 3:45 (96) *Aspects of ergodicity in flows and foliations.* Dr. SUSAN MARY REES, University of Minnesota, Minneapolis (792-58-384) (Introduced by Professor Harvey B. Keynes)

3:50– 4:10 (97) *Sofic systems and encoding data on magnetic tape.* Preliminary report. BRIAN MARCUS, University of North Carolina, Chapel Hill (792-94-403)

4:15– 4:35 (98) *Two counterexamples.* Professor DANIEL J. RUDOLPH, University of Maryland, College Park (792-60-222)

4:40– 5:00 (99) *Conditional structural stability and real analytic models of Thurston's pseudo-Anosov maps.* Dr. MARLIES GERBER, University of California, Berkeley (792-58-381)

5:00– 6:30 (100) Problem Session.

WEDNESDAY, 2:10 P. M.

Special Session on Rings of Continuous Function. I, Convention Center, Room 3

2:10– 2:30 (101) *Prime ideals in function rings.* Professor MEYER JERISON, Purdue University, West Lafayette (792-46-60)

2:40– 3:00 (102) *A cardinal generalization of z-embedding.* Preliminary report. Professor ROBERT L. BLAIR, Ohio University, Athens (792-54-62)

3:10– 3:30 (103) *A survey of α-compact spaces.* Preliminary report. Professor W. W. COMFORT, Wesleyan University (792-54-59)

3:40– 4:00 (104) *The quasi-F cover of a compact space and strongly irreducible surjections.* Dr. FREDERICK K. DASHIELL, Jr., Los Angeles (792-54-93)

4:10– 4:30 (105) *Some subspaces of F-spaces.* ALAN DOW, Vrije Universiteit, Amsterdam (792-54-252)

4:40– 5:00 (106) *Algebraic properties of lattice-ordered groups of continuous functions.* ANTHONY W. HAGER, Wesleyan University (792-06-45)

WEDNESDAY, 2:10 P. M.

Special Session on Multivariate Spline Functions and Piecewise Polynomial Approximation. I, Convention Center, Room 8

2:10– 2:30 (107) *Non simplicial B-splines.* Preliminary report. Professor CARL de BOOR, University of Wisconsin, Madison (792-41-503)

2:40– 3:00 (108) *Approximation by smooth multivariate splines.* Professor CARL de BOOR, Mathematics Research Center, Madison and Professor RONALD DeVORE*, University of South Carolina, Columbia (792-41-461)

3:10– 3:30 (109) *Some combinatorial aspects of multivariate B-splines.* Preliminary report. Dr. WOLFGANG DAHMEN*, Universität Bonn, Federal Republic of Germany, and CHARLES A. MICCHELLI, IBM Thomas J. Watson Research Center (792-41-174) (Introduced by Professor Alfred S. Cavaretta, Jr.)

3:40– 4:00 (110) *On the dimension of spaces of piecewise polynomials in two variables.* Professor LARRY L. SCHUMAKER, Texas A&M University, College Station (792-41-164)

4:10– 4:30 (111) *C^k piecewise polynomial subspaces over triangulations of macro-triangles.* Preliminary report. Professor LOIS MANSFIELD, University of Virginia (792-41-364)

4:40– 5:00 (112) *A scale invariant surface spline.* Preliminary report. GREGORY M. NIELSON, Arizona State University (792-41-315) (Introduced by Professor Alfred S. Cavaretta, Jr.)

5:10– 5:30 (113) *A new approach to Euler splines and related functional equations.* Professor I. J. SCHOENBERG, University of Wisconsin, Madison (792-41-281)

WEDNESDAY, 2:10 P. M.

Special Session on Topics in Complex Analysis. I, Convention Center, Room 25

2:10– 2:30 (114) *A method for investigating geometric properties of support points and applications.* Preliminary report. Dr. JOHNNY E. BROWN, Purdue University, West Lafayette (792-30-76)

2:35– 2:55 (115) *Unique composition of multivalent close-to-convex functions.* Preliminary report. Dr. ABDALLAH K. LYZZAIK, University of Petroleum and Minerals, Saudi Arabia (792-30-15)

3:00– 3:20 (116) *Nonvanishing univalent functions, II.* Preliminary report. Professor PETER DUREN*, University of Michigan, Ann Arbor, and Professor GLENN SCHOBER, Indiana University, Bloomington (792-30-127)

3:25– 3:45 (117) *Curves satisfying the chord-arc condition.* Professor ALBERT BAERNSTEIN II, Washington University (792-30-77)

3:50– 4:10 (118) *New constrained inequalities from old ones.* Professor W. E. KIRWAN, University of Maryland, College Park, and Professor GLENN SCHOBER*, Indiana University, Bloomington (792-30-158)

4:15– 4:35 (119) *Constructive conformal mappings of Riemann surfaces.* Preliminary report. Professor CARL H. FITZGERALD, University of California, San Diego (792-30-74)

4:40– 5:00 (120) *The extreme points of Σ.* Professor D. H. HAMILTON, University of California, La Jolla (792-30-195) (Introduced by Professor C. David Minda)

5:05– 5:25 (121) *On support points and extreme points of S.* Preliminary report. Professor L. BRICKMAN*, Professor Y. J. LEUNG, and Professor D. R. WILKEN, State University of New York, Albany (792-30-65)

5:30– 5:50 (122) *Remarks on univalent functions with positive Hayman Index.* Y. J. LEUNG, State University of New York, Albany (792-30-75)

WEDNESDAY, 2:10 P. M.

Session on Ordinary and Partial Differential Equations, Convention Center, Room 10

2:10– 2:20 (123) *Asymptotic behavior of the positive solutions of a functional differential equation with a discontinuity.* Professor JOHN R. GRAEF and Professor PAUL W. SPIKES*, Mississippi State University, and Professor MYRON K. GRAMMATIKOPOULOS, University of Ioannina, Greece (792-34-335)

2:25– 2:35 (124) *Bounded solutions for some gradient type systems.* Preliminary report. Dr. A. REZA AFTABIZADEH, University of Texas, Arlington (792-34-336)

2:40– 2:50 (125) *A type of measurement for bifurcation.* Preliminary report. Dr. STEPHEN R. BERNFELD, University of Texas, Arlington (792-34-352)

2:55– 3:05 (126) *Entire solutions of linear differential equations.* Dr. S. M. SHAH, Ohio University, Athens, and University of Kentucky (792-34-405)

3:10– 3:20 (127) *Special families of periodic orbits and their continuation at resonance in the restricted problem.* EDWARD A. BELBRUNO, Boston University (792-34-435)

3:25– 3:35 (128) *On existence, uniqueness, and construction of solutions for nonlinear two-point boundary value problems.* Preliminary report. JAMES A. PENNLINE, NASA Lewis Research Center, Cleveland (792-34-473)

3:40– 3:50 (129) *Near best approximate solutions of elliptic partial differential equations in two dimensions.* Preliminary report. Professor PETER A. McCOY, U. S. Naval Academu (792-35-58)

3:55– 4:05 (130) *A method of lines for a nonlinear abstract functional evolution equation.* Professor A. G. KARTSATOS* and Professor M. E. PARROTT, University of South Florida (792-35-69)

4:10– 4:20 (131) *On a class of nonlinear functional pseudo-parabolic problems.* Professor A. G. KARTSATOS and Professor M. E. PARROTT*, University of South Florida (792-35-92)

4:25– 4:35 (132) *Almost periodicity in nonlinear elliptic and parabolic equations.* Professor C. CORDUNEANU, University of Texas, Arlington (792-35-241)

4:40– 4:50 (133) *Degenerate non-linear equations.* Dr. KENNETH KUTTLER, Michigan Technological University (792-35-307)

4:55– 5:05 (134) *Non-linear differential equations in Hilbert space.* Dr. VLADIMIR SCHUCHMAN, North Texas State University (792-35-353) (Introduced by John W. Neuberger)

5:10– 5:20 (135) *On the integration of the equation of a clamped rectangular plate.* Professor C. V. COFFMAN, Carnegie-Mellon University (792-35-424)

5:25– 5:35 (136) *The Hamiltonian structure for evolution-type Lagrangians in two independent variables.* WILLIAM F. SHADWICK, University of Waterloo (792-35-480)

5:40– 5:50 (137) *Electromagnetic waves in a three dimensional half space with a dissipative boundary.* Professor DAVID GILLIAM*, Texas Tech University and Arizona State University, and Professor JOHN R. SCHULENBERGER, Tucson, Arizona (792-35-208)

5:55– 6:05 (138) *Nonexistence of asymptotically free solutions for a nonlinear Schrödinger equation.* Preliminary report. JACQUELINE E. BARAB, Indiana University, Bloomington (80T-B21)

WEDNESDAY, 2:10 P. M.

Session on General Topology, Convention Center, Room 24

2:10– 2:20 (139) *Mappings into linearly ordered spaces with nowhere dense fibers.* Professor PETER J. NYIKOS, University of South Carolina, Columbia (792-54-522)

2:25– 2:35 (140) *Yet another equivalent to paracompactness.* Preliminary report. Dr. BRIAN M. SCOTT, Cleveland State University (792-54-156)

2:40– 2:50 (141) *A categorical accommodation of various notions of fuzzy topology.* Preliminary report. Professor STEPHEN E. RODABAUGH, Youngstown State University (792-54-169)

2:55– 3:05 (142) *Foundations of (L)-spaces.* Professor CARLOS A. INFANTOZZI, Instituto de Estudios Superiores, Uruguay (792-54-173)

3:10– 3:20 (143) *Continuity spaces.* Dr. RALPH KOPPERMAN, City University of New York, City College (792-54-199)

3:25– 3:35 (144) *Remote points and products of σ-π spaces.* Preliminary report. THOMAS J. PETERS, Wesleyan University (792-54-201)

3:40– 3:50 (145) *A note on selection theorems for realcompact spaces.* Professor ILYA BLUM, Mount Saint Vincent University, and Professor S. SWAMINATHAN*, Dalhousie University (792-54-291)

3:55– 4:05 (146) *Insertion theorems and subsets of $X \times [0, 1]$.* Preliminary report. Professor ERNEST LANE, Appalachian State University (792-54-292)

4:10– 4:20 (147) *A curious result concerning nowhere CCC $\sigma\pi$ spaces.* Dr. H. E. WHITE, JR., Rolla, Missouri (792-54-293) (Introduced by Professor L. Grimm)

4:25– 4:35 (148) *Closed maps and discrete sets.* Dr. JACOB KOFNER, George Mason University (792-54-294)

4:40– 4:50 (149) *On fixed points in 2-metric spaces.* Dr. ASHOK KUMAR, Ball State University (792-54-305) (Introduced by Professor T. K. Puttaswamy)

4:55– 5:05 (150) *Fixed points for equicontinuous functions on tree-like continua.* Preliminary report. Professor J. B. FUGATE, University of Kentucky (792-54-347)

5:10– 5:20 (151) *The prime end structure of quotient spaces.* Preliminary report. Dr. JOHN C. MAYER, University of Florida (792-54-354)

5:25– 5:35 (152) Withdrawn

5:40– 5:50 (153) *Cauchy conditions on symmetrics.* Preliminary report. S. W. DAVIS, Miami University, Ohio (792-54-387)

5:55– 6:05 (154) *Properties of generalized collectionwise normal spaces.* Preliminary report. JAMES C. SMITH, Jr., Virginia Polytechnic Institute and State University (792-54-442)

6:10– 6:20 (155) *Equivalence of complete Hausdorff metrics.* Preliminary report. HAROLD W. MARTIN, St. Cloud State University (792-54-458)

6:25– 6:35 (156) *Retractions and fixed points.* Preliminary report. Professor ROBERT F. BROWN, University of California, Los Angeles (792-54-55)

WEDNESDAY, 2:10 P. M.

Session on Applied Mathematics, Convention Center, Room 9

2:10– 2:20 (157) *Improved linear duality and multiplier theorems.* Professor ALFONSO G. AZPEITIA, University of Massachusetts, Boston (792-90-177)

2:25– 2:35 (158) *A combinatorial problem on maximal sets of single-peaked rankings.* Preliminary report. Dr. CATHERINE M. MURPHY, Purdue University, Calumet Campus (792-90-231)

2:40– 2:50 (159) *On the probability of having a winning strategy.* Professor DOUGLAS CENZER, University of Florida and North Texas State University (792-90-308)

2:55– 3:05 (160) *The generalized nucleolus of a finite set and the minimum paths multiobjective problems.* Professor IRINEL DRAGAN, University of Texas, Arlington (792-90-345)

3:10– 3:20 (161) *Comparison of Markov processes by stochastic dominance.* Professor EDWARD PACKEL*, Lake Forest College, and Professor EDWARD GREEN and RICHARD McKELVEY, California Institute of Technology (792-90-430)

3:25– 3:35 (162) *Setting the UCC to* MUSIC. Preliminary report. Professor R. KEOWN, University of Arkansas, Fayetteville (792-90-468)

3:40– 3:50 (163) *Optimal harvesting in populations subject to immigration.* Dr. KENNETH LANE*, Hamilton College, and Dr. LINDA HILL, Idaho State University (792-92-302)

3:55– 4:05 (164) *Modeling of plasmid replication and partition.* Preliminary report. Dr. WILLIAM D. EMERSON, Texas Tech University (792-92-332)

4:10– 4:20 (165) *Antipodal graphs.* Preliminary report. Professor SANDRA L. ARLINGHAUS, Loyola University, Chicago (792-92-404)

4:25– 4:35 (166) *Deterministic models of the population dynamics of polygamous mating systems.* Preliminary report. Professor KENNETH H. ROSEN, University of Maine, Orono (792-92-460)

4:40– 4:50 (167) *Predators encountering a model-mimic system with alternative prey.* Professor JOHN K. LUEDEMAN*, Professor F. R. McMORRIS and Professor DANIEL D. WARNER, Clemson University (792-92-497)

4:55– 5:05 (168) *An operator approach to linear-quadratic-gaussian control problems.* Preliminary report. ROLAND MINTON* and Professor JAMES A. RENEKE, Clemson University (792-93-513)

5:10– 5:20 (169) *Weight enumerators of normalized codes, II, the Hermitian case.* Dr. STEPHEN M. GAGOLA, JR., Texas A&M University, College Station (792-94-402)

5:25– 5:35 (170) *Gravity waves in a permeable medium.* Professor K. K. PURI, University of Maine, Orono (792-76-515) (Introduced by Professor Henrik Bresinsky)

WEDNESDAY, 2:10 P. M.

General Session, Convention Center, Room 4 and **Poster Session,** Room 5

2:10– 2:20 (171) *Groups and simple languages.* Professor ROBERT H. HARING-SMITH, College of the Holy Cross (792-20-189)

2:25– 2:35 (172) *Periodic solution for nonlinear delay equations in higher order.* Preliminary report. SEN-WO DU, University of Texas, Arlington (792-34-377)

2:40– 2:50 (173) *Second order eigenvalue problems with boundary conditions dependent on the eigenvalue parameter.* Dr. HYUN JOON AHN, Indiana State University, Terre Haute (792-34-412)

2:55– 3:05 (174) *Integro-differential operators associated with diffusion processes with jumps.* Dr. SUZANNE LENHART, University of Tennessee, Knoxville (792-35-440)

3:10– 3:20 (175) *On binary alloy solidification.* Preliminary report. Professor VASILI ALEXIADES, University of Tennessee, Knoxville (792-35-441)

3:25– 3:35 (176) *The splitting of the Künneth sequence in K-theory for C^*-algebras.* Preliminary report. Professor ANDRE H. DEUTZ, Oakland University (792-46-448)

3:40– 3:50 (177) *Nonlinear equations involving m-accretive operators in Banach spaces.* Preliminary report. Dr. CLAUDIO MORALES, Pan American University (792-47-491)

3:55– 4:05 (178) *Optimal selection problems in a random environment.* Preliminary report. Dr. MOU-HSIUNG CHANG, University of Alabama, Huntsville (792-60-142)

4:10– 4:20 (179) *On strong mixing of vector-valued Gaussian stationary processes.* Dr. MOHSEN POURAHMADI, Northern Illinois University (792-60-242)

4:25– 4:35 (180) *On a theorem of Ky Fan.* Professor S. P. SINGH, Memorial University of Newfoundland (792-47-519)

WEDNESDAY, 2:10 P. M.

Invited Address, Convention Center, North Meeting Room

(181) *Linear algebra over $K[X_1, \ldots, X_n]$ 1890 to 1980.* Professor E. GRAHAM EVANS, Jr., University of Illinois, Urbana-Champaign (792-13-146)

WEDNESDAY, 2:30 P. M.

Special Session on Operator Theory. II, Convention Center, Room 23

2:30: 2:55 (182) *A spectral mapping theorem for conformal mappings.* Professor C. FOIAS, Indiana University, Bloomington, Professor C. PEARCY*, University of Michigan, Ann Arbor, and Professor B. SZ.-NAGY, Bolyai Institute of the University, Szeged, Hungary (792-47-116)

3:00– 3:25 (183) *(BCP) operators as universal strong dilations.* Professor C. FOIAS, Indiana University, Bloomington, and H. BERCOVICI* and Professor C. PEARCY, University of Michigan, Ann Arbor (792-47-117)

3:30– 3:55 (184) *Recent progress in the theory of subnormal operators.* Professor JOHN B. CONWAY, Indiana University, Bloomington (792-47-17)

4:00– 4:25 (185) *Absolute values of completely hyponormal operators.* Professor C. R. PUTNAM, Purdue University, West Lafayette (792-47-110)

4:30– 4:55 (186) *A nonstandard dilation theory.* Professor CHARLES A. BERGER, Lehman College, City University of New York (792-47-111)

5:00– 5:25 (187) *Rectifiable currents and commuting tuples of subnormal operators.* Professor RICHARD W. CAREY, University of Kentucky (792-47-112)

5:30– 5:55 (188) *Triangularization of collections of compact operators.* Professor PETER ROSENTHAL, University of Toronto (792-47-113)

WEDNESDAY, 3:20 P. M.

Invited Address, Convention Center, North Meeting Room

(189) *Log-concave and unimodal sequences in algebra, combinatorics and geometry.* Professor RICHARD P. STANLEY, Massachusetts Institute of Technology (792-05-134)

WEDNESDAY, 8:30 P. M.

Josiah Willard Gibbs Lecture, Convention Center, North Meeting Room

(190) *The dynamics and evolution of some sociotechnical systems.* ELLIOTT W. MONTROLL, Institute for Physical Science and Technology, University of Maryland, College Park

THURSDAY, 8:00 A. M.

Special Session on Algebraic Combinatorics. II, Convention Center, Room 24

8:00– 8:20 (191) *Coloring unlabelled graphs and counting unlabelled digraphs.* PHIL HANLON, Massachusetts Institute of Technology (792-05-67)

8:30– 8:50 (192) *A general logarithmic connexion between sequence problems.* Professor IAN P. GOULDEN and Professor DAVID M. JACKSON*, University of Waterloo (792-05-432)

9:00– 9:20 (193) *Combinatorics of wild problems of linear algebra.* Professor VICTOR G. KAC, Massachusetts Institute of Technology (792-05-445)

9:30– 9:50 (194) *Computation of relations in certain semigroups.* Preliminary report. Professor DAVID A. KLARNER, State University of New York, Binghamton (792-05-90) (Introduced by Professor Ira M. Gessel)

10:00–10:20 (195) *Hereditary families of combinatorial geometries.* Preliminary report. Dr. JOSEPH KUNG, North Texas State University (792-05-421)

10:30–10:50 (196) *A new family of algebras underlying the Rogers-Ramanujan identities and generalizations.* Professor JAMES LEPOWSKY* and Professor ROBERT LEE WILSON, Rutgers University, New Brunswick (792-05-454)

THURSDAY, 8:00 A. M.

Special Session on Topics in Complex Analysis. II, Convention Center, Room 25

8:00– 8:20 (197) *Hölder continuous functions, quasiconformal mappings and theorems of Hardy-Littlewood type.* Professor F. W. GEHRING*, University of Michigan, Ann Arbor, and Professor O. MARTIO, University of Jyväskylä, Finland (792-30-125)

8:25– 8:45 (198) *Commuting analytic functions.* Dr. CARL C. COWEN, Purdue University, West Lafayette (792-30-18)

8:50– 9:10 (199) *Uniqueness and nonuniqueness for the Radon transform.* LAWRENCE ZALCMAN, University of Maryland, College Park (792-30-20)

9:15– 9:35 (200) *Approximation in the mean by polynomials.* Preliminary report. JOSEPH A. CIMA*, University of North Carolina, Chapel Hill, and ALEC MATHESON, University of Oklahoma, Stillwater (792-30-44)

9:40–10:00 (201) *Embedding Bergman spaces in* $L^p(\mu)$. Professor DANIEL H. LUECKING, University of Arkansas, Fayetteville (792-32-157)

10:05–10:25 (202) *Hyperbolic convexity and level sets of univalent functions.* Preliminary report. BARBARA A. BROWN, University of Michigan, Ann Arbor (792-30-95) (Introduced by F. W. Gehring)

10:30–10:50 (203) *Annular functions and gap series.* Preliminary report. Professor DOUGLAS M. CAMPBELL, Brigham Young University, Provo (792-30-78)

10:55–11:15 (204) *BMOA and additive automorphic functions.* THOMAS A. METZGER, University of Pittsburgh, Pittsburgh (792-30-123)

11:20–11:40 (205) *Asymptotic estimates for functions extremal for Baernstein's* $\cos\beta\lambda$ *theorem.* Professor JOHN ROSSI*, Purdue University, West Lafayette, and Professor JACK WILLIAMSON, University of Hawaii, Honolulu (792-30-100)

THURSDAY, 8:00 A. M.

Special Session on The Interaction Between Contemporary Pure Mathematics and Engineering at the Research Level. I, Convention Center, Room 23

8:00– 8:40 (206) *Nonlinear estimation theory and the representation of Lie algebras.* ROGER W. BROCKETT, Harvard University (792-93-303)

8:50– 9:30 (207) *Real algebraic geometry as motivated by and applied to problems of control.* Professor CHRISTOPHER I. BYRNES, Harvard University (792-93-331)

9:40–10:20 (208) *Expansions for nonlinear physical systems.* Preliminary report. Dr. IRWIN W. SANDBERG, Bell Laboratories, Murray Hill (792-46-511) (Introduced by Professor Gail S. Young)

10:30–11:10 (209) *Some mathematical problems of VLSI semiconductor design.* Preliminary report. Professor MELVYN S. BERGER, University of Massachusetts, Amherst (792-94-167)

THURSDAY, 8:00 A. M.

Special Session on Rings of Continuous Function. II, Convention Center, Room 3

8:00– 8:20 (210) *Algebraic problems about rings of continuous functions that need solution.* Professor MELVIN HENRIKSEN, Harvey Mudd College (792-54-225)

8:30– 8:50 (211) *Partial extension of functions to compactifications.* Preliminary report. RONNIE LEVY, George Mason University (792-54-27)

9:00– 9:20 (212) *Real compactness, N-compactness and dimension theory.* Preliminary report. Professor S. MROWKA, State University of New York, Buffalo (792-54-48)

9:30– 9:50 (213) *The extension of uniformly continuous mappings and uniformly continuous pseudometrics.* Preliminary report. M. D. RICE, George Mason University (792-54-66) (Introduced by Steve Seidman)

10:00–10:20 (214) *Pseudocompact and Stone-Weierstrass product spaces.* Professor R. M. STEPHENSON, JR., University of South Carolina, Columbia (792-54-37)

10:30–10:50 (215) *Some topological characterizations of the generalized continuum hypothesis.* MARY ANNE SWARDSON, Ohio University, Athens (792-54-47)

11:00–11:20 (216) *Remainders of nowhere locally compact realcompact spaces.* Preliminary report. ERIC K. VAN DOUWEN, Ohio University, Athens (792-54-64)

THURSDAY, 8:00 A. M.

Special Session on Fixed Points, Nonexpansive Mappings and Related Topics. I, Convention Center, Room 26

8:00– 8:40 (217) *Asymptotic behavior of nonexpansive mappings.* Professor RONALD E. BRUCK, University of Southern California (792-47-215)

9:00– 9:20 (218) *Mapping theorems for differentiable and accretive operators.* Professor WILLIAM O. RAY* and ANITA M. WALKER, University of Oklahoma, Norman (792-47-7)

9:30– 9:50 (219) *A coincidence theorem for mappings satisfying local conditions.* Professor W. A. KIRK* and MELISSA DUNN, University of Iowa (792-47-29)

10:00–10:20 (220) *A dual view of a theorem of Baillon.* BARRY TURETT, Oakland University (792-46-30)

10:30–10:50 (221) *Renorming and the theory of phi-accretive set-valued mappings.* D. J. DOWNING*, Oakland University, and W. O. RAY, University of Oklahoma, Norman (792-47-22)

11:00–11:20 (222) *Extension and selection problems for nonlinear nonexpansive semigroups in Banach spaces.* Dr. MAXIMIANO M. ISRAEL, JR., and Professor SIMEON REICH*, University of Southern California (792-47-24)

THURSDAY, 8:00 A. M.

Session on Algebraic Geometry, Linear Algebra and Associative Rings, Convention Center, Room 8

8:00– 8:10 (223) *Fermat surfaces over finite fields.* Professor NORIKO YUI, Ohio State University, Columbus (792-14-193)

8:15– 8:25 (224) *Essential valuations.* JONATHAN FINE, Southern Illinois University, Carbondale (792-14-270)

8:30– 8:40 (225) *Canonical embeddings of complete Gorenstein algebraic curves.* Preliminary report. Dr. BEN THOMAS, University of Dallas (792-14-506)

8:45– 8:55 (226) *The Stein-Rosenberg theorem revisited.* Preliminary report. Dr. JOHN J. BUONI*, Youngstown State University, and Dr. RICHARD S. VARGA, Kent State University (792-15-204)

9:00– 9:10 (227) *Monotonicity of integral matrices.* Professor JEAN H. BEVIS and Professor FRANK J. HALL*, Georgia State University (792-15-218)

9:15– 9:25 (228) *Linear systems having nonnegative least squares solution.* Professor S. K. JAIN* and Professor L. E. SNYDER, Ohio University, Athens (792-15-219)

9:30– 9:40 (229) *Solution of linear algebraic systems using all-integer tableaux.* Professor J. C. CROWN, Purdue School of Science, Indiana University-Purdue University, Indianapolis (792-15-228) (Introduced by Professor J. E. Kuczkowski)

9:45– 9:55 (230) *On the projective equivalence of invariant subspace lattices.* MICHAEL J. McASEY*, Bradley University, and PAUL S. MUHLY, University of Iowa (792-15-245)

10:00–10:10 (231) *Some classes of integral matrices.* Dr. JEAN H. BEVIS* and Dr. FRANK J. HALL, Georgia State University (792-15-248)

10:15–10:25 (232) *Hermitian pencils with a cubic minimal polynomial.* HELENE SHAPIRO, Swarthmore College (792-15-399)

10:30–10:40 (233) *Linear transformations in cubic-quadratic spaces.* Preliminary report. Dr. KONRAD J. HEUVERS, Michigan Technological University (792-15-504)

10:45–10:55 (234) *Serial rings.* SURJEET SINGH, Kuwait University (792-16-41)

11:00–11:10 (235) *Singular submodule relative to a kernel functor.* Professor JITENDRA MANOCHA, Kent State University (792-16-133)

11:15–11:25 (236) *An instance of quasi-injectivity.* Preliminary report. W. D. BURGESS, University of Ottawa, and R. RAPHAEL*, Concordia University, Montreal (792-16-188)

11:30–11:40 (237) *Near ring automorphisms.* Preliminary report. Professor J. J. MALONE, Worcester Polytechnic Institute (792-16-217)

11:45–11:55 (238) *Properness of Lie algebras and enveloping algebras.* Professor WALTER J. MICHAELIS, University of Montana (792-16-271)

12:00–12:10 (239) *Morita equivalence for rings with local units.* Dr. GENE ABRAMS, Colorado College (792-16-333)

THURSDAY, 8:00 A. M.

Session on Operator Theory, Convention Center, Room 13

8:00– 8:10 (240) *Ergodic theory of contractions on $C(X)$.* Professor ROBERT E. ATALLA, Ohio University, Athens (792-47-240)

8:15– 8:25 (241) *Spectral properties of cyclic subnormal n-tuples.* Professor RAUL E. CURTO*, University of Iowa, and Professor NORBERTO SALINAS, University of Kansas (792-47-254)

8:30– 8:40 (242) *Generalized inverse for linear manifold.* Preliminary report. Professor SUNG J. LEE*, University of South Florida, and Professor M. Z. NASHED, University of Delaware (792-47-286)

8:45– 8:55 (243) *Absolute continuity for functions in topological vector spaces.* Preliminary report. Professor TED W. GOODMAN, Appalachian State University (792-47-287)

9:00– 9:10 (244) *Dunford-Pettis operators on Banach lattices.* Professor C. D. ALIPRANTIS and Professor O. BURKINSHAW*, Indiana University-Purdue University, Indianapolis (792-47-288)

9:15– 9:25 (245) *Locally quasi-dissipative operators and global solvability.* Professor JEROME A. GOLDSTEIN, Tulane University (792-47-304)

9:30– 9:40 (246) *Spectral properties of some tridiagonal matrices.* Dr. DONALD D. ROGERS, Texas A&M University, College Station (792-47-323)

9:45– 9:55 (247) *The Jordan-von Neumann lemma for existence of operators and an application.* Preliminary report. Professor MILTON ROSENBERG, St. John's University, Jamaica, New York (792-47-378)

10:10–10:10 (248) *Invariant measures and weighted composition processes.* Preliminary report. Professor ALAN LAMBERT, Technion-Israel Institute of Technology, and Professor JOSEPH QUINN*, University of North Carolina, Charlotte (792-47-389)

10:15–10:25 (249) *Reductive operators and another equivalent of the invariant subspace conjecture.* GARY D. FAULKNER and HOWARD B. MENDELSON*, North Carolina State University, Raleigh (792-47-449)

10:30–10:40 (250) *Essentially normal and essentially subnormal operators.* Dr. RIDGLEY LANGE, University of New Orleans (792-47-478)

10:45–10:55 (251) *Automorphisms and derivations of quasitriangular algebras.* Preliminary report. BRUCE WAGNER, University of California, Berkeley (792-47-492)

11:00–11:10 (252) *Quasisimilarity and essential spectra for subnormal operators.* Preliminary report. MARC RAPHAEL, Indiana University, Bloomington (792-47-501)

11:15–11:25 (253) *AF algebras and character rings.* Preliminary report. Dr. ANDREW MATCHETT, Texas A&M University, College Station (792-47-237)

THURSDAY, 8:00 A. M.

Session on Algebraic Topology, Manifolds and Global Analysis, Convention Center, Room 1

8:00– 8:10 (254) *A moduli representation for the classification of twisted tensor products.* Professor ELI KATZ, Cleveland State University (792-55-230)(Introduced by Professor Wojbor A. Woyczynski)

8:15– 8:25 (255) *Free abelian homology of groups.* Dr. ROSS GEOGHEGAN*, State University of New York, Binghamton, and Dr. MICHAEL L. MIHALIK, University of Utah (792-55-295)

8:30– 8:40 (256) *Cartan's cohomology theories and spectral sequences.* Dr. JOHN McCLEARY, Vassar College (792-55-194)

8:45– 8:55 (257) *The strong ends of a group.* Dr. MICHAEL L. MIHALIK, University of Utah (792-55-498)

9:00– 9:10 (258) *Growth of leaves and the Godbillon-Vey class.* Professor LAWRENCE CONLON*, Washington University, and Professor JOHN CANTWELL, St. Louis University (792-57-73)

9:15– 9:25 (259) *Proper starlike equivalent decompositions of* $E^3(E^n)$. Professor LOUIS F. McCAULEY, State University of New York, Binghamton (792-57-147)

9:30– 9:40 (260) *Embedding semi-algebraic spaces and manifolds.* ROBERT ROBSON, Michigan State University (792-57-184)

9:45– 9:55 (261) Withdrawn

10:00–10:10 (262) *Homotopy equivalences of punctured manifolds.* Professor DARRYL McCULLOUGH, University of Oklahoma, Norman (792-57-296)

10:15–10:25 (263) *A computation of the action of the mapping class group on isotopy classes of curves and arcs in surfaces.* Preliminary report. ROBERT CLARK PENNER, Massachusetts Institute of Technology (792-57-297)

10:30–10:40 (264) *Homology 3-manifolds and the Poincaré conjecture.* THOMAS L. THICKSTUN, Southwest Texas State University (792-57-298)

10:45–10:55 (265) *PL involutions on some twisted l-bundles.* Preliminary report. Professor PAIK K. KIM, Iowa State University (792-57-341)

11:00–11:10 (266) *The Witt classes of torsion linking forms of Seifert manifolds.* Preliminary report. Professor HAE SOO OH, Louisiana State University, Baton Rouge (792-57-350)

11:15–11:25 (267) *Nonorientable manifolds with Morse characteristic* 4. Professor JOHN D. BLANTON, St. John Fisher College (792-57-490)

11:30–11:40 (268) *A decomposition theorem for diffeomorphisms of the circle, with applications to geodesics.* Professor JOEL LANGER* and Professor DAVID A. SINGER, Case Western Reserve University (792-58-40)

11:45–11:55 (269) *Periods of periodic points of maps of the circle.* Dr. CHRISTOPHER BERNHARDT, Southern Illinois University, Carbondale (792-58-299)

12:00–12:10 (270) *A direct method for minimizing the Yang-Mills functional over* 4*-manifolds.* Preliminary report. STEVEN B. SEDLACEK, Northwestern University (792-58-314)

THURSDAY, 10:10 A. M.

Invited Address, Convention Center, North Meeting Room

(271) *Applications of the trace formula.* Professor ROBERT P. LANGLANDS, Institute for Advanced Study (792-10-262)

THURSDAY, 11:20 A. M.

Invited Address, Convention Center, North Meeting Room

(272) *Variational problems with geometric constraints.* Professor LUIS A. CAFFARELLI, Courant Institute of Mathematical Sciences, New York University (792-49-526)

THURSDAY, 1:00 P.M.

Colloquium Lectures: Lecture II, Convention Center, North Meeting Room

(273) *Geometry, iteration, and group theory.* Professor DENNIS SULLIVAN, City University of New York, Graduate School and University Center

THURSDAY, 2:10 P. M.

Special Session on Algebraic Combinatorics. III, Convention Center, Room 24

2:10– 2:30 (274) *Schur functions and the invariant polynomials characterizing $U(n)$ tensor operators.* Professor R. GUSTAFSON and Professor S. C. MILNE*, University of California, San Diego (792-05-220)

2:35– 2:55 (275) *Representations of $sl(2, C)$ on posets and the Sperner property.* Professor ROBERT A. PROCTOR, University of California, Los Angeles (792-05-366)

3:00– 3:20 (276) *Congruences via abelian groups.* Preliminary report. BRUCE E. SAGAN, University of Michigan, Ann Arbor (792-05-211)

3:25– 3:45 (277) *Coxeter arrangements.* Professor PETER ORLIK and Professor LOUIS SOLOMON*, University of Wisconsin, Madison (792-06-165)

3:50– 4:10 (278) *Generalized n-gons, Chebychev polynomials, and the Feit-Higman Theorem.* DENNIS STANTON, University of Minnesota, Minneapolis (792-05-126)

THURSDAY, 2:10 P. M.

Special Session on Topics in Complex Analysis. III, Convention Center, Room 25

2:10– 2:30 (279) *Meromorphic functions extremal for R. Nevanlinna's defect relation.* DAVID DRASIN, Purdue University, West Lafayette (792-30-107)

2:35– 2:55 (280) *On the coefficients of functions inverse to certain meromorphic univalent functions.* Professor JAMES A. JENKINS, Washington University (792-30-96)

3:00– 3:20 (281) *A unified approach to certain questions in value distribution theory.* Dr. JOHN ROSSI and Dr. ALLEN WEITSMAN*, Purdue University, West Lafayette (792-30-109)

3:25– 3:45 (282) *NASC for the asymptotic form of Ahlfor's second fundamental inequality.* Professor BURTON RODIN* and Professor S. E. WARSCHAWSKI, University of California, San Diego (792-30-108)

3:50– 4:10 (283) *Quadratic differentials on the universal cover.* Professor A. MARDEN, University of Minnesota, Minneapolis (792-30-99)

THURSDAY, 2:10 P. M.

Special Session on Rings of Continuous Function. III, Convention Center, Room 3

2:10– 2:30 (284) *Extensions of Hausdorff spaces.* JACK R. PORTER, University of Kansas, and R. GRANT WOODS*, University of Manitoba (792-54-38)

2:35– 2:55 (285) *Ultrapowers of function rings.* Preliminary report. PAUL BANKSTON, Marquette University (792-54-253)

3:00– 3:20 (286) *Homomorphisms on lattice-ordered algebras.* Professor JAMES F. PORTER* and Professor WILLIAM A. FELDMAN, University of Arkansas, Fayetteville (792-46-214)

3:25– 3:45 (287) *Relatively uniformly complete Φ-algebras.* Professor WILLIAM A. FELDMAN, University of Arkansas, Fayetteville (792-46-213)

3:50– 4:10 (288) *Rings of continuous functions are rings: a survey.* Professor LEONARD GILLMAN, University of Texas, Austin (792-54-221)

THURSDAY, 2:10 P. M.

Special Session on Fixed Points, Nonexpansive Mappings and Related Topics. II, Convention Center, Room 26

2:10– 2:30 (289) *Remarks on nonlinear functional equations.* Dr. RICARDO TORREJÓN, Southwest Texas State University (792-47-43) (Introduced by Robert C. Sine)

2:35– 2:55 (290) *Approximating solutions to $x + Tx = 0$ and $Tx = 0$ for an accretive operator T in Banach space.* Professor T. E. WILLIAMSON, JR., Montclair State College (792-47-28)

3:00– 3:20 (291) *Remarks on the fixed point problem for nonexpansive maps.* Professor E. ODELL, University of Texas, Austin (792-46-284)

3:25– 3:45 (292) *Basic properties of nonexpansive mappings.* Preliminary report. MICHAEL EDELSTEIN, Dalhousie University (792-46-71)

3:50– 4:10 (293) *Asymptotic centers in c_0, c, m and other spaces.* Dr. T. C. LIM, George Mason University (792-47-70)

4:15– 4:35 (294) *Selections for the metric projection.* Preliminary report. Professor FRANK R. DEUTSCH, Pennsylvania State University, University Park (792-47-525)

THURSDAY, 2:10 P. M.

Special Session on Multivariate Spline Functions and Piecewise Polynomial Approximation. II, Convention Center, Room 8

2:10– 2:30 (295) *B-spline bases for piecewise polynomial functions.* Dr. KLAUS HÖLLIG, University of Wisconsin, Madison (792-41-502) (Introduced by Professor Alfred S. Cavaretta, Jr.)

2:35– 2:55 (296) *Entire functions on C^s whose zero sets are unions of hyperplanes and limits of multivariate B-splines.* CHARLES A. MICCHELLI*, IBM Thomas J. Watson Research Center and Dr. WOLFGANG DAHMEN, Universität Bonn, Federal Republic of Germany (792-41-105) (Introduced by Professor Alfred S. Cavaretta, Jr.)

3:00– 3:20 (297) *Fundamental polynomials of Hakoplan interpolation.* T. N. T. GOODMAN, University of Dundee, Scotland, and A. SHARMA*, University of Alberta (792-41-226)

3:25– 3:45 (298) *Polynomial blended mappings from $R^3 \longrightarrow R^3$ and applications to finite element analyses.* Preliminary report. Dr. JAMES C. CAVENDISH, General Motors Research, Warren, Michigan, and Professor CHARLES A. HALL*, ICMA, University of Pittsburgh (792-65-362) (Introduced by Professor Alfred S. Cavaretta, Jr.)

3:50– 4:10 (299) *The finite element method and interpolation of scattered data.* Preliminary report. Professor RICHARD FRANKE, Naval Postgraduate School, Monterey, California (792-65-420) (Introduced by Professor Donald H. Trahan)

THURSDAY, 2:10 P. M.

Session on Algebraic Number Theory, Polynomials and Commutative Algebra, Convention Center, Room 9

2:10– 2:20 (300) *On the discriminant of a trinomial.* Professor GARY R. GREENFIELD, University of Richmond (792-12-196)

2:25– 2:35 (301) *Analytic version of Siegel's theorem on sums of squares.* Preliminary report. Professor CHARLES N. DELZELL, Louisiana State University, Baton Rouge (792-12-269)

2:40– 2:50 (302) *Unique factorization rings.* Dr. RAJ KUMAR MARKANDA, Universidad de los Andes, Venezeula (792-13-50)

2:55– 3:05 (303) *Power invariance of power series ring.* Dr. J. H. KIM, East Carolina University (792-13-246)

3:10– 3:20 (304) *Projective algebras.* Professor JOE YANIK, Louisiana State University, Baton Rouge (792-13-247)

3:25– 3:35 (305) *Some properties of $A(x)$ and an application to localizations.* Professor ULRICH DAEPP*, University of Wisconsin, Parkside, and Professor WEI-EIHN KUAN, Michigan State University (792-13-437)

3:40– 3:50 (306) *CM-homomorphisms of closed binary relations.* Preliminary report. Professor DAVID I. ADU, University of Lagos, Nigeria (792-20-527)

THURSDAY, 2:10 P. M.

Session on Classical and Quantum Mechanics, Convention Center, Room 13

2:10– 2:20 (307) *A wave equation for a two dimensional lattice.* J. N. BOYD* and Professor P. N. RAYCHOWDHURY, Virginia Commonwealth University (792-70-300) (Introduced by Dr. John Schmeelk)

2:25– 2:35 (308) *An iterative technique for positive solutions of a rotating string equation.* C. D. LUNING, Sam Houston State University, and W. L. PERRY*, Texas A&M University, College Station (792-70-301)

2:40– 2:50 (309) *Magneto-thermoelastic plane waves in rotating media.* Dr. S. K. ROY CHAUDHURI, Burdwan University, India, and Dr. L. DEBNATH*, East Carolina University (792-73-202)

2:55– 3:05 (310) *Properties of the sensitivity function for linear elastic systems.* VADIM KOMKOV, West Virginia University (792-73-238)

3:10– 3:20 (311) *Nonlinear convection in rotating wavy channels.* Dr. K. VAJRAVELU* and Dr. L. DEBNATH, East Carolina University (792-76-135)

3:25– 3:35 (312) *The Liouville equation as a classical limit.* Dr. CHARLES E. DICKERSON, Center for Naval Analyses, Alexandria, Virginia (792-81-136)

3:40– 3:50 (313) *Quantum mechanical inverse scattering in dimension two.* Preliminary report. MARGARET CHENEY, Indiana University, Bloomington (792-81-139)

3:55– 4:10 (314) *Quantum measurement of continuous observables using conditional expectations.* RICHARD MERCER, Wright State University, Dayton (792-81-351)

4:15– 4:25 (315) *Energy spectra of anharmonic oscillators.* Professor DAVID ISAACSON, Rensselaer Polytechnic Institute (792-81-523)

THURSDAY, 2:10 P. M.

Session on Mathematical Education, Convention Center, Room 1

2:10– 2:20 (316) *An interdisciplinary course for undergraduates.* Professor H. B. COONCE*, Mankato State University and Humboldt State University, and SUSAN M. SCHILLING, Washington State University (792-98-91)

2:25– 2:35 (317) *The effect of mode of presentation on achievement in college-level remedial mathematics.* Preliminary report. Dr. RONALD J. HARKINS, Miami University, Hamilton (792-98-137) (Introduced by Professor Nazanin Azarnia)

2:40– 2:50 (318) *Applied mathematical sciences—an undergraduate program for the* 80s. Preliminary report. Dr. MICHAEL G. MURPHY, University of Houston, Downtown College (792-98-385) (Introduced by Sudhir Kumar Goel)

2:55– 3:05 (319) *Some inequalities for complex numbers.* Preliminary report. Professor PHILIP W. McCARTNEY, Northern Kentucky University (792-98-487) (Introduced by Professor James E. Sehnert)

3:10– 3:20 (320) *What number x satisfies* $|x| = -1$? PAUL FJELSTAD, Paracollege of St. Olaf College (792-98-518) (Introduced by Professor J. Arthur Seebach, Jr.)

3:25– 3:35 (321) *T_3 completions of Cauchy spaces.* Professor DARRELL KENT, Washington State University, and GARY RICHARDSON*, East Carolina University (792-00-155) (Introduced by Professor Lokenath Debnath)

THURSDAY, 3:45 P. M.

Session on Tomography and the Radon Transform, Convention Center, Room 1

3:45– 3:55 (322) *Tomographic reconstructions which commute with rigid motions must be given by polynomials.* Professor W. R. MADYCH and Professor S. A. NELSON*, Iowa State University (792-46-340)

4:00– 4:10 (323) *Lipschitz classes of functions and their Radon transforms.* Preliminary report. Dr. JAMES V. PETERS, C. W. Post Center, Long Island University (792-44-187)

4:15– 4:25 (324) *The invertibility of rotation invariant Radon transforms.* Dr. ERIC TODD QUINTO, Tufts University (792-44-145)

THURSDAY, 4:30 P. M.–6:00 P. M.

AMS Prize Session and Business Meeting,
Convention Center, North Meeting Room

FRIDAY, 1:00 P. M.

Colloquium Lectures: Lecture III, Convention Center, North Meeting Room

(325) *Geometry, iteration, and group theory.* Professor DENNIS SULLIVAN, City Univeristy of New York, Graduate School and University Center

FRIDAY, 1:00 P. M.

Special Session on the Interaction Between Contemporary Pure Mathematics and Engineering at the Research Level. II, Convention Center, Room 23

1:00– 1:40 (326) *Soliton oscillators.* Preliminary report. Dr. ALWYN C. SCOTT*, Los Alamos National Laboratory, New Mexico, and Dr. MARIO SALERNO, University of Salerno, Italy (792-35-277) (Introduced by Professor Gail S. Young)

1:50– 2:30 (327) *Why the gap?* Dr. H. S. WITSENHAUSEN, Bell Laboratories, Murray Hill (792-99-529)

2:40– 3:20 (328) *Maximal flow and minimal cuts through a domain.* Professor GILBERT STRANG, Massachusetts Institute of Technology (792-90-514)

FRIDAY, 1:00 P. M.

Special Session on Algebraic Topology. I, Convention Center, Room 3

1:00– 1:20 (329) *Secondary cohomology operations that detect homotopy classes.* RALPH L. COHEN, Stanford University (792-55-485)

1:30– 1:50 (330) *Orthogonal algebraic K-theory and representation theory of finite fields.* Professor ZBIGNIEW FIEDOROWICZ, Ohio State University, Columbus (792-55-426)

2:00– 2:20 (331) *The bu cohomology of the spectra BP⟨n⟩.* Preliminary report. Professor DAVID COPELAND JOHNSON, University of Kentucky (792-55-132)

2:30– 2:50 (332) *A Kahn-Priddy sequence and a conjecture of G. Whitehead.* Professor NICHOLAS J. KUHN, University of Washington (792-55-53)

3:00– 3:20 (333) *Self-maps and indecomposability of loop spaces of spheres.* Preliminary report. Dr. PAUL SELICK, University of Western Ontario (792-55-103)

3:30– 3:50 (334) *The Lichtenbaum-Quillen conjecture for localized higher algebraic K-groups.* R. W. THOMASON, Massachusetts Institute of Technology (792-55-63)

FRIDAY, 1:00 P. M.

Special Session on Ordered Algebraic Structures. I, Convention Center, Room 24

1:00– 1:20 (335) *Free lattice-ordered groups.* Professor STEPHEN H. McCLEARY, University of Georgia (792-06-319)

1:30– 1:50 (336) *Unital l-prime lattice-ordered rings with polynomial constraints are domains.* STUART A. STEINBERG, University of Toledo (792-06-49)

2:00– 2:20 (337) *Nilpotent and weakly abelian lattice ordered groups.* Dr. NORMAN R. REILLY, Simon Fraser University (792-06-162)

2:30– 2:50 (338) *The word problem for lattice-ordered groups.* Professor A. M. W. GLASS, Bowling Green State University (792-06-80)

3:00– 3:20 (339) *Semigroup power series rings.* Preliminary report. JOHN DAUNS, Tulane University (792-06-128)

3:30– 3:50 (340) *Partially ordered semigroups with an abundance of principal idempotents.* Dr. MARLOW E. ANDERSON, Indiana University-Purdue University, Fort Wayne (792-06-249)

4:00– 4:20 (341) *Above and below subgroups of an l-group.* Professor PAUL CONRAD* and MIKE DARNEL, University of Kansas, and Professor RICHARD BALL, Boise State University (792-06-452)

4:30– 4:50 (342) *An example of the lateral completion of a lattice-ordered group.* Preliminary report. J. PATRICK BIXLER, Virginia Polytechnic Institute and State University (792-06-317)

5:00–5:20 (343) *The l-group varieties* L_n. Dr. JO E. SMITH, General Motors Institute, Flint, Michigan (792-06-417)

5:30– 5:50 (344) *Expansions of o-permutation groups.* Preliminary report. Professor KEITH R. PIERCE, University of Minnesota, Duluth (792-06-462)

FRIDAY, 1:00 P. M.

Special Session on Topics in Scattering and Spectral Theory. I, Convention Center, Room 26

1:00– 1:40 (345) *Leading singularity of the reflection of a plane wave by a moving obstacle.* Professor JEFFERY COOPER*, University of Maryland, College Park, and Professor WALTER STRAUSS, Brown University (792-35-5)

1:50– 2:30 (346) *Electromagnetic waves reflecting off a moving conductor.* Preliminary report. Professor JEFFERY COOPER, University of Maryland, College Park, and Professor WALTER STRAUSS*, Brown University (792-78-3)

2:40– 3:20 (347) *Scattering theory for the wave equation with a short range perturbation.* Preliminary report. Professor RALPH S. PHILLIPS, Stanford University (792-35-26)

3:30– 4:10 (348) *Time-dependent Hamiltonians.* JAMES S. HOWLAND, University of Virginia (792-81-517) (Introduced by Professor A. G. Ramm)

4:20– 5:00 (349) *Geometric approach to some multichannel scattering problems in* R^n. Professor JULES M. COMBES, University of Toulon, France (792-81-510) (Introduced by A. G. Ramm)

FRIDAY, 1:00 P. M.

Special Session on Quadratic Forms. I, Convention Center, Room 8

1:00– 1:20 (350) *Hermitian forms over local hereditary orders.* CARL RIEHM, McMaster University (792-20-72)

1:30– 1:50 (351) *Indecomposable symmetric bilinear forms.* WINFRIED SCHARLAU, University of Münster, West Germany (792-12-34) (Introduced by Professor Daniel B. Shapiro)

2:00– 2:20 (352) *Quadratic forms of height two.* Professor ROBERT W. FITZGERALD, Dartmouth College (792-10-84)

2:30– 2:50 (353) *A generalization of the Hasse norm theorem.* Preliminary report. Professor DAVID B. LEEP, University of Chicago (792-12-163)

3:00– 3:20 (354) *On the congruence transformation of a pencil of real symmetric matrices to a pencil with identical characteristic polynomial.* Preliminary report. Professor OLGA TAUSSKY-TODD, California Institute of Technology (792-12-322)

3:30– 3:50 (355) *Growth of class numbers of binary quadratic forms.* Professor ANDREW G. EARNEST, Southern Illinois University, Carbondale (792-10-82)

4:00– 4:20 (356) *Representations by ternary quadratic forms.* Preliminary report. Dr. JAMES W. BENHAM, Ohio State University, Columbus (792-10-516)

FRIDAY, 1:00 P. M.

Session on Foundations, Set Theory and Combinatorics. I, Convention Center, Room 10

1:00– 1:10 (357) *Two separate approaches to capturing dynamics: Mathematical; and algorithmic.* Dr. G. ARTHUR MIHRAM, Princeton, New Jersey (792-00-178)

1:15– 1:25 (358) *Some thoughts on the philosophy of mathematics.* Preliminary report. Dr. LYNN E. GARNER, Brigham Young University, Provo (792-00-263)

1:30– 1:40 (359) *Plato's noble lie.* Preliminary report. PRESTON C. HAMMER, Grand Rapids, Michigan (792-01-479)

1:45– 1:55 (360) *Well foundedness of a system of ordinal notations.* Preliminary report. Dr. JON PEARCE, University of Colorado, Boulder (792-03-447) (Introduced by Professor Jerome I. Malitz)

2:00– 2:10 (361) *Persistently finite, persistently arithmetic theories.* Preliminary report. CHRIS ASH, Monash University, Australia, and TERRENCE MILLAR*, University of Wisconsin, Madison (792-03-477)

2:15– 2:25 (362) *Immutably recursive does not imply formally recursive--the Ash-Nerode theorem is sharp for decidability.* MARK S. MANASSE, University of Wisconsin, Madison (792-03-483)

2:30– 2:40 (363) *Some definability questions in abstract computational complexity theory.* ROBERT E. BYERLY, Texas Tech University (792-03-496)

2:45– 2:55 (364) *A large cardinal property of the first uncountable cardinal under* AD. Preliminary report. Dr. ROBERT MIGNONE, College of Charleston (792-04-159)

3:00– 3:10 (365) *Additivity of measure implies dominating reals.* Dr. ARNOLD W. MILLER, University of Texas, Austin (792-04-206)

3:15– 3:25 (366) *Normal measure one homogeneous sets for restricted infinite exponent partitions on a measurable cardinal.* Preliminary report. RONALD J. WATRO, State University of New York, Buffalo (792-04-264)

3:30– 3:40 (367) *Designs with no three mutually disjoint blocks.* Preliminary report. Professor A. BAARTMANS, Southern Illinois University, Carbondale, and Professor MOHAN SHRIKHANDE*, Central Michigan University (792-05-89)

3:45– 3:55 (368) *N-homogeneous graphs.* Dr. RUSSELL W. MYERS, JR., Southampton College (792-05-97)

4:00– 4:10 (369) *Vertex-transitive digraphs of prime power order.* Preliminary report. DANIEL GOLDSTEIN, University of Chicago (792-05-98) (Introduced by Professor J. A. Gallian)

4:15– 4:25 (370) *A combinatorial analog of the Jordan curve theorem.* SAUL STAHL, University of Kansas (792-05-131)

4:30– 4:40 (371) *k-ply Hamiltonian circuits.* KEVIN KEATING, Washington University (792-05-179) (Introduced by Professor J. A. Gallian)

4:45– 4:55 (372) *Graph reconstruction.* Professor STEVEN E. ANACKER, Louisiana State University, Baton Rouge (792-05-200)

5:00– 5:10 (373) *q-counting n-dimensional lattice paths.* Dr. ROBERT A. SULANKE, Boise State University (792-05-260) (Introduced by Professor Richard N. Ball)

5:15– 5:25 (374) *One- and two-way infinite Hamiltonian paths in Cayley digraphs of infinite groups.* IRWIN JUNGREIS, Cornell University (792-05-265) (Introduced by Professor J. A. Gallian)

5:30– 5:40 (375) *Series-parallel graphs: a logical approach.* Dr. TERRY A. McKEE, Wright State University, Dayton (792-05-266)

5:45– 5:55 (376) *Smallest cubic and quartic graphs with a given number of cutpoints and bridges.* Dr. G. CHARTRAND and F. SABA, Western Michigan University, Dr. J. K. COOPER, Eastern Michigan University, Dr. F. HARARY, University of Michigan, Ann Arbor, and Dr. C. E. WALL*, Old Dominion University (792-05-391)

6:00– 6:10 (377) *Odd triperfect numbers.* Dr. MASAO KISHORE, University of Toledo (792-10-205)

6:15– 6:25 (378) *Sums of three primes and the generalized Riemann hypothesis.* Preliminary report. Professor J. MARSHALL ASH, De Paul University (792-10-376)

FRIDAY, 1:00 P. M.

Session on Category Theory, Group Theory, Lie Groups, Convention Center, Room 9

1:00– 1:10 (379) *A q-analog of the Campbell-Baker-Hausdorff formula.* Professor DAVID L. REINER, Grinnell College (792-17-339)

1:15– 1:25 (380) *Conditions on a nonassociative ring for nucleus equal to center.* Preliminary report. Professor TAE-IL SUH, East Tennessee State University (792-17-272)

1:30– 1:40 (381) *Abelian centralizers in semisimple Lie algebras.* Dr. STEVE E. BOWSER, Bucknell University (792-17-486)

1:45– 1:55 (382) *Injective hulls of finite-dimensional modules over solvable Lie algebras.* Preliminary report. RANDALL DAHLBERG, University of Oklahoma (792-17-494)

2:00– 2:10 (383) *Partially ordered closed categories, ideals, and mixed lattice semigroups.* Preliminary report. Professor KIMMO ROSENTHAL, University of New Hampshire (792-18-150)

2:15– 2:25 (384) *Picard group and categorical groups.* Preliminary report. Dr. ALEXANRU SOLIAN, University of North Carolina, Charlotte (792-18-320)

2:30– 2:40 (385) *The norm-recipient in a topos.* J. Z. REICHMAN, University of Dayton (792-18-401)

2:45– 2:55 (386) *Some theorems for Boolean groups.* Professor IRVING H. ANELLIS, University of Minnesota, Duluth (792-20-154)

3:00– 3:10 (387) *Maximal inverse subsemigroups of $S(X)$.* Preliminary report. Professor BRIDGET B. BAIRD, University of Florida (792-20-175)

3:15– 3:25 (388) *Periodic properties of groupbound semigroups.* Professor B. L. MADISON*, University of Arkansas, Dr. T. K. MUKHERJEE, Jadavpur University, India, and Dr. M. K. SEN, University of Calcutta, India (792-20-176)

3:30– 3:40 (389) *Representations and automorphisms of discrete groups.* Professor HYMAN BASS, Columbia University, and Dr. ALEXANDER LUBOTZKY*, Columbia University and Bar-Ilan University, Israel (792-20-273)

3:45– 3:55 (390) *Inner points and breadth in certain compact semilattices.* Professor D. R. BROWN and Professor JAMES W. STEPP*, University of Houston, Houston (792-20-274)

4:00– 4:10 (391) *Regularity of the closure of reductive groups.* Professor MOHAN S. PUTCHA, North Carolina State University (792-20-309)

4:15– 4:25 (392) *Semigroups with isomorphic endomorphism semigroups.* Preliminary report. Professor BORIS M. SCHEIN, University of Arkansas, Fayetteville (792-20-343)

4:30– 4:40 (393) *Infinite symmetric groups, maximal subgroups, and filters.* Preliminary report. STEPHEN W. SEMMES, Washington University (792-20-373)

4:45– 4:55 (394) *Finite solvable groups having conjugate splitting systems.* Professor H. BECHTELL, University of New Hampshire (792-20-379)

5:00– 5:10 (395) *Group congruences on regular semigroups.* Professor DON LaTORRE, Clemson University (792-20-508)

5:15– 5:25 (396) *Minimal ideals and maximal groups in βN.* Professor NEIL HINDMAN, Howard University (792-22-153)

5:30– 5:40 (397) *Topological groups with small invariant neighborhoods.* Preliminary report. Professor R. W. BAGLEY, University of Miami, and Professor J. S. YANG*, University of South Carolina, Columbia (792-22-370)

5:45– 5:55 (398) *Closures of weakened analytic groups.* T. CHRISTINE STEVENS, Arkansas State University (792-22-398)

6:00– 6:10 (399) *Coadjoint orbits of nilpotent Lie groups.* Preliminary report. Professor THOMAS A. FARMER, Miami University, Ohio (792-22-407)

6:15– 6:25 (400) *Evaluation of projection operators on L^2 of a nilmanifold at rational points of the group.* Preliminary report. Professor WILLIAM G. FREDERICK, Indiana University-Purdue University, Fort Wayne (792-22-450)

FRIDAY, 1:00 P. M.

Session on Finite Differences, Summability and Harmonic Analysis, Convention Center, Room 1

1:00– 1:10 (401) *On some functional equations from additive and nonadditive measures,* V. PL. KANNAPPAN, University of Waterloo (792-39-148)

1:15– 1:25 (402) *Second order nonlinear difference equations: nonoscillation.* JOHN W. HOOKER and WILLIAM T. PATULA*, Southern Illinois University, Carbondale (792-39-152)

1:30– 1:40 (403) *Difference equations and multipoint boundary value problems.* Dr. PAUL W. ELOE, University of Dayton (792-39-171)

1:45– 1:55 (404) *Unbounded trajectories in superlinear functional equations.* Professor BHAGAT SINGH, University of Wisconsin, Manitowoc (792-39-279)

2:00– 2:10 (405) *A difference equation analogue for Atkinson's oscillation criterion.* Professor JOHN W. HOOKER*, and Professor WILLIAM T. PATULA, Southern Illinois University, Carbondale (792-39-280)

2:15– 2:25 (406) *A problem in summability and asymptotics.* Professor K. SONI* and Professor R. P. SONI, University of Tennessee, Knoxville (792-40-427)

2:30– 2:40 (407) *Series as functions on the Cantor set.* Preliminary report. Dr. NICHOLAS PASSELL, University of South Florida, New College (792-40-469)

2:45– 2:55 (408) *Convergence of the Pólya algorithm.* Professor RICHARD B. DARST, Colorado State University, and Professor DAVID A. LEGG* and Professor DOUGLAS W. TOWNSEND, Indiana University-Purdue University, Fort Wayne (792-41-243)

3:00– 3:10 (409) *On polynomials with interior constraints.* Preliminary report. Dr. MICHAEL A. LACHANCE, University of Michigan, Dearborn (792-41-414)

3:15– 3:25 (410) *A generalization of Blumenthal's theorem of the three term recursion relationship for orthogonal polynomials.* Preliminary report. Professor JOSEPH L. ULLMAN, University of Michigan, Ann Arbor (792-41-459)

3:30– 3:40 (411) *Estimates for polyharmonic splines.* Preliminary report. Professor W. R. MADYCH* and E. H. POTTER, Iowa State University (792-41-505)

3:45– 3:55 (412) *On the L^1-convergence of Fourier series.* Preliminary report. Dr. WILLIAM O. BRAY, University of Maine, Orono (792-42-227)

4:00– 4:10 (413) *An F. and M. Riesz theorem for generalized Walsh-Fourier series.* Professor J.-A. CHAO, Cleveland State University (792-42-355)

4:15– 4:25 (414) *Hilbert transforms and the geometry of plane curves.* Preliminary report. WILLIAM NESTLERODE, University of South Carolina, Columbia (792-42-408)

4:30– 4:40 (415) *A relationship with $L \log^+ L$ and the Hilbert transform.* GERALDO SOARES DE SOUZA, Syracuse University (792-42-433)

4:45– 4:55 (416) *The range of the transform of certain parts of a measure.* Preliminary report. Dr. KERRITH B. CHAPMAN*, LeMoyne College, and Dr. LOUIS PIGNO, Kansas State University (792-43-160)

5:00– 5:10 (417) *A general maximal operator and the A_p-condition.* MARK A. LECKBAND* and Professor CHRISTOPH J. NEUGEBAUER, Purdue University, West Lafayette (792-43-229)

5:15– 5:25 (418) *A characterization of $A(T)$ among its subalgebras.* Preliminary report. Dr. SUNG-WOO SUH, Louisiana State University (792-43-261)

5:30– 5:40 (419) *Distal compactifications of semitopological semigroups.* Professor H. D. JUNGHENN, George Washington University (792-43-282)

5:45– 5:55 (420) *Bounded synthesis and a class of U_0-sets.* Preliminary report. DAVID COLELLA, Youngstown State University (792-43-476)

FRIDAY, 1:00 P. M.

Session on Functional Analysis and Operator Theory, Convention Center, Room 25

1:00– 1:10 (421) *Plurisubharmonic functions associated with uniform algebras.* Professor DONNA KUMAGAI, Pennsylvania State University, Berks Campus, Reading (792-32-68)

1:15– 1:25 (422) *The leviform and* CR *extension.* Preliminary report. Dr. AL BOGGESS*, University of Michigan, Ann Arbor, and Dr. JOHN C. POLKING, Rice University (792-32-144)

1:30– 1:40 (423) *Oscillation and asymptotic behaviour of nonlinear equations with middle terms of order $n-1$ and forcings.* Dr. WITOLD A. KOSMALA, University of Tampa (792-34-348) (Introduced by Dr. M. Manougian)

1:45– 1:55 (424) *Strongly damped nonlinear evolution equations.* Preliminary report. Professor SAMUEL M. RANKIN III, Mathematics Research Center, Madison, Wisconsin, and West Virginia University (792-34-415)

2:00– 2:10 (425) *The dual of the space of sections of a Banach bundle.* Professor J. W. KITCHEN, Duke University, and Professor D. A. ROBBINS*, Trinity College, Hartford (792-46-33)

2:15– 2:25 (426) *Reflexivity of operator spaces.* Dr. J. M. BAKER, Western Carolina University (792-46-124)

2:30– 2:40 (427) *Isometries of vector valued functions.* Preliminary report. J. E. JAMISON and IRENE H. LOOMIS*, Memphis State University (792-46-149)

2:45– 2:55 (428) *Local approximation and uniform algebras.* Preliminary report. R. C. SMITH* and W. H. SUMMERS, University of Arkansas, Fayetteville (792-46-233)

3:00– 3:10 (429) *Fixed points for multivalued nonexpansive mappings in linear topological spaces.* Dr. K. L. SINGH*, University of Minnesota, Duluth, and Dr. J. H. M. WHITFIELD, Lakehead University (792-46-283)

3:15– 3:25 (430) *Automatic continuity of homomorphisms into Banach algebras.* Professor JOHN C. TRIPP, Southeast Missouri State University (792-46-285)

3:30– 3:40 (431) *Nonlinear eigenvalue problems with infinite dimensional parameters.* MARIA PATRIZIA PERA and ALLAN L. EDELSON*, Istituto Matematicà, Università di Firenze, Italy (792-46-306)

3:45– 3:55 (432) *The Radon-Nikodým property for the space of operators.* Professor KEVIN T. ANDREWS, Texas A&M University, College Station (792-46-342)

4:00– 4:10 (433) *A new orthogonality relation for normed linear spaces.* Preliminary report. Professor CHARLES R. DIMINNIE, St. Bonaventure University (792-46-357)

4:15– 4:25 (434) *The J-sum of Banach spaces.* Preliminary report. Professor STEVEN F. BELLENOT, Florida State University (792-46-394)

4:30– 4:40 (435) *(LF)-spaces, quasi-Baire spaces and the strongest locally convex topology.* Preliminary report. Dr. STEPHEN A. SAXON*, University of Florida, and Dr. P. P. NARAYANASWAMI, Memorial University of Newfoundland (792-46-438)

4:45– 4:55 (436) *A class of n-dimensional symmetric normed spaces which do not uniformly contain $l_p^{n^\alpha}$ for any $\alpha > 0$, $1 \leqslant p \leqslant \infty$.* Preliminary report. PATRICK FLINN*, Ohio State University, Columbus, and CARSTEN SCHUTT, Johannes Kepler Universität Linz (792-46-455)

5:00– 5:10 (437) *Extension of functions in Besov and Sobolev spaces.* Dr. DAVID WILLIAM HUTCHISON, Indiana State University, Terre Haute (792-46-456) (Introduced by Professor Hyun Joon Ahn)

5:15– 5:25 (438) *Unicellular shifts on Banach spaces.* Professor SANDY GRABINER, Indiana University, Bloomington (792-47-36)

5:30– 5:40 (439) *A stronger metric for the closed linear operators densely defined in a Hilbert space.* Preliminary report. Professor WILLIAM E. KAUFMAN, Ohio University, Athens (792-47-143)

5:45– 5:55 (440) *Positive operators on operator algebras.* Dr. NAZANIN AZARNIA*, Miami University, Ohio, and Professor J. D. M. WRIGHT, University of Reading, England (792-47-186)

6:00– 6:10 (441) *Closure properties of operators on the second dual of the space of continuous functions.* Professor DAVID C. CAROTHERS, Hope College (792-47-52)

FRIDAY, 2:10 P. M.

Invited Address, Convention Center, North Meeting Room

(442) *C*-algebraic structure and noncommutative geometry.* Professor EDWARD GEORGE EFFROS, University of California, Los Angeles (792-46-464)

FRIDAY, 3:20 P. M.

Invited Address, Convention Center, North Meeting Room

(443) *What is a quantum field theory*? Professor DAVID C. BRYDGES, University of Virginia (792-81-207)

SATURDAY, 1:00 P. M.

Colloquium Lectures: Lecture IV, Convention Center, North Meeting Room

(444) *Geometry, iteration, and group theory.* Professor DENNIS SULLIVAN, City University of New York, Graduate School and University Center

SATURDAY, 1:00 P. M.

Special Session on Algebraic Topology. II, Convention Center, Room 3

1:00– 1:20 (445) *The A-algebra structure of Thom spectra*: MSO *as an example.* Dr. DAVID J. PENGELLEY, Massachusetts Institute of Technology (792-55-130)

1:30– 1:50 (446) *Lie groups and finite groups.* Preliminary report. Professor MORTON L. CURTIS, Rice University (792-20-102)

2:00– 2:20 (447) *The cohomology of classifying spaces of compact Lie groups and their finite subgroups.* Preliminary report. MARK FESHBACH, University of Minnesota, Minneapolis (792-55-54)

2:30– 2:50 (448) *Morava K-theory and finite H-spaces.* Preliminary report. Professor RICHARD M. KANE, University of Western Ontario (792-55-61) (Introduced by Professor Charles A. McGibbon)

3:00– 3:20 (449) *Commutative algebra over the Steenrod algebra and finite loop spaces with p-torsion.* Professor DAVID L. RECTOR, University of California, Irvine (792-55-453)

3:30– 3:50 (450) *The width of homotopies.* Dr. ALLAN CALDER, Birkbeck College, University of London, Dr. JERROLD SIEGEL, University of Missouri, St. Louis, and Dr. FRANK WILLIAMS*, New Mexico State University, Las Cruces (792-55-46)

SATURDAY, 1:00 P. M.

Special Session on Topics in Scattering and Spectral Theory. II, Convention Center, Room 26

1:00– 1:40 (451) *Spectral properties of some nonselfadjoint operators and applications.* Professor A. G. RAMM, Kansas State University (792-47-4)

1:50– 2:30 (452) *On the linearization of the Korteweg-deVries and Painlevé II equations.* Professor MARK J. ABLOWITZ* and ATHANASSIOS J. FOKAS, Clarkson College of Technology (792-35-509) (Introduced by Professor A. G. Ramm)

2:40– 3:20 (453) *A generalized Hilbert problem and its applications to inverse scattering.* ROGER G. NEWTON, Indiana University, Bloomington (792-47-23) (Introduced by Professor A. G. Ramm)

3:30– 4:10 (454) *An inequality for the reduced wave operator and applications to geometrical optics.* HANS-DIETER ALBER, Universität Bonn, Federal Republic of Germany (792-78-35) (Introduced by Professor A. G. Ramm)

4:20– 5:00 (455) *Spectral analysis and scattering theory for acoustic signals in plane-stratified fluids.* Professor CALVIN H. WILCOX, University of Utah (792-35-363)

5:10– 5:50 (456) *Absence of discrete spectrum in highly negative ions.* Professor MARY BETH RUSKAI, University of Lowell (792-81-223)

SATURDAY, 1:00 P. M.

Special Session on Quadratic Forms. II, Convention Center, Room 8

1:00– 1:20 (457) *Ultraproducts of fields and Witt rings.* Preliminary report. Professor MURRAY A. MARSHALL, University of Saskatchewan (792-12-512)

1:30– 1:50 (458) *Witt rings of local type.* Preliminary report. Professor JOSEPH L. YUCAS, Southern Illinois University, Carbondale (792-10-83)

2:00– 2:20 (459) *Reduced forms and Witt rings of higher level.* Professor EBERHARD BECKER, University of Dortmund, Federal Republic of Germany, and Professor ALEX ROSENBERG*, Cornell University (792-10-425)

2:30– 2:50 (460) *The Galois group of the Pythagorean closure of a formally real field.* Preliminary report. Professor ROGER WARE, Pennsylvania State University, University Park (792-10-104)

3:00– 3:20 (461) *Quadratic forms under semi-local transcendental extension.* Preliminary report. Professor RICARDO BAEZA*, Universidad de Chile, Santiago (792-12-470) (Introduced by Professor Daniel B. Shapiro)

3:30– 3:50 (462) *When are generalized real closures of a field isomorphic*? Preliminary report. RON BROWN, University of Hawaii, Honolulu (792-12-313)

4:00– 4:20 (463) *Remarks on intersections of value sets of Pfister forms.* Preliminary report. Dr. JONATHAN L. MERZEL, Holy Names College (792-12-429)

SATURDAY, 1:00 P. M.

Special Session on Ordered Algebraic Structures. II, Convention Center, Room 24

1:00– 1:20 (464) *Intrinsic metrics for lattice ordered groups.* Professor W. CHARLES HOLLAND, Bowling Green State University (792-06-471)

1:30– 1:50 (465) *Semigroup-lattices.* Preliminary report. Dr. JORGE MARTINEZ, University of Florida (792-06-88)

2:00– 2:20 (466) *On some automorphism groups of the real numbers.* Preliminary report. MANFRED DROSTE, Bowling Green State University (792-06-81) (Introduced by Dr. W. C. HOLLAND)

2:30– 2:50 (467) *Retractability of some two-generator, one-relator groups.* Preliminary report. Professor JUSTIN T. LLOYD, University of Houston, Houston (792-06-182) (Introduced by Professor G. J. Etgen)

3:00– 3:20 (468) *Varieties of representable l-groups.* Dr. TODD FEIL, University of Akron (792-06-216)

3:30– 3:50 (469) *l-group completions by means of lattice completions.* Preliminary report. Dr. RICHARD N. BALL, Boise State University (792-06-318)

4:00– 4:20 (470) *Amalgamations of lattice ordered groups.* Professor WAYNE B. POWELL, Oklahoma State University, Stillwater, and Professor CONSTANTINE TSINAKIS*, Vanderbilt University (792-06-316)

4:30– 4:50 (471) *Recognizing homogeneous chains by elementary properties of their automorphism groups.* Professor YURI GUREVICH, Ben-Gurion University, Israel, and Bowling Green State University (792-06-528)

5:00– 5:20 (472) *Unique product elements and right orders in groups.* Preliminary report. Dr. F. D. PEDERSEN, Southern Illinois University, Carbondale (792-06-209)

5:30– 5:50 (473) *Precedence in finite semigroups.* Preliminary report. Professor PIERRE A. GRILLET, Tulane University (792-20-151)

SATURDAY, 1:00 P. M.

Session on Foundations, Set Theory, and Combinatorics. II, Convention Center, Room 10

1:00– 1:10 (474) *Face colorings of embedded graphs.* Preliminary report. DAN ARCHDEACON, University of Kansas, Lawrence (792-05-267)

1:15– 1:25 (475) *The acyclic intermediate partition conjecture.* Preliminary report. Professor GARY CHARTRAND, Professor S. F. KAPOOR, and Professor LINDA LESNIAK-FOSTER*, Western Michigan University, and Professor FRANK HARARY, University of Michigan, Ann Arbor (792-05-327)

1:30– 1:40 (476) *Topological invariants of 2-designs.* Professor NEAL BRAND* and Professor W. CARY HUFFMAN, Loyola University, Chicago (792-05-337)

1:45– 1:55 (477) *Applications of topological invariants of 2-designs.* Professor W. CARY HUFFMAN* and Professor NEAL BRAND, Loyola University, Chicago (792-05-338)

2:00– 2:10 (478) *Polynomial expansions with an umbral twist.* JOHN M. FREEMAN, Florida Atlantic University (792-05-371) (Introduced by Professor Frederick Hoffman)

2:15– 2:25 (479) *Non-standard minimal graphs with given abelian 3-group.* Professor WILLIAM C. ARLINGHAUS, Loyola University, Chicago (792-05-375)

2:30– 2:40 (580) *Box-threshold graphs.* URI N. PELED*, Columbia University, and BRUNO SIMEONE, Istituto "M. Picone", Rome (792-05-388)

2:45– 2:55 (481) *The structure of minimally strong directed graphs.* JEFFREY A. ROSS, University of South Carolina, Columbia (792-05-392)

3:00– 3:10 (482) *Association hypergraphs.* Preliminary report. SAMUEL F. BARGER, Youngstown State University (792-05-393)

3:15– 3:25 (483) *Homomorphisms, folds and absolutely n-chromatic graphs.* Dr. ANTHONY BRIAN EVANS, Wright State University, Dayton (792-05-395)

3:30– 3:40 (484) *Hamiltonian paths in cartesian products of directed cycles.* STEPHEN J. CURRAN, Beloit College, and DAVID WHITE*, University of Chicago (792-05-396)

3:45– 3:55 (485) *On the reverse of a hamiltonian cycle.* Preliminary report. Professor JOSEPH B. KLERLEIN* and Professor A. GREGORY STARLING, Western Carolina University (792-05-397)

4:00– 4:10 (486) *Intersection graphs* II: *Intersection numbers, a theme and variations.* Professor JERALD A. KABELL, University of Cincinnati (792-05-439)

4:15– 4:25 (487) *(s, c, a, k)-graphs and distance-regular graphs.* Preliminary report. PAUL A. TERWILIGER, University of Illinois, Urbana-Champaign (792-05-444)

4:30– 4:40 (488) *Chains and fixing blocks in irreducible binary sequences.* Dr. ROBERT O. SHELTON*, Michigan Technical University, and Dr. RAJ PAL SONI, University of Tennessee, Knoxville (792-05-446)

4:45– 4:55 (489) *On some properties of Halin graphs.* Preliminary report. Professor LOWELL W. BEINEKE*, Indiana University-Purdue University, Fort Wayne, and ANTHONY HILL, University College, University of London (792-05-451)

5:00– 5:10 (490) *Tiling regular convex and stellated polygons with rhombs and pairs of rhombs.* Professor ALAN H. SCHOEN, Southern Illinois University, Carbondale (792-05-463)

5:15– 5:25 (491) *Sequential labellings of graphs.* THOM GRACE, University of Illinois, Chicago Circle (792-05-466)

5:30– 5:40 (492) *Some properties of the generalized Bernoulli polynomials.* Dr. DONALD R. SNOW, Brigham Young University, Provo (792-05-488)

5:45– 5:55 (493) *Domination in $K_{1,3}$-free graphs.* Preliminary report. Professor DAVID P. SUMNER, University of South Carolina, Columbia (792-05-488)

SATURDAY, 1:00 P. M.

Session on Measures and Complex Variables, Convention Center, Room 25

1:00– 1:10 (494) *On the magnitude of Fourier coefficients.* MICHAEL SCHRAMM* and Professor DANIEL WATERMAN, Syracuse University, Syracuse (792-26-356)

1:15– 1:25 (495) *Uniform σ-additivity of Bochner integrable functions over a locally compact group.* Preliminary report. Professor NICOLAE DINCULEANU, University of Florida (792-28-25)

1:30– 1:40 (496) *Sets with the weak Radon-Nikodým property in dual Banach spaces.* LAWRENCE H. RIDDLE* and Professor J. J. UHL, JR., University of Illinois, Urbana-Champaign, and Professor ELIAS SAAB, University of Missouri (792-28-232)

1:45– 1:55 (497) *A simple proof of the ergodic theorem.* PAUL C. SHIELDS, Stanford University (792-28-386) (Introduced by Professor Henry Wente)

2:00– 2:10 (498) *Characterisations of universally measurable spaces and the marginal problem.* Preliminary report. RAE MICHAEL SHORTT, Massachusetts Institute of Technology (792-28-428)

2:15– 2:25 (499) *Starlike and prestarlike hypergeometric functions.* Preliminary report. Professor B. C. CARLSON*, Ames Laboratory-DOE, Iowa State University, and Professor DOROTHY B. SHAFFER, Fairfield University (792-30-39)

2:30– 2:40 (500) *Differential conditions for functions of a quaternion variable equivalent to regularity in the sense of Fueter.* Professor HERBERT H. SNYDER, Southern Illinois University, Carbondale, and Indiana Christian University, Indianapolis (792-30-161)

2:45– 2:55 (501) *Coefficient bounds for quotients of starlike functions.* HERB SILVERMAN, College of Charleston (792-30-172)

3:00– 3:10 (502) *A coefficient test for singularities.* Preliminary report. DEBORAH A. FRANTZ, Lehigh University (792-30-244) (Introduced by J. P. King)

3:15– 3:25 (503) *Regular functions on a degenerate quaternion algebra.* Preliminary report. Professor RALPH W. WILKERSON, Winthrop College (792-30-324)

3:30– 3:40 (504) *Julia sets, invariant measure, and orthogonal polynomials.* Preliminary report. Dr. M. F. BARNSLEY, Dr. J. S. GERONIMO, and Dr. A. N. HARRINGTON*, Georgia Institute of Technology (792-30-328)

3:45– 3:55 (505) *Infinite Blaschke products.* Professor MYRON GOLDSTEIN, Arizona State University (792-30-329)

4:00– 4:10 (506) *Generalised growth and rate of convergence for a power series of functions analytic in a finite disc.* Preliminary report. Professor HARI SHANKAR, Ohio University, Athens (792-30-380)

4:15– 4:25 (507) *Fourier coefficients of nonanalytic automorphic forms.* Professor V. V. RAO, University of Regina (792-30-431)

4:30– 4:40 (508) *An update on the radius of starlikeness of* $\mathcal{R}$. Professor KENT PEARCE, Texas Tech University (792-30-436)

4:45– 4:55 (509) *Colorfully locating fixed points.* Preliminary report. Dr. ARTHUR M. DuPRÉ, Forest Heights, Maryland (792-30-472)

5:00– 5:10 (510) *A distortion theorem for close-to-convex functions.* Professor J. R. QUINE, Florida State University (792-30-493)

5:15– 5:25 (511) *An infinitely divisible distribution involving modified Bessel functions.* Dr. MOURAD E. H. ISMAIL*, Tempe, Arizona, and Dr. KENNETH S. MILLER, Riverside Research Institute, Arlington, Virginia (792-33-1)

5:30– 5:40 (512) *A Mehler type formula for the continuous q-ultraspherical polynomials.* Professor GEORGE GASPER*, Northwestern University, and Professor MIZAN RAHMAN, Carleton University (792-33-234)

5:45– 5:55 (513) *The Dirichlet problem for* $\Delta^2 u = 0$ *on a* C^1 *domain.* Preliminary report. JONATHAN COHEN, University of Tennessee, Knoxville, and JOHN GOSSELIN*, University of Georgia (792-35-278)

6:00– 6:10 (514) *Generalized Tychonoff theorem in extending the generalized Stone-Weierstrass theorems.* Dr. HUEYTZEN J. WU, Texas A&I University (792-46-12)

SATURDAY, 1:00 P. M.

Session on Probability, Statistics, Numerical Analysis and Computer Science, Convention Center, Room 9

1:00– 1:10 (515) *Stochastic processes with ugly sample functions.* Professor TOM S. PITCHER, University of Hawaii (792-60-57) (Introduced by H. S. Bear)

1:15– 1:25 (516) *Partial barrier-crossing probabilities for the Wiener process.* Professor CHULL PARK* and Professor FRED J. SCHUURMANN. Miami University, Oxford (792-60-239)

1:30– 1:40 (517) *Bivariate step processes and random evolutions.* Preliminary report. Professor KYLE SIEGRIST, University of Alabama, Huntsville (792-60-346)

1:45– 1:55 (518) *Optional times of a Markov process.* Preliminary report. Professor BRUCE W. ATKINSON, University of Southern California (792-60-349)

2:00– 2:10 (519) *The parameter* R_0 *for the Gaussian Channel.* ROBERT J. McELIECE, University of Illinois, Urbana, and EUGENE RODEMICH*, Jet Propulsion Laboratory, Pasadena (792-60-372)

2:15– 2:25 (520) *When do weighted sums of independent r. v.'s have a density*? Preliminary report. JAKOB I. REICH, City University of New York, Baruch College (792-60-411)

2:30– 2:40 (521) *On the linearity of regression.* Professor CLYDE HARDIN, University of Wisconsin, Milwaukee (792-60-484)

2:45– 2:55 (522) *Prophet inequalities and order selection in optimal stopping problems.* Preliminary report. Professor T. P. HILL, Georgia Institute of Technology (792-60-499)

3:00– 3:10 (523) *A central limit problem for random evolutions.* JOSEPH C. WATKINS, University of Wisconsin, Madison (792-60-507)

3:15– 3:25 (524) *Reversing excursions of dual Markov processes using an auxiliary process.* Preliminary report. Professor JOANNA B. MITRO, University of Cincinnati (792-60-521)

3:30– 3:40 (525) *Small sample quantile estimation of the exponential distribution using optimal spacings.* Professor M. MASOOM ALI* and Dr. DALE UMBACH, Ball State University, and Professor A. K. MD. EHSANES SALEH, Carleton University (792-62-94)

3:45– 3:55 (526) *Some new results in SSOR (symmetric successive overrelaxation) iterative method.* Preliminary report. Dr. LALA B. KRISHNA, University of Akron (792-65-413)

4:00– 4:10 (527) *Euler-Maclaurin expansions for integrals over a triangle and a square with singularities along an edge.* Dr. AVRAM SIDI, Computer Science, Technion—Institute of Technology, Israel and NASA—Lewis Research Center, Cleveland, Ohio (792-65-474) (Introduced by Professor Israel Navot)

4:15– 4:25 (528) *Numerical solution of Volterra integral equations with continuous or discontinuous terms.* BARUCH CAHLON*, Oakland University, and DAVID WESTREICH, Ben Gurion University of the Negev, Israel (792-65-481) (Introduced by Professor Darrell Schmidt)

4:30– 4:40 (529) *Frequency algorithms for unordered trees.* Preliminary report. Professor NED I. ROSEN, Boston College (792-68-203)

4:45– 4:55 (530) *A constructive method for solving the unit circle problem.* Preliminary report. Dr. B. N. DATTA, Northern Illinois University (728-65-198)

5:00– 5:10 (531) *On induced economic change in precapitalist societies.* Professor STEPHEN B. MAURER* and Professor FREDERIC L. PRYOR, Swarthmore College (792-92-138)

Tulane University
New Orleans, Louisiana

Frank T. Birtel
Associate Secretary

LECTURES IN APPLIED MATHEMATICS

NONLINEAR OSCILLATIONS IN BIOLOGY
edited by *Frank C. Hoppensteadt*

This seminar, sponsored jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics, was held at the University of Utah from June 12 to June 23, 1978, and intended as an introduction to the theory and methods of nonlinear oscillations and how they are used to study oscillatory phenomena in the life sciences. A core series of lectures by L. N. Howard, in-depth case studies by A. S. Winfree and C. Steele and background lectures on mathematical topics by J. Guckenheimer, J. K. Hale, F. C. Hoppensteadt, D. Ludwig and O. E. Rössler are reproduced in these proceedings. Additional lectures on cell metabolism, population dynamics, perturbation theory, neural sciences, epidemiology and reaction-diffusion systems were given but without written record. The program for the seminar was organized by W. S. Childress (Courant Institute of Mathematical Sciences, New York University), D. S. Cohen (California Institute of Technology), F. C. Hoppensteadt (University of Utah), P. Waltman (University of Iowa), and A. S. Winfree (Purdue University).

This book is an unusual and useful collection of applied and theoretical articles geared toward introducing the reader to a wide variety of methods in nonlinear oscillations. It will be of interest to applied mathematicians, bioengineers, and biophysicists who have a background of undergraduate mathematics (calculus, differential equations), and some graduate mathematics (diffusion processes, fluid mechanics). It contains summaries of some recent applications of nonlinear oscillations methods in life sciences. The papers are directed at introducing mathematically adept scientists to recent methods and results.

Volume 17, x + 253 pages
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Publication date: November 1979
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Bryn Mawr, March 16–17, Bryn Mawr College

First Announcement of the 793rd Meeting

The seven hundred ninety-third meeting of the American Mathematical Society will be held at Bryn Mawr College, Bryn Mawr, Pennsylvania, on Tuesday and Wednesday, March 16-17, 1982. The meeting will be followed by a symposium sponsored by the Association for Women in Mathematics to commemorate the 100th anniversary of the birth of the celebrated mathematician Emmy Noether.

Invited Addresses

By invitation of the Committee to Select Hour Speakers for Eastern Sectional Meetings, there will be four invited one-hour addresses. The speakers, and the titles of their talks, are as follows:

ALBRECHT FRÖLICH, University of London, England, and the University of Illinois, Urbana-Champaign, *Rings of integers as Galois modules.*

STEPHEN S. SHATZ, University of Pennsylvania, Philadelphia, Title to be announced.

NANCY K. STANTON, University of Notre Dame, *The heat equation in several complex variables.*

LEONID N. VASERSTEIN, Pennsylvania State University, University Park, *Classical groups over rings.*

Special Sessions

By invitation of the same committee, there will be twelve special sessions of selected twenty-minute papers, some of which will be related to the Noether Symposium. The topics of these special sessions, names of the organizers, and partial lists of speakers are as follows:

Constructive methods in algebra, CHRISTINE AYOUB, Pennsylvania State University, University Park. A partial list of the speakers includes G. Baumslag, J. T. B. Beard, Jr., W. W. Boone, B. Caviness, Ray Mines, Anil Nerode, F. Richman, D. Y. Yun, and H. Zassenhaus.

Galois module structure of algebraic integers, ALBRECHT FRÖLICH.

Combinatorics and graph theory, C. W. GRINSTEAD, Virginia Polytechnic Institute and State University, and STEPHEN MAURER, Swarthmore College. The speakers will include Robert Bland, Robert Calderbank, Fan Chung, Donald Coopersmith, Jerrold Griggs, Daniel Kleitman, Thomas Leighton, Andrew Odlyzko, Torrence Parsons, Scott Provan, David P. Robbins, Fred Roberts, Doug West, and Thomas Zaslavsky.

Functional analysis, RHONDA HUGHES, Bryn Mawr College. Speakers will include Allan Devinatz, Seymor Goldberg, Mark Kon, Catherine Olsen, and Judy Packer.

Applied mathematics, FERN HUNT, Howard University. Speakers will include Gail Carpenter, G. Bard Ermentrout, Annett Nold, and Jane Cronin Scanlon.

Differential and differential-delay equations, MARIO MARTELLI, Bryn Mawr College, and ROGER D. NUSSBAUM, Rutgers University. A partial list of speakers includes Jack Hale, James Yorke, Roger D. Nussbaum, John Mallet-Paret, Shui-nee Chow, and Jerry Shuur.

Mathematics of voting and bargaining, SAMUEL MERRILL, Wilkes College. The speakers will include Francine F. Abeles, Arthur Q. Frank, William V. Gehrlein, Samuel Merrill, and Edward W. Packel.

Applications of algebra, VERA PLESS, University of Illinois at Chicago Circle.

Algebraic geometry and cognate areas: Algebra, number theory, commutative algebra, STEPHEN S. SHATZ.

Representation theory of finite groups, BHAMA SRINIVASAN, University of Illinois at Chicago Circle.

Several complex variables, NANCY K. STANTON.

Algebraic K- and L-theory, LEONID N. VASERSTEIN. A partial list of speakers includes Hyman Bass, S. Bloch, R. Charney, K. Dennis, B. Magurn, A. Ranicki, M. Stein, R. Swan, C. Weibel.

Most of the papers to be presented at these special sessions will be by invitation. However, anyone submitting an abstract for the meeting who feels that his or her paper would be particularly appropriate for any of these special sessions should indicate this clearly on the abstract and submit it by **January 4**, two weeks before the deadline for contributed papers.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Abstracts should be sent to the American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940, so as to arrive **prior to the deadline of January 18**. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in departments of mathematics.

Council Meeting

The Council of the Society will meet at 7:00 p.m. on Tuesday, March 16, in Delaware Room 1 at the Philadelphia Marriott Hotel, City Line Avenue and Monument Road.

Other Organizations

The Association for Women in Mathematics has organized a symposium to commemorate the 100th anniversary of the birth of Emmy Noether. This symposium will start on Wednesday evening and continue Thursday and Friday, March 17–19, following the AMS meeting. It is anticipated that the symposium will be supported in part by a grant from the National Science Foundation. Please note that **this will be the only announcement prior to the February issue of the** *Notices*, which will include the complete program.

Those who have accepted invitations to present talks are ARMAND BOREL, the Institute for Advanced Study; NATHAN JACOBSON, Yale University; DAVID MUMFORD, Harvard University; JUDITH D. SALLY, Northwestern University; RICHARD SWAN, University of Chicago; OLGA TAUSSKY, California Institute of Technology; KAREN UHLENBECK, University of Illinois at Chicago Circle; and MICHELE VERGNE, Massachusetts Institute of Technology.

There will also be a session at which speakers will give personal reminiscences and other testimonials to Emmy Noether; these include Marguerite Lehr, Ruth McKee, Gottfried Noether, Grace Quinn, and Olga Taussky.

It is scarcely necessary to introduce Emmy Noether to the mathematical community. She is one of the principal founders of, and an important contributor to, the subject that has come to be called Abstract Algebra. Born in Erlangen, Germany, where her father, Max Noether, was professor of mathematics, she studied under P. Gordan, the master of invariant theory. Upon the retirement of her father and death of her mother, she moved to Göttingen where the championship of D. Hilbert helped her to overcome the traditional discrimination against women. In Göttingen her gifts and creativity blossomed. With the rise of the National Socialists in 1933, being a woman, Jewish, and a liberal, she was dismissed from the modest post she held and migrated to Bryn Mawr, where, after a year and a half, she died suddenly on April 14, 1935.

Her influence in the development of mathematics has been profound. It is part of the object of the symposium to pay tribute to this great mathematician and to show how, in contemporary mathematics, the impact of her ideas and methodology is still felt.

The organizing committee thought it was appropriate to hold the symposium at Bryn Mawr in conjunction with the Society's meeting, as a fitting tribute to Emmy Noether.

Registration

The location of the meeting registration desk and its hours of operation will be announced in the February issue of the *Notices*. The registration fees will be $10 for members of the American Mathematical Society or the Association for Women in Mathematics, $16 for nonmembers, and $5 for students or unemployed mathematicians.

Accommodations

Rooms have been blocked for participants at the following hotels or motels in the area. Individuals should make their own reservations prior to the cut-off date of **February 15**, and should identify themselves as participants in the American Mathematical Society's meeting. Rates listed are subject to possible change and do not include the 6 percent Pennsylvania state tax.

Philadelphia Sheraton Hotel
1725 J. F. Kennedy Boulevard, Philadelphia 19103
Telephone: 215-568-3300 or 800-325-3535
Single $49 Double $59

The Sheraton is located directly above the Penn Center Station; see the TRAVEL section for directions to Bryn Mawr College by train.

St. Davids Inn (3 miles from College)
Lancaster Avenue, (Route 30), St. Davids 19087
Telephone: 215-688-5800
Single $52 Double $59

Arrangements have been made to run bus service between the St. Davids Inn and Bryn Mawr College three times a day from Tuesday through Friday, March 16–19. St. Davids and Bryn Mawr are also connected by ConRail (Penn Central) Railroad, which provides frequent service.

Valley Forge Hilton
251 West DeKalb Pike (Route 202)
King of Prussia 19406
Telephone 215-337-1200
Single $55 Double $70

A limited number of dormitory rooms might be available on campus, mostly for single occupancy. Anyone interested in obtaining these inexpensive accommodations **should write to** Ms. Dedi Felman, c/o Department of Mathematics, Bryn Mawr College, Bryn Mawr, Pennsylvania 19010 by **February 1**. Participants will receive written confirmation in return if rooms are available, including the daily rate.

Although rooms **have not been blocked** at the following, they are included here for information purposes.

Budget Lodge at Valley Forge
Route 202 and Schuylkill Expressway (I-76)
King of Prussia 19406
Telephone: 215-265-7200
Single $25 Double $30 and $35

Howard Johnson's Motor Lodge
Route 202 and Gulph Road
King of Prussia 19406
Telephone: 215-265-4500
Single $37 Double $40 (1 bed) $44 (2 beds)

Philadelphia Mariott Hotel
City Line Avenue and Monument Road (Route 1)
Philadelphia 19131
Telephone: 215-667-0200
Single $66–72 Double $76–82

Food Service

Participants may obtain meals at restaurants in the Bryn Mawr area, but, meals on campus will be provided on a **reservation basis only**. A form for the campus meal service will be included in the February issue of the *Notices*, or may be obtained sooner by **writing to** Ms. Dedi Feldman at the Department of Mathematics. The daily rate is $13 for three meals which includes breakfast, lunch, and dinner. Meals may also be arranged on an individual basis; the prices would then be breakfast $3, lunch $4.50, dinner $7.50.

Parking

A limited number of parking spaces will be available to participants on campus at no charge in either the Wyndham or Erdman lots, both off Morris Avenue.

Travel

Bryn Mawr is a 35-40 minute drive from Philadelphia International Airport, which is served by most major

airlines. Bennett Airport Limousine Service provides transportation to and from the airport, Bryn Mawr College, and St. Davids Inn between 7:00 a.m. and 11:30 p.m. daily, at a one-way cost of $7 for each person. Liberty Limousine travels to and from the airport and the Valley Forge Hilton between 8:00 a.m. and midnight, and the one-way fare is $8.20 per person. Both services have dispatchers on duty at the airport baggage claim areas to assist passengers. Participants arriving at the airport can also take the SEPTA bus from the baggage areas at the airline terminals to the 30th Street train station in downtown Philadelphia, and follow the directions below for train service to Bryn Mawr. These buses run every half hour from 6:50 a.m. until 11:10 p.m. daily.

Trains arrive at either the Penn Center Station (sometimes called the Suburban Station) at 16th Street and J. F. Kennedy Boulevard, or the 30th Street Station at 30th and Market Streets in downtown Philadelphia. Take either the Paoli or the Bryn Mawr local trains to reach Bryn Mawr. The walk from the station to the college takes approximately 8 minutes; walk across Montgomery Avenue by the Baldwin School to Yarrow Road and turn left on Yarrow Road to Rockefeller Arch at the college. Taxis also operate from Bryn Mawr station daily, and a direct-line telephone is located on the wall of the taxi booth on the west-bound train platform.

Participants coming by car via **the Pennsylvania Turnpike** should take Exit 24 (Valley Forge Interchange), and follow signs to Route 76 East (Expressway to Philadelphia). Drive approximately 3 miles and leave Route 76 at Gulph Mills Exit, taking Route 320 South (Gulph Road becomes Montgomery Avenue). Continue 4 miles on Montgomery to Morris Avenue; turn left (north) on Morris and, after one block, turn left again onto Yarrow Street.

Those coming from **north** of Philadelphia on the **New Jersey Turnpike** should take Exit 6 (Pennsylvania Turnpike Entry) and drive west to Exit 24 (Valley Forge Interchange) then follow the above directions.

Drivers coming from **south** of Philadelphia should leave the **New Jersey Turnpike** at Exit 3 (Camden-Woodbury) and follow the green "Walt Whitman Bridge" signs to Route 168 North; drive approximately 1 mile and follow signs to Route 295 South. Take Route 295 South for about 1 mile and bear left to join Route 76 North, still following the Walt Whitman Bridge signs; after crossing the bridge this becomes Route 676. Continue on Route 676 following the blue signs indicating "Schuylkill Expressway – West Philadelphia" and join the Expressway (which is still Route 676). As the Expressway reaches **center-city Philadelphia**, follow signs indicating "through traffic" and "Route 76 West, Valley Forge". From this area continue to follow the "Valley Forge" signs, until about 4 miles west of center-city take Exit 41, which is a ramp marked "U.S. 1 South – City Avenue"; continue on U.S. 1 to Lancaster Pike (Route 30) and turn right on Route 30 to Bryn Mawr. When reaching Bryn Mawr, turn right at the Bryn Mawr Trust Company and follow the traffic pattern under the railroad to a traffic light at Montgomery and Morris Avenues. Continue one block on Morris Avenue to Yarrow Road.

Raymond G. Ayoub
University Park, Pennsylvania — Associate Secretary

CONTEMPORARY MATHEMATICS

PROCEEDINGS OF THE CONFERENCE ON INTEGRATION, TOPOLOGY, AND GEOMETRY IN LINEAR SPACES

edited by *William H. Graves*

This book contains survey articles contributed by speakers at a conference held at the University of North Carolina in Chapel Hill in the spring of 1979 and organized around contributions of the late B. J. Pettis to the development of measure and integration in linear spaces and the role of general linear spaces in measure-theoretic considerations. Topics covered include strict topologies in topological measure theory (by H. Collins), the Dunford-Pettis property (by J. Diestel), the Radon-Nikodym property (by R. Huff), the Orlicz-Pettis phenomenon (by N. Kalton), applications of measure and integration in linear spaces (by I. Kluvanek), and the role of the Pettis measurability theory (by J. J. Uhl, Jr.). In addition to these survey articles which impart both a historical and a state-of-the art flavor, the book contains several research articles devoted to topics as diverse as spectral theory (by N. Dunford) and weak and strong compactness in spaces of Pettis integrable functions (by J. Brooks and N. Dinculeanu).

The book gives an overview of the current state of affairs in the study of measure and integration in linear spaces and applications thereof. Those who will enjoy these papers are workers in functional analysis with an interest in measure and integration in linear spaces, especially the many delighted readers of Diestel and Uhl's *Vector Measures* (Amer. Math. Soc. Mathematical Surveys, Volume 15).

Volume 2, x + 269 pages (soft cover)
List price $16.00, institutional member $12.00,
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Publication date: November 1980
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Madison, April 16–17, 1982, University of Wisconsin

First Announcement of the 794th Meeting

The seven hundred ninety-fourth meeting of the American Mathematical Society will be held at the University of Wisconsin, Madison, on Friday and Saturday, April 16–17, 1982. Sessions will be held in the Wisconsin Center, located at the corner of Langdon and Lake Streets.

Invited Addresses

By invitation of the 1981 Committee to Select Hour Speakers for Western Sectional Meetings, there will be four invited one-hour addresses. The speakers, their titles, and the scheduled times of presentation are as follows:

MICHAEL G. CRANDALL, University of Wisconsin, Madison, *Degenerate nonlinear diffusion equations*, 11:00 a.m. Friday.

CASPER GOFFMAN, Purdue University, *Some uses of Cesari spaces and of Sobolev spaces*, 1:45 p.m. Friday.

JAMES S. MILNE, University of Michigan, Ann Arbor, *Arithmetic varieties*, 11:00 a.m. Saturday.

YASUTAKA SIBUYA, University of Minnesota, Minneapolis, *Gevrey expansions and cohomological methods in the theory of asymptotic solutions*, 1:45 p.m. Saturday.

Special Sessions

By invitation of the same committee, there will be seven sessions of selected twenty-minute papers. The topics of these special sessions and the names of the organizers are:

Minimal manifolds, RICHARD L. BISHOP, University of Illinois, Urbana-Champaign.

The legacy of Srinivasa Ramanujan, DAVID M. BRESSOUD, Pennsylvania State University, University Park.

Asymptotic solutions of ordinary differential equations, PO-FANG HSIEH, Western Michigan University.

Applications of cohomology in number theory, JOHN M. MASLEY, University of Illinois at Chicago Circle and University of Notre Dame.

Partial differential equations, PAUL H. RABINOWITZ, University of Wisconsin, Madison.

Classical real analysis, DANIEL WATERMAN, Syracuse University.

Topics in the theory of functions of a single complex variable, JACK WILLIAMSON, University of Hawaii, Honolulu, and University of Wisconsin, Madison.

Most of the papers to be presented at these special sessions will be by invitation. However, anyone submitting an abstract for the meeting who feels that his or her paper would be particularly appropriate for one of these special sessions should indicate this clearly on the abstract and submit it by **February 1, 1982**, three weeks before the deadline for contributed papers.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Abstracts should be sent to the American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940, so as to arrive prior to the deadline of **February 22**. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence, or in departments of mathematics.

Symposium on Several Complex Variables

With the anticipated support of the National Science Foundation, a symposium on Several Complex Variables is scheduled to take place Monday through Thursday, April 12–15. This topic was selected by the 1980 Committee to Select Hour Speakers for Western Sectional Meetings, whose members were Paul T. Bateman, William H. Jaco (chairman), Albert Marden, Mary E. Rudin, and Paul J. Sally, Jr.

Since the 1975 AMS Summer Institute on Several Complex Variables, there have been a number of important developments in the field. These developments infringe upon several related fields of mathematics such as partial differential equations, differential geometry, and algebraic geometry. The purpose of the symposium is to bring together active researchers and major contributors to the recent developments to present a coherent and comprehensive review of the recent important results and to discuss the future directions of research in the field of several complex variables.

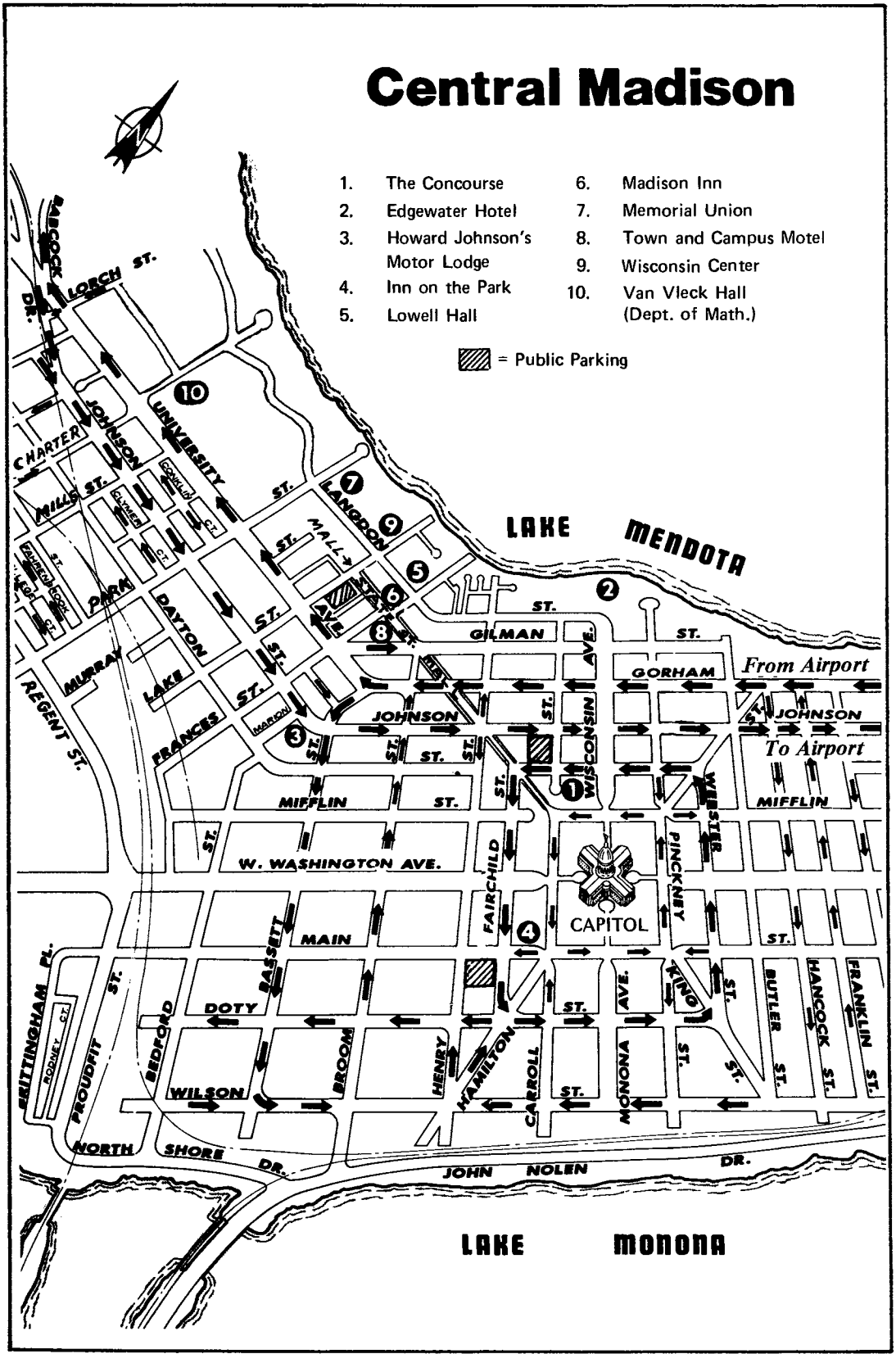
The Organizing Committee for the symposium includes Robert C. Gunning, Princeton University; F. Reese Harvey, Rice University; Raghavan Narasimhan, University of Chicago; Walter Rudin, University of Wisconsin, Madison; Yum-Tong Siu (chairman) Stanford University; Wilhelm F. Stoll, University of Notre Dame; and Shing-Tung Yau, Institute for Advanced Study.

Names of speakers in the symposium and the titles of their talks will be announced in the February issue of the *Notices*.

Registration

The registration desk will be open from 8:30 a.m. until 4:00 p.m. Monday through Friday, and from 8:30 a.m. until noon on Saturday in the Wisconsin Center; the location will be announced in the February *Notices*. Registration fees for the symposium and meeting are:

Symposium Only	
Nonmember	$15
Member	$10
Student/Unemployed	$ 5
Meeting Only	
Nonmember	$16
Member	$10
Student/Unemployed	$ 5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Symposium and Meeting

Nonmember	$31
Member	$20
Student/Unemployed	$10

Accommodations

Blocks of rooms are being held for participants at the following area motels. Individuals should make their own reservations prior to the cut-off date of **March 15**, and should identify themselves as participants in the American Mathematical Society's meeting. Rates listed do not include the 4 percent Wisconsin State nor the 6 percent City of Madison taxes, and are subject to possible change. The zip code for all locations is 53703, except Lowell Hall (the Wisconsin Center Guest House) which is 53706.

Howard Johnson's Motor Lodge
525 W. Johnson Street
Telephone: 608-251-5511 or 800-654-2000

Single	$34 (1 queen bed, 1 person)
Double	$39 (1 queen bed, 2 people)
Double	$43 (2 double beds, 2 people)

Lowell Hall (Wisconsin Center Guest House)
610 Langdon Street
Telephone: 608-256-2621
Single $22 Double $26

Madison Inn
601 Langdon Street
Telephone: 608-257-4391
Single $30 – 40 Double $40

Town & Campus Best Western Motel
State at Frances Street
Telephone: 608-257-4881 or 800-528-1234
Single $36 Double $44

Food Service

A cafeteria located in the basement of the Wisconsin Center is open Monday through Friday from 7:30 to 11:00 a.m. for continental breakfast, and from 11:30 a.m. to 12:30 p.m. for lunch; **it is not open Saturday or Sunday.** A wider variety of food can be purchased at the Lakeside Cafeteria on the first floor (northeast corner) of the Memorial Union. The Lakeside cafeteria is open Monday through Friday from 7:00 a.m. to 3:00 p.m. and 4:45 to 6:30 p.m., and Sunday from 9:00 a.m. to 1:30 p.m. **It is closed on Saturday.** The Tripp Commons, which is on the floor above the Lakeside Cafeteria, specializes in a salad bar where salad is paid for by the ounce. Tripp Commons is open only Monday through Friday from 11:45 a.m. to 1:00 p.m. Also in the Memorial Union is the Rathskeller which serves beer, hamburgers, and sandwiches; it is open Monday through Friday from 7:30 a.m. until 9:30 p.m.

Many restaurants are to be found within walking distance of the Wisconsin Center, and a list will be available at the registration desk.

Parking

All of the hotels or motels listed above offer parking for their guests. There is a public parking ramp only a block and a half from the Wisconsin Center on Lake Street, between State Street and University Avenue.

Travel

Madison is located 150 miles northwest of Chicago (via Route I-90) and 80 miles west of Milwaukee (via Route I-94). The Dane County Regional Airport is located five miles northeast of Madison and is served by Frontier, Northwest, Ozark, and Republic Airlines. Transportation between the airport and all points in Madison is provided by Bender's Limousine Service and Union Cab Company. The trip from the airport takes approximately 20 minutes and the cost per person for the limousine is $2.75, while the taxi service costs about $6.50 regardless of the number of passengers. At the present time flights between Madison and distant points have not been affected too much by the air controller's strike, but the former frequent flights between Madison and Chicago have become more sporadic. This gap has been partially filled by the Alco Bus Company, which operates buses between O'Hare Airport and Madison. Buses are scheduled to depart from O'Hare daily at 9:30 and 11:00 a.m., 2:00, 5:00, 7:00 and 10:00 p.m., and return daily from Madison at 7:00 and 10:00 a.m., 1:00, 2:30, and 5:30 p.m. The trip in either direction takes approximately 3 hours and costs $10 per person. In Madison the Alco buses arrive at and depart from the front entrance of the Memorial Union. Up-to-date information may be obtained by calling Alco Bus in Madison at 608-257-5593.

Madison is also served by Greyhound and Trailways bus lines, and by the major rental car companies. The closest Amtrak service is to or from Columbus, Wisconsin, located 30 miles northeast of Madison.

Paul T. Bateman
Urbana, Illinois Associate Secretary

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.

Bryn Mawr, March 1982

Albrecht Frölich	Nancy Stanton
Stephen Shatz	Leonid Vaserstein

Madison, April 1982

Michael G. Crandall	James S. Milne
Casper Goffman	Yasutaka Sibuya

Organizers and Topics of Special Sessions

Names of organizers of special sessions to be held at meetings of the Society are listed below, along with the topic of the session. Most of the papers presented at special sessions are by invitation. Other papers will be considered at the request of the author provided that this is indicated clearly on the abstract form and the abstract is submitted by the deadlines given below. These deadlines are usually three weeks earlier than the normal abstract deadlines for meetings. Papers not selected for special sessions will automatically be considered for regular sessions unless the author gives specific instructions to the contrary.

March 1982 Meeting in Bryn Mawr

Deadline for consideration: January 4

Christine Ayoub, *Constructive methods in algebra*

Albrecht Frölich, *Galois module structure of algebraic integers*

C. W. Grinstead and Stephen Maurer, *Combinatorics and graph theory*

Rhonda Hughes, *Functional analysis*

Fern Hunt, *Applied mathematics*

Mario Martelli and Roger Nussbaum, *Differential and differential-delay equations*

Samuel Merrill, *Mathematics of voting and bargaining*

Vera Pless, *Applications of algebra*

Stephen Shatz, *Algebraic geometry and cognate areas: Algebraic number theory, commutative algebra*

Bhama Srinivasan, *Representation theory of finite groups*

Nancy Stanton, *Several complex variables*

Leonid Vaserstein, *Algebraic K- and L-theory*

April 1982 Meeting in Madison

Deadline for consideration: February 1

Richard L. Bishop, *Minimal manifolds*

David M. Bressoud, *The legacy of Srinivasa Ramanujan*

Po-Fang Hsieh, *Asymptotic solutions of ordinary differential equations*

John M. Masley, *Applications of cohomology in number theory*

Paul H. Rabinowitz, *Partial differential equations*

Daniel Waterman, *Classical real analysis*

Jack Williamson, *Topics in the theory of functions of a single complex variable*

Special Sessions at Meetings of the Society

Special sessions at Annual and Summer meetings are held under the general supervision of the Program Committee. They are administered by the Associate Secretary in charge of the meeting with staff assistance from the Society office in Providence.

Some special sessions arise from an invitation to a proposed organizer issued through the Associate Secretary. Others are spontaneously proposed by interested organizers or participants. Such proposals are welcomed. They may be submitted to the Associate Secretary, to the Chairman of the Program Committee, or to the Secretary, who is a member of the Program Committee. The number of special sessions at a Summer or Annual Meeting is limited to twelve. Proposals, invited or offered, which are received at least eight months prior to the meeting are screened for suitability of the topic and of the proposed list of speakers and for possible overlap or conflict with other proposals. If necessary, the numerical limitation is enforced. Later proposals, within the numerical limit, are accepted if convenience allows.

Special sessions are effective at regional meetings and can usually be accommodated. They are arranged by the Associate Secretary under the supervision of the Committee to Invite Hour Speakers for the region. The limitation on the number of sessions depends on the space and time available.

No person is entitled to present more than one paper in the special sessions at any one meeting.

The Associate Secretary who will be in charge of the AMS programs at the Summer Meeting in Toronto, August 1982, is Raymond G. Ayoub; Paul T. Bateman will be the Associate Secretary in charge of the Annual Meeting in Denver, January 1983. The Associate Secretary who will be in charge of the AMS program at the Summer Meeting in 1983 is Hugo Rossi. The programs of regional meetings are arranged by the Associate Secretary of the region in question: Far Western Region (Pacific and Mountain), Hugo Rossi; Western Region (Midwest), Paul T. Bateman; Northeastern Region, Raymond G. Ayoub; Southeastern Region, Frank T. Birtel.

1982 SUMMER SEMINAR IN APPLIED MATHEMATICS

Applications of Group Theory in Physics and Mathematical Physics

July 6-16, 1982
University of Chicago, Chicago, Illinois

The fourteenth AMS-SIAM Summer Seminar in Applied Mathematics will be held July 6-16, 1982, and will take place at the University of Chicago, Chicago, Illinois. The seminar will be sponsored jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics, and it is anticipated that it will be supported by a grant from a federal agency. The topic *Applications of Group Theory in Physics and Mathematical Physics* was selected by the AMS-SIAM Committee on Applied Mathematics whose members at the time were Roger Brockett, Lily E. Christ, John Dennis, Norman Lebovitz, Sanjoy K. Mitter, John A. Morrison, Alan Newell (chairman), and George C. Papanicolaou. The members of the organizing committee are M. Flato (Mathematical Physics), University of Dijon, France; C. Fronsdal (Physics), University of California, Los Angeles; I. Kaplansky (Mathematics), University of Chicago; Y. Nambu (Physics), University of Chicago; P. J. Sally (Mathematics), chairman, University of Chicago; I. M. Singer (Mathematics-Physics), University of California, Berkeley; J. Wolf (Mathematics), University of California, Berkeley; and G. Zuckerman (Mathematics), Yale University.

This conference will provide a means for the exchange of ideas, methods, and recent results among mathematicians who work in Lie superalgebras, Kac-Moody Lie algebras, and group representations, and mathematical physicists and physicists who use these theories in their study of physical phenomena.

Formal talks will be presented by members of all groups, and considerable time will be provided for informal discussions.

Individuals may apply for admission to the seminar. Application blanks for admission and/or financial assistance can be obtained from the Meeting Arrangements Department, American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940. **The application deadline is March 15, 1982.** An applicant will be asked to indicate his or her scientific background and interest, and should have completed at least one year of graduate school. A graduate student's application must be accompanied by a letter from his or her faculty advisor concerning the applicant's ability and promise. Those who wish to apply for a grant-in-aid should so indicate; however, funds available for the seminar are limited and so individuals who can obtain support from other sources should do so.

1982 SUMMER RESEARCH INSTITUTE

Recursion Theory

June 28-July 16, 1982
Cornell University, Ithaca, New York

The thirtieth Summer Research Institute sponsored by the American Mathematical Society will be devoted to recursion theory. The Institute which will take place at Cornell University in Ithaca, New York, from June 28 to July 16, will be cosponsored by the Association for Symbolic Logic. Members of the Organizing Committee include Solomon Feferman, Yiannis Moschovakis, Anil Nerode (co-chairman), Hilary Putnam, Gerald Sacks, Joseph Shoenfield, Richard A. Shore (co-chairman), and Robert I. Soare. It is anticipated that the institute will be supported by a grant from the National Science Foundation.

The main objective of the institute is to explain recent developments of new techniques and approaches to major problems in recursion theory to a wider audience, and to encourage interaction between workers in various areas of recursion theory with researchers in related branches of set theory, model theory, constructive mathematics, and computer science, with an eye toward the dissemination of problems and techniques. No such major meeting on recursion theory has taken place since the institute held at Cornell in 1957 and, needless to say, the field has developed enormously since that time.

Housing accommodations will be available on campus for those attending the institute, and daily meals will be served in a dining hall near the dormitories. In the early spring a brochure will be available, which will include information about the scientific program, firm room and board rates, the residence and dining hall facilities, local information, and a reservation form to be used for accommodations on campus. Each participant will pay a social fee to cover the cost of refreshments served at breaks and for social events. There will also be a meeting registration fee of $45 ($15 for students).

Funds for support will be limited, and it is hoped that a number of participants who wish to attend will obtain their own support. Those interested in taking part in the institute and/or being considered for financial assistance should send their requests to the Co-chairmen of the Organizing Committee, c/o Meeting Arrangements Department, American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940, **prior to April 9, 1982.** The Committee will consider such requests, and applicants will be informed later if funds are available.

AMS SUMMER RESEARCH CONFERENCE SERIES

University of New Hampshire, June and July, 1982

A Series of Week-Long Conferences

Articles in the October and November, 1981, issues of the *Notices* described the new AMS series of week-long Summer Research Conferences, to be inaugurated in the summer of 1982 on the campus of the University of New Hampshire in Durham. The topics and organizers for the 1982 Conferences are listed below. For comprehensive descriptions of each topic, and for names of the members of the individual organizing committees, see the article in the November issue (pages 604, 605). Robert F. Williams of Northwestern University was added to the Organizing Committee for the second conference (Ergodic theory and applications) too late for his name to appear in the November issue.

It is expected that funding will be available for about thirty participants in each conference. Others, in addition to those funded, will be welcome, within the limitations of the facilities of the campus. Up to about seventy participants can be accommodated at each conference. Since it is expected that participants will live in dormitories, these limitations are real, and it may be impossible to reserve space for families of participants.

Anyone interested in attending a given conference should request an application form from Carole Kohanski, AMS Summer Research Conference Coordinator, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940 (401-272-9500, extension 241), specifying which conference. Selection of the participants and approval of participant support will be made by the Organizing Committee for each conference. Women and members of minority groups are encouraged to apply and participate in these conferences. The deadline for receipt of applications is February 15, 1982. Those who wish to apply for a grant-in-aid should so indicate; however, funds available for these conferences are limited and so individuals who can obtain support from other sources should do so.

June 6 to June 12

Probabilistic computational complexity,
ALBERT R. MEYER, Chairman,
Massachusetts Institute of Technology.

June 13 to June 19

Ergodic theory and applications,
ROY L. ADLER, Chairman,
IBM Watson Research Center.

June 20 to June 26

Nonlinear partial differential equations,
JOEL A. SMOLLER, Chairman,
University of Michigan, Ann Arbor.

June 27 to July 3

Values of L-series at special points,
HAROLD M. STARK, Chairman,
University of California, San Diego.

July 4 to July 10

Four-manifold theory,
ROBION C. KIRBY, Chairman,
University of California, Berkeley.

July 11 to July 17

Quantum fields, probability and geometry,
ARTHUR M. JAFFE, Chairman,
Harvard University.

Invitations are solicited from chairmen of mathematics departments interested in having the 1983 AMS Summer Research Conferences, or later ones, on their campuses. Forms for supplying the information needed about campus facilities may be obtained by writing to Carole Kohanski at the address above.

PROCEEDINGS OF THE STEKLOV INSTITUTE

A METHOD OF AVERAGING IN THE THEORY OF ORTHOGONAL SERIES AND SOME QUESTIONS IN THE THEORY OF BASES

by *S. V. Bočkarev*

In this monograph a method of averaging is presented and developed for problems on the divergence of Fourier series in arbitrary orthonormal systems. A number of familiar problems in the theory of orthogonal series and the theory of bases are solved (Zygmund's problem on the absolute convergence of trigonometric Fourier series of functions of bounded variation, Banach's problem on the existence of a basis in the space of analytic functions in the disk, the problem of the existence of a Fourier series diverging on a set of positive measure for a bounded orthonormal system). New inequalities are obtained for a sequence of numbers and for orthogonal systems.

CONTENTS

I. Averaging over independent arrangements of signs
II. Averaging over shifts and singular functions
III. Averaging over supports of δ-functions
IV. Some problems in the theory of bases

1980, Issue 3, Number 146, vi + 92 pages (soft cover)
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SPECIAL MEETINGS

THIS SECTION contains announcements of meetings of interest to some segment of the mathematical public, including *ad hoc*, local, or regional meetings, and meetings or symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. (Information on meetings of the Society, and on meetings sponsored by the Society, will be found inside the front cover.)

AN ANNOUNCEMENT will be published in the *Notices* if it contains a call for papers, and specifies the place, date, subject (when applicable), and the speakers; a second full announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in each issue until it has been held and a reference will be given in parentheses to the month, year and page of the issue in which the complete information appeared.

IN GENERAL, announcements of meetings held in North America carry only date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadline dates for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. All communications on special meetings should be sent to the Editor of the *Notices*, care of the American Mathematical Society in Providence.

DEADLINES are listed on the inside front cover of each issue. In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the *Notices* prior to the meeting in question. To achieve this, listings should be received in Providence SIX MONTHS prior to the scheduled date of the meeting.

1981–1982. **Special Program in Algebraic Number Theory and Algebra**, University of Illinois at Urbana-Champaign, Urbana, Illinois. (October 1981, p. 546)

1981–1982. **Academic Year Devoted to Mathematical Problems in Theoretical Physics**, The Mittag-Leffler Institute, Djursholm, Sweden. (February 1981, p. 177)

January 3–October 2, 1982. **Mathematisches Forschungsinstitut Oberwolfach**, (Weekly Conferences), Federal Republic of Germany.

Information: Martin Barner, Institute Director, Albertstrasse 24, 78 Freiburg i. Br., Federal Republic of Germany.

January

3–9. Formale Methoden und Mathematische Hilfsmittel zur Softwarekonstruction, *Chairmen*: H. Langmaack, E. Neuhold, M. Paul.

10–16. Modelltheorie, *Chairmen*: W. Baur, A. Macintyre, A. Prestel.

17–23. Angewandte Stochastische Prozesse, *Chairmen*: M. Schäl, R. Schaßberger, W. Whitt.

24–30. Mathematische Wirtschaftstheorie, *Chairmen*: W. Hildebrand, D. Sondermann.

31–February 6. Iterative Lösungen Nichtlinearer Gleichungssysteme, *Chairmen*: R. Ansorge, Th. Meis, W. Törnig.

February

7–13. Mehrdimensionale Konstruktive Funktionentheorie, *Chairmen*: W. Schempp, K. Zeller.

14–20. Funktionentheorie, *Chairmen*: G. Frank, Ch. Pommerenke, K. Strebel.

21–27. Methoden und Verfahren in der Mathematischen Physik, *Chairmen*: B. Brosowski, E. Martensen.

28–March 6. Regelungstheorie, *Chairmen*: H. W. Knobloch, M. Thoma.

March

14–20. Einhüllende Algebren von Lie-Algebren, *Chairmen*: W. Borho, J. Dixmier, R. Rentschler.

21–27. Finite Geometries, *Chairmen*: F. Buekenhout, D. R. Hughes, H. Lüneburg.

28–April 4. Mathematische Stochastik, *Chairmen*: L. Arnold, H. Strasser.

April

4–10. Anwendungen der Darstellungstheorie in der Zahlentheorie, *Chairmen*: A. Fröhlich, P. Roquette.

12–17. Arbeitsgemeinschaft Geyer-Harder,:

18–24. Mathematische Logik, *Chairmen*: W. Felscher, H. Schwichtenberg.

May

2–8. Gruppentheorie, *Chairmen*: W. Gaschütz, K. W. Gruenberg.

9–15. Kombinatorik, *Chairmen*: D. Faota.

23–29. Lokale Algebra und Lokale Analytische Geometrie, *Chairmen*: R. Berger, J. Lipman, G. Scheja.

June

6–12. Differential-Differenzengleichungen, Anwendungen und Numerische Probleme, *Chairmen*: L. Collatz, G. Meinardus, W. Wetterling.

13–19. Ag-Algebra: Darstellungstheorie und 1-Adische Kohomologie, *Chairmen*: J. C. Jantzen, T. A. Springer.

20–26. Algebraische Gruppen, *Chairmen*: T. A. Springer, J. Tits.

27–July 3. Riesz Spaces and Operator Theory, *Chairmen*: W. A. J. Luxemburg, H. H. Schäfer.

July

4–10. Probability in Banach Spaces, *Chairmen*: A. Beck, K. Jacobs.

11-17. Variationsrechnung, *Chairmen*: J. Frehse, W. Jäger, F. Tomi.

18–24. Konvexe Körper, *Chairmen*: R. Schneider, G. C. Shephard.

25–31. Kohomologie der Gruppen, *Chairmen*: R. Bieri, K. W. Gruenberg.

August

1–7. Funktionalgleichungen, *Chairmen*: J. Aczel, W. Benz, J. Rätz.

8–14. Jordan-Algebren, *Chairmen*: K. McCrimmon, K. Meyberg, H. P. Petersson.

15–21. Topologie, *Chairmen*: L. Siebenmann, C. B. Thomas, F. Waldhausen.

22-28. Topologie Spezialtagung: Transformation Groups, *Chairmen*: T. tom Dieck, R. Oliver.

29–September 4. Komplexe Analysis, *Chairmen*: H. Grauert, R. Remmert, K. Stein.

September

5–11. Geometrie, *Chairmen*: K. Leichtweiß, K. Voss.

12–18. Schwingungstheorie, *Chairmen*: W. Schieler, W. Wedig, F. Weidenhammer.

26–October 2. Inkorrekt Gestellte Probleme und ihre Numerische Behandlung, *Chairmen*: G. Hämmerlin, K. H. Hoffmann.

September 1, 1982–August 31, 1983. **Statistical and Continuum Approaches to Phase Transition**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, Minnesota.

Program: The fall semester will be coordinated by Oscar Lanford and the emphasis will be on statistical mechanics and on turbulence and chaotic behavior in dynamical systems. In the spring and summer terms James Serrin will coordinate activities on continuum thermodynamics and phase transition. The emphasis during the winter months will be on chemical and physical properties of materials undergoing phase transition.

Invited Participants: M. Aizenman, B. Coleman, P. Collet, J. P. Eckmann, R. Ellis, M. Feinberg, G. Gallavotti, L. Gross, O. Lanford, J. Lebowitz, E. Lieb, S. MacLane, B. Ninham, D. Owen, J. Serrin, Ja. Sinai, and C. Truesdell.

Information: Hans Weinberger, Director, Institute for Mathematics and its Applications, University of Minnesota, 206 Church Street S.E., Minneapolis, Minnesota 55455.

JANUARY 1982

4–8. **NSF Research Conference on Exterior Differential Systems**, University of New Mexico, Albuquerque, New Mexico. (November 1981, p. 643)

11–16. **Fourth International Conference on Universal Algebra and Lattice Theory**, University of Puebla, Mexico. (June 1981, p. 348)

18–22. **Ninth Biennial AAMT Conference**, Sydney, Australia.

Sponsor: Australian Association of Mathematics Teachers.

Information: Ninth Biennial AAMT Conference, P.O. Box 265, Lindfield, N.S.W. 2070, Australia.

FEBRUARY 1982

15–18. **Thirteenth Southeastern Conference on Combinatorics, Graph Theory and Computing**, Florida Atlantic University, Boca Raton, Florida.

Invited Lecturers: Belá Bollobás (University of Cambridge and Louisiana State University), Paul Erdös (Hungarian Academy of Sciences), Nicholas Pippenger (IBM Research Laboratory), and Vera T. Søs (Scientific University of Budapest and the Mathematical Institute of the Hungarian Academy of Sciences).

Call for Papers: There will be fifteen-minute sessions for contributed papers. An abstract of 10-20 single-spaced lines should be submitted to the address below by February 1, 1982.

Information: Frederick Hoffman, Department of Mathematics, Florida Atlantic University, Boca Raton, Florida 33431, 305-393-3345 or 305-393-3340.

MARCH 1982

11–13. **Spring Topology Conference**, U.S. Naval Academy, Annapolis, Maryland. (November 1981, p. 643)

15–19. **Seventh International Time Series Meeting**, Dublin, Ireland. (October 1981, p. 547)

18–19. **Emmy Noether Centenary Symposium**, Bryn Mawr College, Bryn Mawr, Pennsylvania.

Sponsor: Association for Women in Mathematics.

Invited Speakers: A. Borel, N. Jacobson, D. Mumford, J. Sally, R. Swan, O. Taussky-Todd, K. Uhlenbeck, M. Vergne.

Program: In addition to the hour lectures there will be a panel discussion on "Emmy Noether at Erlangen, Göttingen, and Bryn Mawr."

Information: Rhonda Hughes, Department of Mathematics, Bryn Mawr College, Bryn Mawr, Pennsylvania 19010 (215-645-5351).

22–26. **Homotopy Theory**, Northwestern University, Evanston, Illinois.

Program: Ten plenary lectures; specialized talks to be presented in seminars.

Support: Limited support for at least 30 participants will be available; final plans depend on the level of NSF and corporate funding.

Information: Stewart Priddy (312-492-5511) or Haynes Miller (312-492-3295), Department of Mathematics, Northwestern University, Evanston, Illinois 60201.

29–April 2. **Conference on Ordinary and Partial Differential Equations**, University of Dundee, Scotland. (August 1981, p. 438)

Program: The program will consist of invited and contributed lectures.

Invited Lecturers: F. V. Atkinson (Canada), P. J. Browne (Canada), J. A. Burns (U.S.A.), L. Collatz (West Germany), D. L. Colton (U.S.A.), P. A. Deift (U.S.A.), D. E. Edmunds (United Kingdom), P. C. Fife (U.S.A.), D. B. Hinton (U.S.A.), H. Kalf (West Germany), H. G. Kaper (U.S.A.), H. W. Knobloch (West Germany), I. W. Knowles (U.S.A.), J. Kurzweil (Czechoslovakia), R. T. Lewis (U.S.A.), S.-O. Londén (Finland), J. McLaughlin (U.S.A.), J. Mawhin (Belgium), J. D. Murray (United Kingdom), F. Neuman (Czechoslovakia), D. A. Sánchez (U.S.A.), K. Schmidt (U.S.A.), J. K. Shaw (U.S.A.), A. Zettl (U.S.A.).

Deadline for Application and Abstracts: February 15, 1982.

Information: Organizing Secretaries, Differential Equations 1982 Conference, Department of Mathematical Sciences, The University of Dundee, Dundee DD1 4HN, Scotland, United Kingdom.

30–April 3. **Thirty-Fourth British Mathematical Colloquium**, University College of North Wales, Bangor, Gwynedd, United Kingdom. (October 1981, p. 547)

APRIL 1982

2–3. **Discrete Geometry and Convexity Days**, New York Academy of Sciences and Courant Institute of Mathematical Sciences, New York, New York.

Sponsors: City College (CUNY), Courant Institute (NYU), New York Academy of Sciences, Polytechnic Institute of New York, York College (CUNY).

Program: There will be half-hour and one-hour talks, mostly by invitation, on topics including extremal problems in combinatorial geometry, convexity in finite-dimensional spaces, configurational geometry, and computational geometry.

Speakers: (Tentative) R. L. Graham (Bell Laboratories), W. O. J. Moser (McGill University), M. I. Shamos (Carnegie-Mellon University), and R. P. Stanley (MIT).

Information: J. Malkevitch, Chairman, Mathematics Section, New York Academy of Sciences, 2 East 63rd Street, New York, New York 10021.

13–16. **GAMM-Tagung 1982**, Budapest, Hungary. (October 1981, p. 547)

15–17. **John H. Barrett Memorial Lectures in Differential Equations**, University of Tennessee, Knoxville, Tennessee.

Principal Speaker: Jean Mawhin (Institut de Mathématiques, Louvain-La-Neuve, Belgium).

Information and Abstracts: Gene Klaasen, Department of Mathematics, University of Tennessee, Knoxville, Tennessee 37996/1300.

16–17. **Fifteenth Annual Small College Computing Symposium**, North Dakota State University, Fargo, North Dakota.

Topics: Computer-aided instruction, computer-managed instruction, job projections for computer science graduates, in-house maintenance, regional networks, microcomputers, and computer languages.

Information: Sandy Sprafka, University Computer Center, North Dakota State University, Fargo, North Dakota 58105 (701-237-8685).

16–17. **A Hundred Years of Algebra 1830-1930**, Oxford, England.

Topic: This special meeting is concerned with the development of algebra and number theory in the nineteenth and twentieth centuries.

Speakers: H. M. Edwards, T. Hawkins, W. Ledermann, R. Taton, and B. L. van der Waerden.

Information: S. M. Oakes, London Mathematical Society, Burlington House, Piccadilly, London W1V 0NL, England.

22-23. **Thirteenth Annual Pittsburgh Conference on Modeling and Simulation**, University of Pittsburgh, Pittsburgh, Pennsylvania. (October 1981, p. 547)

26–28. **Society for Industrial and Applied Mathematics Special Conference on Linear Algebra and Applications**, Raleigh, North Carolina. (October 1981, p. 547)

26–29. **Society for Industrial and Applied Mathematics Special Conference on Applied Linear Algebra**, Raleigh, North Carolina. (October 1981, p. 547)

Principal Speakers: Gene H. Golub (Stanford University), Robert C. Thompson (University of California, Santa Barbara), C. R. Rao (Indian Statistical Institute and University of Pittsburgh), Robert E. Tarjan (Bell Laboratories), A. F. Veinott, Jr. (Stanford University), Thomas Kailath (Stanford University), Richard S. Varga (Kent State University).

Information: Hugh B. Hair, Society for Industrial and Applied Mathematics, 117 South 17th Street, Philadelphia, Pennsylvania 19103.

26–30. **NSF-CBMS Conference on Automorphism Groups of von Neumann Algebras and the Structure of Factors**, The University of Iowa, Iowa City, Iowa. (October 1981, p. 547)

MAY 1982

5–7. **Fourteenth Annual ACM Symposium on the Theory of Computing**, San Francisco, California. (October 1981, p. 548)

10–14. **Twenty-Sixth Annual Meeting of the Australian Mathematical Society**, Newcastle, Australia.

Information: J. G. Couper, The Secretary, Australian Mathematical Society Meeting, Department of Mathematics, The University of Newcastle, New South Wales, Australia 2308.

13–14. **Optimization Days 1982**, University of Montréal, Montréal, Canada.

Sponsors: IEEE Control Systems Society, Society for Industrial and Applied Mathematics.

Topics: Mathematical programming; optimal control theory; numerical methods of optimization; systems theory, including large-scale systems; statistical methods; estimation and identification; applications to engineering, management sciences, transportation, economics, urban and environmental problems, resource management, biology, telecommunications networks, etc. Particular emphasis will be given to mathematical methods of optimization and their interaction with computer science.

Call for Papers: Papers presenting original developments as well as those of an expository nature will be considered. Two copies of a 200-700 word summary in either English or French should be sent to the address below by January 31, 1982.

Information: Jacques Ferland or Jean-Marc Rousseau, Centre de Recherche sur les Transports, Université de Montréal, P. O. Box 6128, Station "A", Montréal, Québec, Canada H3C 3J7, (514-343-7575).

16–28. **NATO Advanced Study Institute on Nonlinear Stochastic Problems**, Algarve, Portugal.

Program: Stochastic control, identification, nonlinear filtering, stochastic differential equations, realization theory.

Lecturers: Alengrin (France), Arnold (Germany), Bucy (U.S.A.), Burg (U.S.A.), Kalman (Switzerland), Lo (U.S.A.), Mitter (U.S.A.), Mosca (Italy), Moura (Portugal), Shepp (U.S.A.), Senne (U.S.A.) and others.

Call for Papers: Papers submitted for the meeting should be mailed to the address below to arrive before April 17, 1982. Detailed preparation instructions will be available later.

Information: J. M. F. Moura, Caps Complexo, Instituto Superior Tecnico, Ave. Rovisco Pais, P-1000 Lisbon, Portugal.

17–19. **Fourth Symposium on Mathematical Programming with Data Perturbations**, Marvin Center, George Washington University, Washington, D. C.

Call for Papers: Papers are solicited in the following areas: sensitivity and stability analysis results and their applications; solution methods for problems involving implicitly defined problem functions; solution methods for problems involving deterministic or stochastic parameter changes; solution approximation techniques and error analysis.

Deadline for Abstracts: Abstracts not exceeding 500 words should be sent in triplicate to the address below by March 1, 1982.

Information: Anthony V. Fiacco, Cloyd Heck Marvin Center, The George Washington University, 800 21st Street, N.W., Washington, D.C. 20052.

17–19. **Seventeenth New Zealand Mathematics Colloquium**, University of Otago, Dunedin, New Zealand.

Information: Colloquium Secretaries, Department of Mathematics, University of Otago, P. O. Box 56, Dunedin, New Zealand.

17–June 5. **Second Franco-Southeast Asian Mathematical Conference**, Quezon City, Philippines.

Program: Workshops will be held from May 17 to 29. A general conference will be held from May 31 to June 5.

Information: The Secretariat, Second Franco-Southeast Asian Mathematical Conference, Mathematics Department, University of the Philippines, Diliman, Quezon City, Philippines.

24–28. **International Forecasting Conference**, Valencia, Spain. (October 1981, p. 548)

27. **Trends and Applications 1982: Advances in Information Technology**, National Bureau of Standards, Gaithersburg, Maryland.

Topics: Advanced computer architecture, advanced graphics technology, distributed processing, office automation technology, networking technology, software technology, data base management technology.

Information: Allen Hankinson, National Bureau of Standards, Administration Building A209, Washington, D.C. 20234.

JUNE 1982

6–11. **Conference on Approximation Theory**, University of Alberta, Edmonton, Canada. (November 1981, p. 644)

Principal Speakers: H. Berens (Erlangen), Z. Ciesielski (Sopot), R. A. DeVore (South Carolina), J. P. Kahane (Paris), J. Korevaar (Amsterdam), G. Lorentz (Texas), P. Nevai (Ohio State), D. J. Newman (Temple), Jaak Peetre (Lund), R. S. Varga (Kent State).

8–11. **Conference in Modern Analysis and Probability (in honor of Shisuo Kakutani)**, New Haven, Connecticut.

Program: Approximately eight one-hour addresses and twenty shorter talks in ergodic theory, measure theory, probability, stochastic processes, functional analysis. All talks by invitation.

Information: R. Beals, Mathematics Department, Box 2155 Yale Station, New Haven, Connecticut 06520.

8–11. **1982 Short Course on Teaching Computer Science in a Mathematics Department**, Denison University, Granville, Ohio.

Sponsor: Ohio Section, Mathematical Association of America.

Program: There will be discussions with invited participants as well as panel discussions drawn from the following areas: a review of ACM and CUPM recommendations; training needed for faculty; current computer science programs within mathematics departments; the design of the first computer course; hardware; and course offerings needed for business, industry, and graduate school.

Information: Andrew Sterrett, Jr., of Zaven Karian, Department of Mathematics, Denison University, Granville, Ohio 43023.

14–18. **Fifth International Conference on Trends in Theory and Practice of Nonlinear Differential Equations**, Department of Mathematics, The University of Texas at Arlington, Arlington, Texas 76019.

Topics: The conference will stress the areas of comparison techniques; frequency domain techniques; and current trends in differential and related equations.

Program: There will be survey lectures and talks on topics of current interest by invited speakers. A balance between theory and applications will be maintained. There will be sessions for contributed papers and a session to discuss open problems and new directions.

Information: V. Lakshmikantham, Department of Mathematics, The University of Texas at Arlington, Box 19408, Arlington, Texas 76019.

16–18. **Second International Conference on Boundary and Interior Layers–Computational and Asymptotic Methods (BAIL II)**, Dublin, Ireland. (November 1981, p. 644)

21–25. **IEEE International Symposium on Information Theory**, Les Arcs, France. (October 1981, p. 548)

21–25. **Ninth U. S. National Congress of Applied Mechanics**, Cornell University, Ithaca, New York. (August 1981, p. 438)

28–30. **1982 National Educational Computing Conference**, Kansas City, Missouri. (November 1981, p. 644)

28–July 2. **Differential Geometric Control Theory**, Michigan Technological University, Houghton, Michigan.

Organizing Committee: R. Brockett (Harvard University), R. Millman (Michigan Technological University), H. Sussmann (Rutgers University).

Program: H. Sussmann will present a lecture series on "Analyticity, Lie Brackets and Geometric Control" and R. Gardner (North Carolina) will present a series on "Invariants of Differential Systems." There will also be other lectures.

Information: R. Millman, Department of Mathematical and Computer Sciences, Michigan Technological University, Houghton, Michigan 49931.

28–July 2. **Eleventh Conference on Stochastic Processes and their Applications**, University of Clermont-Ferrand, France. (October 1981, p. 548)

28–July 3. **Second World Conference on Mathematics at the Service of Man**, Las Palmas (Canary Islands), Spain. (October 1981, p. 548)

JULY 1982

25–August 7. **Joint NATO/London Mathematical Society Advanced Study Institute on Systems of Nonlinear Partial Differential Equations**, Oxford, United Kingdom. (November 1981, p. 644)

26–30. **International Seminar on Functional Analysis, Holomorphy and Approximation Theory**, State University of Campinas, Brazil. (November 1981, p. 644)

AUGUST 1982

August 1982. **International Conference on Finite Element Methods**, Beijing, China.

Sponsors: Architectural Society of China, Society of Civil Engineers of China, Society of Mechanics of China, University of Hong Kong.

Information: Conference Secretary, International Conference on Finite Element Methods, Department of Civil Engineering, University of Hong Kong, Hong Kong.

3–10. **Meeting on Binary Systems and Ring Theoretic Methods in Universal Algebra**, Czechoslovakia.

Topics: Algebraic, geometric and combinatorial aspects of "small" binary systems as groupoids, quasigroups, loops, hypergroups, etc. Ring constructions, ternary rings, graded rings, modules, generalized modules and equivalent varieties.

Information: J. Ježek, Department of Algebra, Charles University, Sokolovská 83, 18600 Praha 8, Czechoslovakia.

8–13. **Tenth IMACS World Congress on Systems Simulation and Scientific Computation**, Montreal, Canada. (June 1981, p. 348)

8–13. **First International Conference on Teaching of Statistics**, Sheffield, England.

Information: Conference Secretary, International Conference on the Teaching of Statistics, Department of Probability and Statistics, The University, Sheffield, S37RH, England.

11–19. **International Congress of Mathematicians**, Warsaw, Poland. (August 1981, p. 426)

19–27. **Eighth Conference on Analytic Functions**, Blazejewko, Poland. (August 1981, p. 438)

23–28. **Equadiff 82**, Würzburg, Federal Republic of Germany.

Information: H. W. Knobloch, Equadiff 82, Mathematisches Institut, Universität Würzburg, D-8700 Würzburg, Federal Republic of Germany.

30–September 3. **Eleventh International Symposium on Mathematical Foundations of Computer Science**, Gdansk, Poland. (November 1981, p. 644)

OCTOBER 1982

October–November 1982. **Workshop on Teaching of Graduate and Undergraduate Mathematics**, Chiangmai, Thailand.

Information: Mark Tamthai, Department of Mathematics, Chulalongkorn University, Bangkok 5, Thailand.

LATE ENTRY

March 1982

25-27. Statistics on Spheres: Sixth Annual Lecture Series in the Mathematical Sciences, University of Arkansas, Fayetteville, Arkansas.

Principal Speaker: Geoffrey S. Watson, Princeton University.

Program: Professor Watson will deliver five lectures on the statistical analysis of directional data, including spherical uniformity and "normality", inference, and probability density estimation. There will also be sessions for contributed papers.

Deadline for Abstracts: Abstracts should be submitted by February 15, 1982.

Information: Dennis Brewer, Department of Mathematics, SE 301, University of Arkansas, Fayetteville, Arkansas 72701, (501)575-3351.

Personal Items

Richard D. Anderson of Louisiana State University was awarded the Bolzano Medal by the Czechoslovak Academy of Sciences for his research in infinite dimensional topology as well as his service to the mathematical sciences.

Benjamin Epstein of the Technion-Israel Institute of Technology was elected President of the Israel Statistical Association for 1981–1983.

Elyahu Katz of Haifa University and the University of North Carolina, Chapel Hill, has been appointed to an associate professorship at Cleveland State University.

Kenneth L. Kuttler of the University of Texas, Austin, has been appointed to a visiting assistant professorship at Michigan Technological University.

Paul B. Massell has been appointed to an assistant professorship at the U. S. Naval Academy in Annapolis, Maryland.

Daniel S. Moak of Texas Tech University has been appointed to an assistant professorship at Michigan Technological University.

Randy Odendahl has been appointed to an instructorship at Michigan Technological University.

R. K. Oliver has been appointed to an assistant professorship at the University of Pittsburgh, Johnstown.

Paolo Ranaldi of Purdue University has been appointed to an instructorship at Michigan Technological University.

Russell Reid of the University of Missouri has been been appointed to an assistant professorship at Michigan Technological University.

Claude L. Schochet of Wayne State University has been promoted to a professorship.

J. M. S. Simões-Pereira of City University of New York, Hunter College, has been promoted to a professorship.

Douglas Troeger has been appointed to an assistant professorship at the Stevens Institute of Technology.

Robert J. Vanderbei of Cornell University has been awarded an NSF Postdoctoral Research Fellowship at the Courant Institute of Mathematical Sciences, New York University.

Ai-Nung Wang of the University of California, Berkeley, has been appointed to a visiting assistant professorship at Michigan Technological University.

Deaths

Henry G. Forder of the University of Auckland, New Zealand, died on September 21, 1981 at the age of 91. He was a member of the Society for 27 years.

Lester L. Gavurin of City University of New York, Brooklyn College, died on October 16, 1981 at the age of 59. He was a member of the Society for 34 years.

Felix Pollaczek of Boulogne, France, died on April 29, 1981 at the age of 88. He was a member of the Society for 29 years.

Andrew Sobczyk of Clemson University died on November 7, 1981 at the age of 66. He was a member of the Society for 41 years.

Duppanapudi Suryanarayana of Andhra University, India, died on August 12, 1981 at the age of 47. He was a member of the Society for six years.

Lars E. Zachrisson of Kungliga Tekniska Högskolan, Sweden, died recently at the age of 61. He was a member of the Society for 27 years.

Visiting Mathematicians — *Supplementary List*

The following lists of visiting mathematicians include both foreign mathematicians coming to the United States and Canada, and Americans going abroad. The original lists appeared on pages 440-444 of the August 1981 *Notices*; supplementary lists appeared on pages 538-540 of the October 1981 issue.

MATHEMATICIANS VISITING ABROAD

Name and Home Country	Host Institution	Field of Special Interest	Period of Visit
Abdali, Kamal (U.S.A.)	University of Petroleum and Minerals, Saudi Arabia	Computer Science	9/81 - 6/82
Snider, R. L. (U.S.A.)	University of Cambridge, England	Algebra	8/81 - 7/82

VISITING FOREIGN MATHEMATICIANS

Akinyele, Olusola (Nigeria)	Iowa State University	Ordinary Differential Equations	8/81 - 5/82
Alekseyev, Valery (U.S.S.R.)	University of Colorado	Mathematical Cybernetics	9/81 - 5/82
Bernhardt, Chris (Great Britain)	Southern Illinois University, Carbondale	Dynamical Systems	8/81 - 5/82
Chipot, Michel (France)	Brown University	Variational Inequalities, Free Boundaries and Elasticity	9/81 - 6/82
de Oliveira, G. N. (Portugal)	City University of New York, Hunter College	Matrix Theory	3/82 - 4/82

Name and Home Country	Host Institution	Field of Special Interest	Period of Visit
Edelstein, Leah (Israel)	Brown University	Partial Differential Equations, Biomathematics	9/81 - 5/82
Ekeland, I. (France)	University of British Columbia	Mathematical Economics, Differential Equations, Nonlinear Analysis	8/81 - 7/82
Eldor, Haim (Israel)	State University of New York, Binghamton	Search Theory	9/81 - 6/82
Fine, Jonathan (England)	Southern Illinois University, Carbondale	Algebraic Geometry	8/81 - 5/82
Gamst, J. (West Germany)	University of British Columbia	Smooth Dynamical Systems, Mechanics	8/81 - 4/82
Garcia, Octavio (Mexico)	University of Colorado	Universal Algebras	11/81 - 5/82
Grasman, Johan (Holland)	University of British Columbia	Asymptotics, Nonlinear Oscillations, Cheap Control, Mathematical Biology	8/81 - 1/82
Hajnal, A. (Hungary)	University of Calgary	Combinatorial Set Theory	1/82 - 6/82
Heath-Brown, Roger (England)	University of Texas, Austin	Analytic Number Theory	1/82
Hsiao, Ling (Republic of China)	Brown University	Hyperbolic Conservation Laws	9/81 - 1/82
Hurlimann, Werner S. (Switzerland)	Yale University	Algebra, Brauer Groups, Invariant Theory	10/81 - 5/82
Koppelberg, Berndt (West Germany)	University of Colorado	Logic	11/81 - 3/82
Koppelberg, Sabine (West Germany)	University of Colorado	Logic	11/81 - 3/82
Kusano, Takasi (Japan)	Iowa State University	Differential Equations	1/82 - 5/82
Matsumoto, K. (Japan)	University of British Columbia	Differential Geometry	4/81 - 1/82
McCullagh, P. (Ireland)	University of British Columbia	Statistics	7/81 - 6/82
Meier, David (Switzerland)	Southern Illinois University, Carbondale	Group Theory	8/81 - 5/82
Pavlu, Luis Carlos (Brazil)	Brown University	Infinite Dimensional Problems and Bifurcation Theory	1/81 - 12/82
Sapounakis, A. (Greece)	University of British Columbia	Measure Theory, General Topology and Related Fields	7/81 - 6/82
Sato, Ken-iti (Japan)	Carleton University	Probability Theory	8/81 - 4/82
Shi, Shengming (People's Republic of China)	Yale University	Representation Theory of Lie Groups and Lie Algebras	7/81 - 6/82
Shiue, Jau-Shyong (Republic of China)	Southern Illinois University, Carbondale	Number Theory	8/81 - 8/82
Shun-Si, Feng (China)	Memorial University of Newfoundland	Numerical Analysis	9/81 - 8/82
Singh, B. M. (India)	University of Calgary	Applied Mathematics	10/81 - 6/82
Slodowy, Peter (West Germany)	Yale University	Singularity Theory	9/81 - 5/82
Somolinos, Alfredo (Spain)	Brown University	Ordinary Differential Equations	9/81 - 8/82
Spezamiglio, Adalberto (Brazil)	Brown University	Ordinary Differential Equations	9/80 - 8/82
Sreehari, M. (India)	Southern Illinois University, Carbondale	Probability	8/81 - 7/82
Sun, Guofang (Republic of China)	Brown University	Engineering Mechanics, Applied Mathematics	8/81 - 1/82
Szczerba, Letaw W. (Poland)	Iowa State University	Foundations of Mathematics	8/81 - 5/82
Tan, Keng-Teh (Malaysia)	Carleton University	Ring Theory	1/82 - 7/82
Van Haagen, Antonius J. (The Netherlands)	Southern Illinois University, Carbondale	Probability	8/81 - 5/82
Wang, Jia-song (People's Republic of China)	Pomona College	Numerical Analysis	4/81 - 4/83
Wu, Li-de (Republic of China)	Brown University	Probability and Statistics	7/80 - 1/82
Xia, D. L. (China)	University of Regina	Computer Mechanics	6/81 - 6/82
Ye, Biquan (Republic of China)	Brown University	Continuum Mechanics and Applied Mathematics	7/81 - 6/83
Yun, Ti-Quan (China)	University of British Columbia	Elasticity, Perturbation and Asymptotics	7/81 - 1/82

AMS SHORT COURSE LECTURE NOTES

A Subseries in Proceedings of Symposia in Applied Mathematics (ISSN 0160-7634)

The AMS Short Course Series was initiated in 1973 in response to what was then an urgent employment problem for recent mathematics Ph.D's. It has turned out to have a wider impact. The applied mathematical sciences are currently experiencing real growth and indications are that this trend will continue. The Short Course series addresses the problem of keeping mathematicians in touch with new developments for both intellectual and pragmatic reasons.

The first Short Course to have its Lecture Notes published as a book was "Mathematical Aspects of Production and Distribution of Energy." The success of this book and the one following, "Numerical Analysis," indicated that publication was worthwhile. The following pages have descriptions of the five sets of Lecture Notes published and a sampling of favorable comments from questionnaires distributed to the persons attending each course.

OPERATIONS RESEARCH: MATHEMATICS AND MODELS

edited by *Saul I. Gass*

As part of its educational activities, the American Mathematical Society sponsors special topic short courses for the attendees of its national meetings. This volume contains the revised lecture notes for the short course *Operations Research: Mathematics and Models* given on August 19-20, 1979 at the 83rd summer meeting held in Duluth, Minnesota. These lectures emphasized specific areas of operations research and the mathematics used in modeling and solving the related problems. The topics and lecturers were:

1. *Mathematical modeling of military conflict situations,* Seth Bonder, Vector Research, Inc.
2. *Queueing networks,* Ralph L. Disney, Virginia Polytechnic Institute and State University.
3. *Practical aspects of fishery management modeling,* Frederick C. Johnson, National Bureau of Standards.
4. *Mathematical modeling of health care delivery systems,* William P. Pierskalla, University of Pennsylvania.
5. *Operations research: Applications in agriculture,* Robert B. Rovinsky, U. S. Department of Agriculture.
6. *Mathematical modeling applied to the relocation of fire companies,* Warren E. Walker, The Rand Corporation.

Each lecturer attempted to make his presentation self-contained in terms of defining the application areas and mathematics employed. The reader of the resulting notes will find that the authors, in their desire to broaden the usefulness of the published material, have, in some instances, stretched the meaning of self-contained. Thus, the reader might find that a bit of perseverance, coupled with dipping into some subsidiary references, is required to obtain the full benefits of the written discussions. However, even the casual reader will be able to ascertain how the field of operations research has contributed to the resolution of important decision problems—and how the field of applied mathematics has flourished in the guise of operations research.

". . . speakers combined real knowledge, interesting topics, and excellent public speaking skills."

"Notes handed out made it possible to concentrate on the speakers."

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GAME THEORY AND ITS APPLICATIONS

edited by *William F. Lucas*

This volume contains the lecture notes prepared by the speakers in the short course on Game Theory and its Applications given in Biloxi, Mississippi in 1979.

Game theory has been a topic of broad interest as a purely theoretical subject which has relationships to many other mathematical areas, and also as a subject widely used in applications over a large variety of problem areas. It is concerned with mathematical models for situations involving conflict and/or cooperation. These arise in a fundamental way throughout the behavioral and decision sciences. Game theory has become a basic modeling technique in much of modern economic theory, political science, sociology, and operations research, and it has frequently been applied to many other fields. It is a subject highly suitable for joint research of an interdisciplinary nature.

This volume is concerned mostly with the n-person theory ($n \geqslant 3$), although chapter 6 also describes several basic two-person models. The first five chapters deal for the most part with the multiperson cooperative games in the characteristic function (coalitional) form. The normal (strategic) form and the extensive (tree) form of a noncooperative game are stressed in chapter 6, although some basic definitions for the normal form do appear in an earlier chapter. Selected applications of the theory which are covered here in some detail include economic market games,

measuring power in political systems, equitable allocation of costs, and auctions. Many of the important recent uses of game theory have involved the *n*-person cooperative models.

These lectures were presented to an audience of mature mathematicians. Nevertheless, this volume could also serve as a textbook for a general course in game theory at the upper division or graduate levels.

William F. Lucas, *The multiperson cooperative games*
William F. Lucas, *Applications of cooperative games to equitable allocation*
Louis J. Billera, *Economic market games*
L. S. Shapley, *Valuation of games*
L. S. Shapley, *Measurement of power in political systems*
Robert J. Weber, *Noncooperative games*

"Careful attention of the speakers to preparation of notes with extensive bibliography."
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MODERN STATISTICS: METHODS AND APPLICATIONS

edited by *Robert V. Hogg*

This volume contains the lecture notes prepared by the speakers for the AMS Short Course given in San Antonio on January 7-8, 1980.

The choice of topics from a field as large as Statistics is a difficult one. The organizers wanted to avoid any substantial overlap with the short course on statistics held three years earlier in St. Louis; therefore it seemed very natural to begin with one important topic that is sometimes overlooked in an introductory course, particularly one in mathematical statistics. This topic is one through which the general public most often hears about statistics, namely, survey sampling. Wayne Fuller spoke on *Samples and Surveys*, noting the operations necessary in conducting a survey of a human population. In his article, he explains the construction of a probability sample design and the corresponding optimal estimators.

The more general problem of the design and analysis of an experiment was covered by Peter John in his *Analysis of Variance*. These techniques have been extremely important in applications and have also motivated a large amount of statistical research. It is clear that even in an elementary design the experimenter must understand the importance of randomization.

Nonparametric statistical methods have played a major role in modern statistics. Two coordinated talks on that subject were given by Ronald Randles and Thomas Hettmansperger. Randles introduced distribution-free rank tests, such as one by Wilcoxon, and some of their good asymptotic properties. Hettmansperger then explained how these rank tests could be used to obtain point and interval estimates for various parameters, including the regression situation. These resulting *R*-estimates are very robust because they are not highly sensitive to reasonable deviations from the underlying assumptions.

The important topic of regression was continued by considering isotonic regression and time series. F. T. Wright showed how to use the method of maximum likelihood to estimate ordered parameters. Then Douglas Martin considered a time sequence of data. After presenting a collection of interesting examples, he discussed appropriate models and their estimates, including robust ones.

This book provides an introduction to the statistical topics above. A background of good mathematics through advanced calculus with a little statistics is adequate preparation for enjoyment of the contents. The attentive reader will gain a fairly good understanding of the nature of survey sampling, design and analysis of experiments, nonparametric methods, isotonic regression, and time series. *Modern Statistics: Methods and Applications* is an excellent companion to MAA's *Studies in Statistics* also edited by Professor Hogg.

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"Notes very good."
"Printed notes were invaluable."

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NUMERICAL ANALYSIS

edited by *Gene H. Golub* and *Joseph Oliger*

This is the collection of texts prepared by the lecturers for the Numerical Analysis Short Course given at the AMS meeting in Atlanta, Georgia, in January 1978. The subject matter was chosen to emphasize prominent research areas and attitudes in numerical analysis. These are introductory lectures on the subject matter for presentation to an audience of scientists from other areas or disciplines. Typically, there is an introduction to a given problem area and to techniques used, an application to applied problems, and a discussion of current research questions or directions.

The papers given here are mainly of a mathematical

nature. Several trends in modern numerical analysis are discussed in these lectures. These texts should be useful to the practicing users of numerical methods, programmers, scientists, and engineers who would like to know that progress is being made on the theoretical and developmental side of the subject. The papers and the bibliographies of current work should be useful in general to those who wish to understand the nature of numerical analysis and its current problems of interest.

The papers included are:

Cleve B. Moler, *Three research problems in numerical linear algebras*

J. E. Dennis, Jr., *A brief introduction to quasi-Newton methods*

Carl de Boor, *The approximation of functions and linear functionals: Best vs. good approximation*

James M. Varah, *Numerical methods for the solution of ordinary differential equations*

Joseph E. Oliger, *Methods for time dependent partial differential equations*

George J. Fix, *Variational methods for elliptic boundary value problems*

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MATHEMATICAL ASPECTS OF PRODUCTION AND DISTRIBUTION OF ENERGY

edited by Peter D. Lax

Volume 21 of the Proceedings of Symposia in Applied Mathematics contains the papers presented at the Energy Short Course held on January 20-21, 1976 in San Antonio, Texas at the Eighty-second Annual Meeting of the American Mathematical Society. The papers are grouped in two categories: those having to do with the mathematical problems involved in the technology of energy production, and those which have to do with the mathematical problems of estimating the resources of energy and the efficient distribution of available energy. In both areas we are dealing with idealized models. The models for energy production are in the form of fairly complicated systems of partial differential equations whose solutions require techniques of finite difference schemes, finite element methods, and Fourier techniques. The models of energy distribution are large networks; their analysis is based on techniques from statistics, linear programming, dynamic programming, and techniques of optimization.

The organizing committee had asked as speakers mathematicians deeply committed to energy related applications as well as experts in these fields who have a flair for mathematical ideas and techniques. Several of the speakers are not only technical experts in their field, but have also been involved in decision making. For this reason, several of the articles contain interesting remarks on public policy.

The section of the book which deals with the mathematics of energy production includes *Magnetic confinement fusion energy research* by Harold Grad, *Nuclear energy—problems and promise* by Milton S. Plesset, and *Laser fusion* by F. D. Tappert. Articles in the section dealing with mathematical problems in modeling energy production and distribution are: *Estimation of undiscovered oil and gas* by E. Barouch and G. M. Kaufman, *On a pilot linear programming model for assessing physical impact on the economy of a changing energy picture* by George B. Dantzig and S. C. Parikh, *The problem of aggregation in modeling physical and social systems and processes* by Richard L. Garwin, and *Project independence evaluation system. Structure and algorithms* by William W. Hogan.

This is expository work; for the papers on energy production, some previous knowledge of differential equations is necessary. For the problem of energy distribution, some background in operations research is needed.

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"Grad – whole talk great."

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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.

Melvin Hochster (1984) and Robion C. Kirby (1984) have been appointed by President Andrew M. Gleason to the *Program Committee for National Meetings.* Continuing members of the committee are Enrico Bombieri (1983), Ronald L. Graham (1983), Everett Pitcher (ex offficio), J. H. Sampson (1982), and Barry Simon, chairman (1982).

Hyman Bass (1983) and Bernard Maskit (1983) have been appointed to the *Committee to Select Hour Speakers for Eastern Sectional Meetings* by President Andrew M. Gleason; Herman R. Gluck (1982) has been appointed chairman. Continuing members of the committee are Raymond G. Ayoub (ex officio), and S. S. R. Varadhan (1982).

Paul J. Cohen (1982), J. William Helton (1983), and Alistair H. Lachlan (1983) have been appointed by President Andrew M. Gleason to the *Committee to Select Hour Speakers for Far Western Sectional Meetings,* with Professor Cohen as chairman. Continuing members of the committee are Morris W. Hirsch (1982), and Hugo Rossi (ex officio).

Bjarni Jonsson (1983) and Michael C. Reed (1983) have been appointed to the *Committee to Select Hour Speakers for Southeastern Sectional Meetings* by President Andrew M. Gleason. Continuing members of the committee are Frank T. Birtel (ex officio), Marvin Rosenblum (1982), and Harsh V. Pittie (1982) who has been reappointed chairman.

Richard A. Askey (1983) has been appointed to the *Committee to Select Hour Speakers for Western Sectional Meetings* by President Andrew M. Gleason. Continuing members of the committee are Paul T. Bateman (ex officio), and R. H. Bing (1982), and M. S. Baouendi (1982) who has been appointed chairman.

R. Creighton Buck, Freeman J. Dyson, and David Gilbarg have been appointed to the *Committee to Select the Gibbs Lecturers for 1983 and 1984* by President Andrew M. Gleason. Professor Buck is the chairman.

President Andrew M. Gleason has appointed Martin D. Davis (1984), and James E. Joseph (1984) to the *Committee on Academic Freedom, Tenure, and Employment Security,* and Arlan B. Ramsay (1983) has been appointed chairman. Continuing members of the committee are Fred G. Bauer (1983), Lewis A. Coburn (1982), and Calvin C. Moore (1983).

Irwin Kra (1984) has been appointed and Donald C. Rung (1984) has been reappointed to the *Committee on Employment and Educational Policy* by President Andrew M. Gleason. Continuing members of the committee are Lida K. Barrett, chairman (1982), Hans Schneider (1983), Robert J. Thompson (1982), and Barnet M. Weinstock (1983).

Peter J. Hilton (1984) has been appointed and Eduardo D. Sontag (1984) has been reappointed to the *Committee on Human Rights of Mathematicians* by President Andrew M. Gleason. Continuing members of the committee are R. H. Bing (1982), Chandler Davis (1983), Ed Dubinsky (1983), John A. Nohel, chairman (1982), and Gail S. Young (1983).

Roland F. Esquerra (1984) has been appointed by President Andrew M. Gleason to the *Committee on Opportunities in Mathematics for Disadvantaged Groups.* Continuing members of the committee are Manual P. Berriozabal (1982), James A. Donaldson, chairman (1984), Gloria F. Gilmer (1982), and Scott Warner Williams (1983).

Richard M. Karp (1983) and Daniel J. Kleitman (1983) have been appointed by President Andrew M. Gleason to the *Committee on Postdoctoral Fellowships.* Continuing members of the committee are Benedict Gross (1982), Paul H. Rabinowitz (1983), Donald E. Sarason (1983), and Robert I. Soare, chairman (1982).

I. M. Singer (1984) has been appointed by President Andrew M. Gleason to the *Committee on Science Policy.* Continuing members of the committee are Hyman Bass (1984), Felix E. Browder (1984), Frederick W. Gehring (1984), Andrew M. Gleason (1983), Kenneth M. Hoffman, chairman (1985), Herbert B. Keller (1983), George D. Mostow (1983), Ralph S. Phillips (1983), Linda Preiss Rothschild (1983), James D. Stasheff (1983), Elias M. Stein (1983), and Hans F. Weinberger (1983).

Daniel Zelinsky (1983) has been appointed by President Andrew M. Gleason to the *Committee on Prizes;* Ivan Niven (1983) has been reappointed and will continue to serve as chairman. Continuing members of the committee are Walter Feit (1982) and John W. Milnor (1982).

Julia B. Robinson (1985) has been appointed by President Andrew M. Gleason to the *Committee on National Awards and Public Representation.* Other members of the committee are Andrew M. Gleason (1982) and Everett Pitcher (ex officio).

Edwin H. Spanier (1984) has been appointed to the *Committee on Steele Prizes* by President Andrew M. Gleason, and Alex Rosenberg (1983) has been appointed chairman. Other members of the committee are Stuart Antman (1983), Robin Hartshorne (1982), Reuben Hersh (1982), M. D. Kruskal (1983), Louis Nirenberg (1983), Max M. Schiffer (1983), and Gail S. Young (1983). Terms on this committee expire on June 30.

Harold M. Stark (1984) has been appointed by President Andrew M. Gleason to the *Committee on*

Summer Institutes, and Robert Osserman (1984) has been reappointed and will continue to serve as chairman. Continuing members of the committee are Morris W. Hirsch (1982), George C. Papanicolaou (1983), Wilfried Schmid (1982), and Stephen Wainger (1983). Terms on this committee expire on February 28.

An ad hoc AMS-SIAM *Committee to Screen Applicants for Graduate Study from the People's Republic of China* has been appointed jointly by Presidents Seymour V. Parter (SIAM) and Andrew M. Gleason (AMS). Members of the committee are Phillip A. Griffiths, Chia-chiao Lin, Beresford N. Parlett, Franklin P. Peterson, chairman, Mei-chang Shen, and Karen Uhlenbeck.

Raymond L. Johnson (1984), Neal I. Koblitz (1984), and Andrew M. Odlyzko (1984) have been appointed by President Andrew M. Gleason to the *AMS Subcommittee of the joint AMS-IMS Committee on Translations from Russian and Other Foreign Languages*. Continuing members of the AMS subcommittee are Israel Berstein (1983), Ronald G. Douglas (1982), David Ebin (1983), Solomon Feferman (1982), Frederick P. Gardiner (1982), John B. Garnett (1982), Jack K. Hale (1983), Boris Mityagin (1983), Melvyn Nathanson (1983), Arthur H. Stone (1983), and Lawrence Zalcman, chairman (1984). The members of the IMS Subcommittee of this committee are A. T. Bharucha-Reid, Miklós Csörgő, Eugene M. Klimko, Eugene Lukacs, chairman, and Lajos F. Takacs. Professor Zalcman is chairman of the combined committee. Terms on this committee expire on September 30.

Barbara L. Osofsky (AMS, 1985), has been appointed by President Andrew M. Gleason to the joint *AMS-MAA-SIAM Joint Projects Committee for Mathematics*, and John Nohel (SIAM, 1983) has been appointed chairman. Other members of the committee are C. Edmund Burgess (AMS, 1983), Wendell H. Fleming (AMS, 1982), Shirley A. Hill (MAA, 1983), Ettore F. Infante (SIAM, 1984), Gottfried E. Noether (MAA, 1982), and Werner C. Rheinboldt (SIAM, 1982). Terms on this committee expire on September 30.

Reports of Past Meetings

The Summer Meeting in Pittsburgh

The 85th summer meeting of the American Mathematical Society was held from Monday to Friday, August 17-21, 1981, at the University of Pittsburgh, Pittsburgh, Pennsylvania. It was held jointly with the 61st summer meeting of the Mathematical Association of America and the 1981 annual meeting of Pi Mu Epsilon. The meeting was preceded by the AMS Short Course, *The Mathematics of Networks*. There were 733 registrants, including 531 members of the Society.

Colloquium Lectures. Serge Lang of Yale University presented a series of four Colloquium Lectures entitled *Units and class numbers in algebraic geometry and number theory*. Andrew M. Gleason presided at the first, third and fourth lectures, and Peter D. Lax was the presiding officer at the second lecture.

Steele Prizes. Three 1981 Leroy P. Steele Prizes were awarded in a prize session held on Thursday, August 20. The 1981 recipients were Oscar Zariski of Harvard University (Emeritus); Eberhard Hopf of Indiana University; and, jointly, Nelson Dunford of Sarasota, Florida, and Jacob T. Schwartz of the Courant Institute of Mathematical Sciences, New York University.

Invited Addresses. By invitation of the Program Committee there were eight invited one-hour addresses as follows:

SHREERAM ABHYANKAR, Purdue University, *Singularities.*

RICHARD W. BEALS, Yale University, *Scattering, inverse scattering, and evolution equations.*

ANDREW CASSON, University of Cambridge, England, *Cobordism problems in geometric topology.*

ROBERT L. GREISS, JR., University of Michigan, Ann Arbor, *Sporadic simple groups and linear algebra.*

PETER W. JONES, University of Chicago, *Some problems in the theory of Hardy spaces.*

RICHARD M. KARP, University of California, Berkeley, *Efficient reducibility: A tool for measuring computational complexity.*

ANDREW ODLYZKO, Bell Laboratories, Murray Hill, *Nontransitive games, pattern matching, and other excursions into probability theory and combinatorics.*

LINDA PREISS ROTHSCHILD, University of Wisconsin, Madison, *Existence and smoothness of solutions for some linear differential equations: Connections with group representation theory and applications to several complex variables.*

Special Sessions. By invitation of the same committee, there were eight special sessions of selected twenty-minute papers as follows:

Topics in complex analysis, JACOB BURBEA, University of Pittsburgh. The speakers were Sheldon Axler, Karl F. Barth, Frank Beatrous, Steven R. Bell, Carlos A. Berenstein, Thomas Bloom, James E. Brennan, Jacob Burbea, Joseph A. Cima, Charles V. Coffman, John P. D'Angelo, Peter L. Duren, Carl H. Fitzgerald, Ian R. Graham, Robert E. Greene, Reuven Harmelin, Peter Henrici, Boris Korenblum, Steven G. Krantz, A. M. MacBeath, Thomas A. Metzger, C. David Minda, R. N. Pederson, S. Sabarou Saitoh, G. Sampson, Glenn Schober, Nobuyuki Suita, Lawrence Zalcman, and R. A. Zalik.

Knots, links, and 3-manifolds, CAMERON MCA. GORDON, University of Texas, Austin. The speakers were Marc Culler, Patrick M. Gilmer, Cameron McA. Gordon, John L. Harer, Charles Livingston, Daniel R. McMillan, Jr., Lee P. Neuwirth, Steven P. Plotnick, Józef H. Przytycki, Lee N. Rudolph,

Jonathan K. Simon, DeWitt L. Sumners, and Lorenzo Traldi.

Noncommutative ring theory, ROBERT GORDON, Temple University. The speakers were John A. Beachy, John Cozzens, Patrick Fleury, K. R. Fuller, Charles Lanski, Wallace S. Martindale, Susan Montgomery, Irving Reiner, Sylvia M. M. Weigand, and Elena Wexler-Kreindler.

Algorithms and complexity, JOHN E. HOPCROFT, Cornell University. The speakers were Ronald V. Book, Ashok K. Chandra, Juri Hartmanis, Christoph M. Hoffman, Maria Klawe, Eugene M. Luks, Attila Máté, Eric S. Rosenthal, and J. T. Schwartz.

Kleinian groups, BERNARD MASKIT, State University of New York, Center at Stony Brook. The speakers were James W. Cannon, Andrew H. Haas, Linda Keen, Bernard Maskit, Howard A. Masur, J. Peter Matelski, Peter Nicholls, Robert J. Sibner, Perry D. Susskind.

C-algebras and applications*, ROBERT T. POWERS, University of Pennsylvania. The speakers were John W. Bunce, Edward Effros, Richard H. Herman, Robert T. Powers, and Jonathan Rosenberg.

Numerical analysis, WERNER C. RHEINBOLDT, University of Pittsburgh. The speakers were Benito Chen-Charpentier, George J. Fix, Janet S. Peterson, Thomas A. Porsching, and Richard S. Varga.

Complex geometry and mathematical physics, R. O. WELLS, JR., Rice University. The speakers were J. D. Finley, James A. Goldberg, C. Denson Hill, Lane P. Hughston, James A. Isenberg, Gerald Kaiser, Morris Kalka, Claude R. LeBrun, Gabriel G. Lugo, Tilla Klotz Milnor, Ezra T. Newman, Zoltán Perjés, Robert Pool, John R. Porter, Simon Salamon, Roger Schlafly, Michael Sheppard, George A. J. Sparling, and Phillip B. Yasskin.

Contributed Papers. There were seven sessions for contributed ten-minute papers. The presiding officers for these sessions were Nazanin Azarnia, Sister Rita M. Ehrmann, Eldon J. Vought, Thomas E. Armstrong, Charles L. Byrne, Earl G. Whitehead, Jr., and Stephen W. Semmes.

Other Events. In addition to the Society's mathematical program there were several events of general interest. The Society's Committee on Employment and Educational Policy and the MAA jointly presented a panel session on preliminary data from the 1980 CBMS survey of undergraduate programs. The moderator was Barnet Weinstock. Gail S. Young participated in place of the late John W. Jewett. A report, *Circular A-21: Cost principles for educational institutions*, was presented by Serge Lang. The Society's new computerized information retrieval system, MATHFILE, was described by John Selfridge and William J. LeVeque. A talk was given by Cheryl G. Tropf on her activities as an AMS-MAA-SIAM Congressional Fellow.

Council and Business Meetings. The reports of the Council and Business Meetings held during the summer meeting were given on pages 550 and 551 of the October 1981 issue of the *Notices*.

Frank T. Birtel
Associate Secretary

New Orleans, Louisiana

CONTEMPORARY MATHEMATICS
(ISSN 0271-4132)

PROBLEMS OF ELASTIC STABILITY AND VIBRATIONS

edited by *Vadim Komkov*

The articles collected in this volume are enlarged versions of the talks presented in one of the special sessions at the spring meeting of the American Mathematical Society held in Pittsburgh in May 1981.

All papers are directly related to problems in stability or eigenvalue problems arising in considerations of elastic stability or elastic vibrations. A multitude of papers has appeared in the five years preceding this meeting in various aspects of elastic stability and elastic vibrations because of the rapidly growing theoretical developments in structural and mechanical design problems.

L. E. Payne, *On the stabilization of ill posed Cauchy problems in nonlinear elasticity*
James Moseley, *A nonlinear eigenvalue problem with an exponential nonlinearity*
Erich Miersemann, *Eigenvalue problems for variational inequalities*
George H. Knightly and D. Sather, *Regularity and symmetry properties of solutions of the John shell equations for a spherical shell*
Kyung K. Choi and Edward J. Haug, *Repeated eigenvalues in mechanical optimization problems*
Vadim Komkov and Edward J. Haug, *Effects of some nonlinear terms on the buckling of elastic bodies*
Raymond H. Plaut, *Vibrations and stability of shallow elastic arches*

1980 *Mathematics Subject Classifications*: 73H05, 73H10, 73D30.

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SIAM '82

30th ANNIVERSARY MEETING

July 19-23, 1982

Stanford University
Stanford, California

GENERAL ANNOUNCEMENT

The 30th Anniversary Meeting of SIAM will be held at Stanford University, Stanford, California on July 19-23, 1982. It will be the only national meeting of SIAM in 1982.

The program will feature five symposia topics, contributed papers and poster presentations and, as a special feature, a number of "mini-symposia."

There will also be a special lecture sponsored by SIAM Institute for Mathematics and Society, the first award of the SIAM Prize in Numerical Analysis and Scientific Computing, and the 21st John von Neumann Lecture.

PROGRAM COMMITTEE

Members of the Program Committee for SIAM '82 are Gene H. Golub (Chairman), Stanford University; Robert E. O'Malley, Rensselaer Polytechnic Institute; James McKenna, Bell Laboratories; and, ex officio, the managing editors of the SIAM journals.

REGISTRATION

Advance registration material will be available in May 1982. For additional meeting information, contact:
H. B. Hair,
117 South 17th Street, Suite 1405,
Philadelphia, PA 19103.
Telephone: 215-564-2929.

TOPICS

The Numerical Solution of Partial Differential Equations and Applications

The Numerical Analysis of Ordinary Differential Equations

Control Theory

Biomathematics

Computer Science

Methods in Nonlinear Analysis

CONTRIBUTED PAPERS AND POSTER PRESENTATIONS
How to contribute...

Contributions in all areas of applied mathematics are welcome, but contributions in the areas of the symposia themes are especially desired. To contribute a "twelve-minute" paper or poster presentations, obtain a standard abstract form from SIAM, Contributed Abstracts, 117 South 17th Street, Suite 1405, Philadelphia, PA 19103; Telephone: 215-564-2929. SIAM must receive abstracts—200 words or less—by March 1, 1982.

SYMPOSIA AND INVITED SPEAKERS

The Numerical Solution of Partial Differential Equations and Applications
- Antony Jameson, Princeton University
- Cathleen S. Morawetz, Courant Institute of Mathematical Sciences, New York University
- Donald J. Rose, Bell Laboratories
- Mary F. Wheeler, Rice University

The Numerical Analysis of Ordinary Differential Equations
- John C. Butcher, University of Auckland
- Germund Dahlquist, Royal Institute of Technology, Stockholm
- Peter Deuflhard, Universitat Heidelberg

Control Theory
- Karl Astrom, University of Lund
- David L. Russell, University of Wisconsin, Madison

Biomathematics
- Samuel Karlin, Stanford University
- Donald A. Ludwig, University of British Columbia
- Lawrence A. Shepp, Bell Laboratories

Computer Science
- Jon Louis Bentley, Carnegie-Mellon University
- Shmuel Winograd, IBM-T. J. Watson Research Center

Methods in Nonlinear Analysis
- Modern Mechanics
  - James A. Yorke, University of Maryland
  - Hermann Flaschka, University of Arizona
- Homotopy and Fixed Point Methods
  - Herbert B. Keller, California Institute of Technology
  - Michael Todd, Cornell University
- Applications to Fluid and Gas Dynamics
  - T. Brooke Benjamin, University of Oxford
  - Andrew Majda, University of California, Berkeley

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SUGGESTED USES for classified advertising are books or lecture notes for sale, books being sought, positions available, exchange or rental of houses, and typing services.

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SITUATION WANTED advertisements are accepted under terms spelled out on page A-355 of the April 1979 *Notices*. (Deadlines are the same as for other classified advertisements.)

SEND AD AND CHECK TO: Advertising Department, AMS, P.O. Box 6248, Providence, Rhode Island 02940. Individuals are requested to pay in advance, institutions are not required to do so.

POSITIONS AVAILABLE

UNIVERSIDAD DE SANTIAGO DE CHILE, Department of Mathematics has professorial positions available in the following areas of research: algebraic geometry, differential equations, dynamical systems, probability, statistics, mathematical biology, numerical analysis and related fields. Requirements: Ph.D. and proven research capability. Working knowledge of Spanish desirable. Annual salaries range from $24,000—to $36,000 (after Chilean income tax and social security payments). Minimum commitment, two years. Send detailed curriculum vitae and have two references sent to: Dean, Faculty of Science, USACH, Casilla 5659, Correo 2, Santiago, Chile. USACH is an equal opportunity employer.

DEPARTMENT OF MATHEMATICS
AND COMPUTER SCIENCE
SOUTHWEST TEXAS STATE UNIVERSITY

Applications invited for positions beginning fall 1982:

Assistant or Associate Professorships in Computer Science, tenure and non-tenure-track. Applicants should have a Ph.D. in Computer Science and demonstrate potential for excellence in teaching graduate and undergraduate courses in Computer Science. Professional activity is expected.

Assistant or Associate Professorships in Mathematics, tenure and non-tenure-track. Applicants should have a Ph.D. in Mathematics (or closely related area) and demonstrate potential for excellence in research and teaching. Preference will be given candidates with research interests in Topology (topology of low dimensional manifolds, decomposition space theory, and algebraic topology), Number Theory (analytic or algebraic), Mathematics Education (elementary or secondary), and Differential Equations (fixed points, variational methods, nonlinear functional analysis, continuum mechanics, numerical methods, functional DE's, bifurcation theory, dynamical systems). Applicants in Operations Research and Quadratic forms are also invited to apply.

Instructorships, non-tenure-track. Applicants should have an M.A. or equivalent in Mathematics (or closely related area), demonstrate teaching ability or teaching potential, and be willing to participate in faculty seminars and committee projects.

Salary and rank commensurate with qualifications and experience. Further information concerning specific positions is available from: Dr. John Spellmann, Chairman, Department of Mathematics and Computer Science, Southwest Texas State University, San Marcos, Texas 78666. Applications should be received by February 15, 1982 (late applications will be considered if openings exist). SWTSU is an equal opportunity/affirmative action employer.

STATE UNIVERSITY OF NEW YORK AT BINGHAMTON

expects to have senior and tenure-track-junior positions open in Fall 1982. Applications are invited from candidates having excellent research records. For senior applicants experience in the supervision of doctoral students is desirable. All areas of pure and applied mathematics will be considered, but one appointment is likely to be in the area of statistics. Applicants, whatever their research area, whose experience also qualifies them to teach undergraduate computer science should describe that experience. Send vita and letters of recommendation to:

Shelemyahu Zacks, Chairman
Department of Mathematical Sciences
State University of New York at Binghamton
Binghamton, NY 13901

An Equal Opportunity/Affirmative Action Employer

TEXAS A&M UNIVERSITY AT GALVESTON. Assistant Professor, tenure-track, starting Fall 1982. Requires Ph.D., teaching excellence and research, or research potential, Undergraduate Math through Differential Equations and Applied Math for Engineers. TAMU at Galveston, a growing institution, presently offers Bachelor degrees in Marine-related programs: Administration, Biology, Engineering, Sciences, Transportation. Graduate programs: Biology, Wildlife & Fisheries Science. Math faculty teaches in all degree programs through the Department of General Academics. Send dossier, including vita and three letters of recommendation to:

Dr. Anthony P. Blozinski
Math/General Academics
Texas A&M University at Galveston
Post Office Box 1675
Galveston, Texas 77553

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Department of Mathematics & Statistics
UNIVERSITY OF SOUTH CAROLINA, Columbia, SC 29208

The Department invites applications for tenure-track positions in mathematics and statistics beginning Fall of 1982. The Department is committed to continued growth and development of its pure and applied programs. The Ph.D. degree and strong potential for excellence in teaching and research are required. The standard teaching load is two courses per semester.

Applicants should submit a résumé and arrange for four letters of recommendation to be sent to Professor W. T. Trotter, Jr., Chairman. The University of South Carolina is an affirmative action/equal opportunity employer.

POSITIONS AVAILABLE

UNIVERSITY OF WISCONSIN-Madison, DEPARTMENT OF MATHEMATICS, 213 VAN VLECK HALL, MADISON, WI 53706.

Van Vleck Assistant Professorships in Mathematics. We invite applications from outstanding mathematicians of any age who are recent recipients of a doctorate—people who will interact well with members of our department, who care about teaching, and who can contribute to our research and instructional programs. Teaching load is 2 courses per semester. High probability of additional income through research or teaching during summers between consecutive years of appointment. Salary dependent on experience—at least $19,000 per academic year. Two or three-year term positions. Write Professor Fred Brauer, Department of Mathematics, 213 Van Vleck Hall, University of Wisconsin-Madison, Wisconsin 53706. Applications and supporting materials should be submitted as soon as possible, but not later than December 31, 1981. The University of Wisconsin is an Equal Opportunity Employer.

CENTRAL MICHIGAN UNIVERSITY
CHAIRPERSON DEPARTMENT OF MATHEMATICS

Applications are invited for Chairperson of the Department of Mathematics, position starting July or August 1982. Applicants should hold a doctorate in the mathematical sciences and have an excellent record of teaching, research and other professional activities. Preference will be given to candidates with at least 8 years experience in college teaching and/or administration. All qualified persons, including females, minorities and the handicapped, are encouraged to apply.

The Department of Mathematics, which includes pure and applied mathematics, statistics, and mathematics education, has a full-time faculty of 37. The Chairperson is expected to provide leadership in maintaining and developing programs at the undergraduate and masters level and in encouraging the professional growth and teaching excellence of the faculty.

Mail letter of application, vita and four letters of reference by February 15, 1982 to:

Dr. Mary R. Wardrop
Department of Mathematics
Central Michigan University
Mt. Pleasant, Michigan 48859

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MICHIGAN TECH UNIV
DEPT OF MATH & COMP SCI
HOUGHTON, MI 49931

About 5 tenure-track positions in *applicable mathematics* (e.g., probability, fluid mechanics, ODE, PDE, functional analysis, calculus of variations, control theory, etc.), *statistics, differential geometry, numerical analysis* and *computer science* as well as visiting positions are available. Assistant or associate professors preferred. Excellent research and teaching are required. MTU is a strong engineering school with good students and consulting possibilities. Houghton has temperatures moderated by Lake Superior with a great deal of snow and recreational activities. To apply write Dr. Richard Millman, Head. MTU is an equal opportunity educational institution/equal opportunity employer.

SOUTHERN ILLINOIS UNIVERSITY
Carbondale, IL 62901

Applications are invited for two assistant professor tenure-track positions in the Department of Mathematics at Southern Illinois University, Carbondale, starting August 16, 1982. AREA OPEN. Any area in pure or applied mathematics will be considered. *Qualifications*: A Ph.D. in Mathematics is required. Candidates must have demonstrated evidence of excellence in research and potential for such in an area of mathematics. Evidence of teaching excellence is preferred. The salary will be competitive. Closing date: February 1, 1982 or until positions are filled. Application plus three letters of recommendation should be directed to: Continuing Position, c/o Alphonse Baartmans, Chairman, Department of Mathematics. SIU-C is an Equal Opportunity/Affirmative Action Employer.

SOUTHERN ILLINOIS UNIVERSITY
Carbondale, IL 62901

Applications are invited for an assistant/associate professor tenure-track position in ANALYSIS in the Department of Mathematics at Southern Illinois University, Carbondale, starting August 16, 1982. *Qualifications*: A Ph.D. in Mathematics is required. Any area of analysis will be considered. Candidates must have demonstrated evidence of excellence in research and potential for such in an area of analysis. A broad background and interest in several areas of analysis is desired. Evidence of teaching excellence is preferred. The salary will be competitive. Closing date: February 1, 1982 or until position is filled. Application plus three letters of recommendation should be directed to: Analysis Position, c/o Alphonse Baartmans, Chairman, Department of Mathematics. SIU-C is an Equal Opportunity/Affirmative Action Employer.

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Carbondale, IL 62901

Applications are invited for an assistant/associate professor, tenure-track position in NUMERICAL ANALYSIS OR OPTIMIZATION in the Department of Mathematics at Southern Illinois University, Carbondale, starting August 16, 1982. *Qualifications*: A Ph.D. is required. Candidates must have demonstrated evidence of excellence and potential for such in Numerical Analysis or Optimization. Evidence of teaching excellence is preferred. The salary will be competitive. Closing date: February 1, 1982 or until position is filled. Application plus three letters of recommendation should be directed to: Numerical Analysis/Optimization Position, c/o Alphonse Baartmans, Chairman, Department of Mathematics. SIU-C is an Equal Opportunity/Affirmative Action Employer.

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Carbondale, IL 62901

Applications are invited for an assistant/associate professor, tenure-track position in DISCRETE MATHEMATICS/ COMPUTER RELATED MATHEMATICS in the Department of Mathematics at Southern Illinois University, Carbondale, starting August 16, 1982. *Qualifications*: A Ph.D. in Mathematics is required. Candidates must have demonstrated evidence of excellence and potential for such in Discrete Mathematics or some area of Computer Related Mathematics. Preference will be given to candidates with background and experience in Computer Science. The salary will be competitive. Closing date: February 1, 1982 or until position is filled. Application plus three letters of recommendation should be directed to: Discrete Math/Computer Related Math Position, c/o Alphonse Baartmans, Chairman, Department of Mathematics. SIU-C is an Equal Opportunity/ Affirmative Action Employer.

SOUTHERN ILLINOIS UNIVERSITY
Carbondale, IL 62901

Applications or nominations are invited for a PROFESSOR of Mathematics in the Department of Mathematics at Southern Illinois University, Carbondale, starting August 16, 1982. Applications in any area of pure and applied mathematics will be considered. Salary is negotiable and will be appropriate for an appointment at this level. Qualifications include an outstanding research record and a commitment to further develop a strong research program in mathematics. Closing date: February 15, 1982 or until filled. Send applications or nominations to: Professor Position, c/o Alphonse Baartmans, Chairman, Department of Mathematics. SIU-C is an Equal Opportunity/Affirmative Action Employer.

POSITIONS AVAILABLE

The UNIVERSITY of PITTSBURGH

Applications invited for junior-level tenure-track position expected fall 1982. Preferred areas: PDE, differential geometry, numerical solutions of PDE. Present teaching load: four classes in eight-month academic year. Evidence of good research, effective teaching abilities required. C.V., four letters of recommendation should be sent to Chairman, Department of Mathematics & Statistics, U.P., Pittsburgh, PA 15260. An Equal Opportunity/Affirmative Action Employer.

DEPARTMENT OF MATHEMATICS AND STATISTICS
UNIVERSITY OF PITTSBURGH

Tenure-track Assistant Professor. Strong research and teaching potential essential. Consulting interest desirable. Responsibilities include research and graduate and undergraduate teaching. Send résumé and three letters of recommendation to:

Dr. Henry Block, Chairperson
Statistics Recruiting Committee
Department of Mathematics and Statistics
University of Pittsburgh
Pittsburgh, PA 15260

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UNIVERSITY OF ARIZONA

Department of Mathematics, beginning August 1982. Several tenure-track and visiting positions, at level depending on qualifications of applicant. Ph.D., excellent research record or potential and strong commitment to teaching required. Especially interested in persons in computational fluid dynamics, nonlinear analysis, dynamical systems, and algebraic or differential geometry; outstanding senior candidates in any area are encouraged to apply. Send application to T. Laetsch, Head, Department of Math, University of Arizona, Tucson, Arizona 85721.

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The UNIVERSITY OF ARIZONA Seeks a Dean of the Faculty of Science

The University of Arizona is creating a new College of Arts and Sciences to be composed of the Faculties of Fine Arts, Humanities, Sciences, Social and Behavioral Sciences. The Faculty of Sciences will consist of about twelve departments including mathematics, the physical, and biological sciences in a growing series of major programs on our campus. The administration recognizes the scientific achievements of its faculty and now desires to enhance both the cohesion and leadership in these disciplines by means of the new organization.

The University is seeking candidates for the Dean of Faculty of Science who have the highest qualifications, both in academic and administrative accomplishments. The appointment will also include a professorship with tenure. The Dean will be responsible for academic, administrative and budgetary activities within his faculty and will report to the Provost of the College of Arts and Sciences. All inquiries, applications, and nominations should be sent to the Office of the Executive Vice President no later than February 1, 1982.

A. B. Weaver, Executive Vice President
University of Arizona
Administration 512
Tucson, Arizona 85721

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STATE UNIVERSITY OF NEW YORK
COLLEGE AT NEW PALTZ

has tenure-track positions available beginning Sept. 1982 for persons capable of making substantial contributions to a Computer Science curriculum at the undergraduate and beginning graduate levels. The rank is open and the salary is competitive. Applicants should either have or be about to complete a Ph.D. Persons with backgrounds in Computer Science, in one of the other mathematical sciences, or in any discipline related to Computer Science, broadly defined, are encouraged to apply. The College is located 75 miles north of New York City in a region known for its natural beauty and abundant recreational facilities. IBM has several major installations in the area. Send vita and three letters of reference which give evidence of teaching effectiveness and scholarly ability to Paul Zuckerman, Chairman, Department of Mathematics and Computer Science, State University of New York, New Paltz, NY 12561.

The Department of Mathematics at **WEST VIRGINIA UNIVERSITY** invites applications for two tenure-track positions at $18,000–$24,000 for nine months. Candidates will be evaluated on their potential for i) research excellence, ii) being effective teachers at both undergraduate and graduate levels, iii) developing cooperative research projects with the mathematics faculty as well as with engineering or other applied areas, and iv) contributing to evolving mathematical sciences programs in mathematics, statistics and computer science. Preference will be given to those with interests in applied mathematics.

Send complete vita and the names of three references to: Vadim Komkov, Chairman, Department of Mathematics, West Virginia University, Morgantown, WV 26506. Applications should be received by March 1, 1982. An Affirmative Action/Equal Opportunity Employer.

VILLANOVA UNIVERSITY
ASSISTANT/ASSOCIATE PROFESSORSHIPS
AVAILABLE FALL 1982

Applications are invited for the position of Assistant or Associate Professor in Mathematics. Several appointments will be made for up to three years with the possibility of tenure-track. Candidates should possess the Ph.D. degree and have a strong interest in undergraduate and graduate teaching as well as mathematical research. Expertise in computer science is preferred but not required. Applicants should send a résumé and three letters of recommendation to:

Frederick W. Hartmann
Chairman, Mathematics Department
Villanova University
Villanova, PA 19085

Villanova University is an Equal Opportunity/Affirmative Action Employer.

INDIANA STATE UNIVERSITY

The Mathematics and Computer Science Department anticipates one tenure-track position in Mathematics for the fall of 1982, subject to budgetary considerations. The Department offers a B.S. and an M.S. in Mathematics. Applicants should have a Ph.D. by September, 1982, a strong interest in teaching, and promise of continuing research activity. Rank and salary will depend on qualifications.

Applicants should send vita and three letters of recommendation by 15 February 1982 to:

Dr. George Graham
Mathematics Search Committee
Mathematics and Computer Science Department
Indiana State University
Terre Haute, Indiana 47809

Affirmative Action/Equal Opportunity Employer

POSITIONS AVAILABLE

RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY. Applications are invited for Tenure-Track Assistant Professorships in Pure Mathematics. Candidates must have a Ph.D., show outstanding promise in research and a concern for teaching. Preference will be given to those whose research interests are in Topology, Algebraic Geometry, Lie Groups, or Analysis (especially Nonlinear Functional Analysis). Résumés and letters of recommendation should be sent to TERENCE BUTLER, ACTING CHAIRMAN, Department of Mathematics PM, New Brunswick, NJ 08903. Rutgers University is an Equal Opportunity/Affirmative Action Employer.

RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY. Applications are invited for Tenure-Track Assistant Professorships in Applied Mathematics. Candidates must have a Ph.D., show outstanding promise in research and concern for teaching. Preference will be given to those whose research interests are in Numerical Analysis, and Mathematical Systems and Control Theory (Deterministic and Stochastic). Résumé and letters of recommendation should be sent to TERENCE BUTLER, ACTING CHAIRMAN, Department of Mathematics AM, Rutgers University, New Brunswick, NJ 08903. Rutgers University is an Equal Opportunity/Affirmative Action Employer.

RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY. Applications are invited for Visiting Positions. Candidates must have Ph.D., proven record of outstanding research accomplishments in pure or applied mathematics and concern for teaching. These are terminal one-year positions. Résumés and letters of recommendation should be sent to: TERENCE BUTLER, ACTING CHAIRMAN, Department of Mathematics VP, New Brunswick, NJ 08903. Rutgers University is an Equal Opportunity/Affirmative Action Employer.

RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY. The Department of Mathematics expects to have a position for a senior mathematical physicist beginning September 1982. The candidate should have a record of outstanding research achievement and a concern for teaching. Résumé and letters of recommendation should be sent to: Terence Butler, Acting Chairman, Department of Mathematics SMP, New Brunswick, NJ 08903. Rutgers University is an Equal Opportunity/Affirmative Action Employer.

RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY. Applications are invited for Instructorships and Lectureships, with primary responsibility and concern for teaching, but with some interest in research. Applicants should have the Ph.D. degree or be working towards its completion. These are one- and two-year non-tenure track non-renewable positions. Résumé and letters of recommendation should be sent to Terence Butler, Acting Chairman, Department of Mathematics AI, Rutgers University, New Brunswick, NJ 08903. Rutgers University is an Equal Opportunity/Affirmative Action Employer.

The Department of Mathematics and Statistics at **MISSISSIPPI STATE UNIVERSITY** anticipates two or more tenure-track positions beginning with the 1982-1983 academic year. A Ph.D. is preferred. Applicants with expertise in some area of applicable mathematics are especially welcomed. Responsibilities include teaching and research. Rank and salary commensurate with qualification and experience. Candidates should submit a vita and three letters of recommendation by February 15, 1982, to J. L. Solomon, Head, Department of Mathematics and Statistics, Mississippi State, Mississippi 39762.

Affirmative Action/Equal Opportunity Employer

Chairperson and Professor, Computer Science Department

The **UNIVERSITY OF MARYLAND AT COLLEGE PARK** invites applications and nominations for the position of professor and chairperson of the Computer Science Department. Candidates for the position should have a well-established reputation in research and teaching, and have demonstrated ability to lead a rapidly growing Department. The Department has thirty professorial rank positions and offers undergraduate and graduate (M.S. and Ph.D.) degrees. The prospective appointment date is July 1 or August 15, 1982; applications received by February 15, 1982, will receive full consideration. Inquiries, nominations, and applications should be addressed to Professor John E. Osborn, Chairman of the Search Committee, Department of Mathematics, University of Maryland, College Park, Maryland 20742. The University of Maryland is an equal opportunity, affirmative action employer.

LOYOLA COLLEGE
Department of Mathematics, Baltimore, Maryland 21210

One tenure-track position for assistant professor available September, 1982. Ph.D. in Mathematics Education, or in Mathematics with an interest in Mathematics Education, is required. Responsibilities include teaching three basic mathematics courses each semester. Interested applicants should submit vita, all college level transcripts and one copy of recent publication or prospective research proposal to: Dr. John Hennessey, Chairman, Mathematics Department. In addition, three letters of recommendation should be mailed directly to the individual above by the recommenders prior to the application deadline of February 1, 1982. Affirmative Action Employer.

YOUNGSTOWN STATE UNIVERSITY
MATHEMATICAL AND COMPUTER SCIENCES

Three entry-level positions open, two in mathematics, one in computer science. Duties include teaching, research, service on committees and advising. The mathematics positions require a Ph.D. or near Ph.D. in mathematics or a related field; any area of mathematics will be considered; interest in computer science is desirable; applications should be received by January 25, 1982; late applications will be considered. The computer science position requires an M.S. in computer science and a Ph.D. in another area, though a Ph.D. in computer science is preferred; applications should be received by February 26, 1982; late applications will be considered.

The department has a faculty of 26, bachelor's and master's programs, over 300 majors, a microcomputer laboratory. The University has an Amdahl 470 V/5 computer, 15,000 students. To apply send letter of application with complete vita, transcripts and three letters of reference to: Dean R. Brown, Chairman, Department of Mathematical and Computer Sciences, Youngstown, OH 44555. Equal Opportunity/Affirmative Action employer.

CASE WESTERN RESERVE UNIVERSITY
Chairman, Department of Mathematics and Statistics

Applications and nominations are invited for the position of Chairman. Candidates should have a strong background in research and dedication to quality teaching; administrative experience is desirable. The position is to be filled by September 1, 1982.

Applications (with curr. vitae and three letters of reference) and nominations should be sent to:

Chairman Search Committee
Department of Mathematics and Statistics
Case Western Reserve University
Cleveland, OH 44106.

CWRU is an Equal Opportunity/Affirmative Action Employer

POSITIONS AVAILABLE

PROFESSOR/ASSOCIATE PROFESSOR PURE MATHEMATICS

Boston University announces a search for a tenure level appointment (professor or associate professor) in pure mathematics. Field unrestricted. A record of distinguished achievements in research and a sustained commitment to excellence in teaching are required. Women and minorities are especially encouraged to apply. Nominations and applications to:

Dennis D. Berkey, Chair
Department of Mathematics
Boston University
Boston, MA 02215

First closing January 30, 1982.

BOSTON UNIVERSITY is an Equal Opportunity/Affirmative Action Employer.

ASSISTANT PROFESSORSHIPS IN MATHEMATICS

Boston University announces several openings at the rank of assistant professor. Field unrestricted. Strong potential for excellence in both teaching and research are required. Women and minorities are especially encouraged to apply. Vita and three letters of reference to:

Dennis D. Berkey, Chair
Department of Mathematics
Boston University
Boston, MA 02215

First closing January 30, 1982.

BOSTON UNIVERSITY is an Equal Opportunity/Affirmative Action Employer.

PROFESSOR/ASSOCIATE PROFESSOR IN DYNAMICAL SYSTEMS

Boston University announces the search for a tenure level appointment (professor or associate professor) in dynamical system theory or one of the related fields. The successful candidate will play a leadership role in a group of ten professors working in these areas. A distinguished record in scholarship and a sustained commitment to excellence in teaching are required. Women and minorities are especially encouraged to apply. Nominations and applications to:

Dennis D. Berkey, Chair
Department of Mathematics
Boston University
Boston, MA 02215

First closing January 30, 1982.

BOSTON UNIVERSITY is an Equal Opportunity/Affirmative Action Employer.

SENIOR LEVEL POSITION IN COMPUTER SCIENCE

The Department of Mathematics at Boston University announces the search for a tenure level appointment (professor or associate professor) in computer science. Field is unrestricted. Substantial productivity in research, a record of effective teaching, and the capability for leadership are required. Industrial experience is a plus. The computer science programs provide instruction at all levels from introductory through Ph.D. Research interests are balanced in both theory and applications. Vita and three letters of reference to:

Dennis D. Berkey, Chair
Department of Mathematics
Boston University
Boston, MA 02215

Women and Minorities are especially encouraged to apply.

BOSTON UNIVERSITY is an Equal Opportunity/Affirmative Action Employer.

NORTHEASTERN UNIVERSITY

Department of Mathematics

Applications are invited for one position at the Assistant Professor level in Computer Science (tenure-track) and five positions at the Assistant Professor level in mathematics (one tenure-track and four non-tenure-track) starting in the Fall of 1982.

Responsibilities: To teach courses, hold related conference hours and contribute to the departmental programs. Computer Science faculty is required to conduct advanced research in that field.

Salary: Negotiable

Qualifications: Ph.D. in mathematics preferred. Candidates with evidence of strong mathematical skills considered first. The department's current needs are in the areas of Applied Mathematics, Statistics, and Computer Science.

Please send résumés to Professor M. Gilmore (504 LA), Chairman, Mathematics Department, Northeastern University, 360 Huntington Avenue, Boston, Massachusetts 02115. Telephone 617-437-2450. Equal Opportunity/Affirmative Action Title IX Employer.

SUNY, COLLEGE AT OLD WESTBURY

MATHEMATICS: Anticipated Faculty Position: Small four-year liberal arts college on Long Island, with heterogeneous, non-traditional student body and strong tradition of social criticism and pedagogical innovation, seeks candidates for the following position: MATHEMATICS: One full-time, tenure-track position anticipated. Assistant Professor rank: (Doctorate required); or Instructor rank: (Master's required). Preferred areas: Statistics, Operations Research, Algebra, Topology and Mathematics Education. Knowledge and experience in the area of Computer Science highly desirable. Experience teaching in multi-racial, multi-cultural environment preferred. Commitment to superior teaching of undergraduate mathematics required. Minorities and women are encouraged to apply. Salary range: $14,000–$22,000, depending on qualifications and experience. Starting Date: September 1, 1982. Send résumé and three letters of recommendation. Deadline for Applications: March 15, 1982. Director of Affirmative Action, State University of New York, College at Old Westbury, Search Committee (MATH), Old Westbury, NY 11568. An Equal Opportunity, Affirmative Action Employer.

Assistant Professor, Computer Science. Initial three-year appointment. Possibility of reappointment and eventual tenure. Qualifications include demonstrated research in computer science and ability and interest in teaching undergraduate courses in computer science and mathematics. Ph.D. required. Write to Professor Martin Arkowitz, Chairman, Department of Mathematics, **DARTMOUTH COLLEGE**, Bradley Hall, Hanover, NH 03755 (Attn: Recruiting). EO/AA.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

The Program in Science, Technology, and Society at MIT invites applications from scientists, engineers, and physicians for several one-year study fellowships on the relationships of science, technology, or medicine with society. Ph.D. or equivalent in science or engineering is desirable. Partial or full stipend available. Deadline: February 1, 1982. For more information write: Kenneth Keniston, Chairman, Mellon Fellowship Committee, E51-210, MIT, Cambridge, MA 02139. MIT is an Equal Opportunity/Affirmative Action Employer.

POSITIONS AVAILABLE

UNIVERSITY OF CALIFORNIA
SANTA BARBARA

The Department of Computer Science is seeking qualified applicants for tenure-track positions at the Assistant Professor level beginning September 1982. Normally, completion of the Ph.D. is required. Some experience in teaching is preferred, and both promise and significant achievement are expected in an area of mainstream Computer Science research. The positions will entail teaching at both the undergraduate and graduate levels, developing extramurally-funded research programs and directing doctoral research. Exceptionally well-qualified persons whose background and experience warrant a tenure-level appointment are also encouraged to apply. Send résumé along with the names of at least four references to: Chairman, Search Committee, Department of Computer Science, 2111 Engineering Building, University of California, Santa Barbara, California 93106, by February 15, 1982. An Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA
SANTA BARBARA

The Department of Computer Science expects to have several temporary positions beginning fall, 1982. Normally, completion of the Ph.D. is required. The positions will entail teaching in mainstream areas of computer science. Appointments will be made in the Visiting or Adjunct Lecturer series, or the Associate series at a rank and salary dependent upon qualifications, and will be one-year appointments with possibility of reappointment. Send résumé along with the names of at least three references to: Chairman, Search Committee, Department of Computer Science, 2111 Engineering Building, University of California, Santa Barbara, California 93106, by February 15, 1982. An Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA, RIVERSIDE

Faculty Position in Computer Science

Applications are invited for a permanent position in Computer Science beginning with the 1982-1983 academic year. Applicants must have a Ph.D. and a commitment to teaching and research in computer science. Candidates from all areas of specialization in computer science will be considered.

Rank and salary are open; candidates for senior rank must have leadership ability and a proven research record.

To apply, send résumé with names of three references to
Professor Sudhir Aggarwal
Chairman, Search Committee
Department of Mathematics
University of California
Riverside, CA 92521

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LEHIGH UNIVERSITY

invites applications for a position of Assistant Professor of Mathematics beginning in August, 1982. The position is tenure-track, and the salary is negotiable. Candidates must possess a Ph.D. in pure or applied mathematics. The area of specialization is open. A strong commitment to excellence in teaching and research is essential. Send résumé, transcripts, and three letters of recommendation to Professor C. C. Hsiung, Chairman of Search Committee, Department of Mathematics, Lehigh University, Bethlehem, PA 18015. Applications will be accepted until February 1, 1982. Lehigh University is an Equal Opportunity/Affirmative Action Employer.

Professor
Applied Mathematics
SOUTHERN METHODIST UNIVERSITY

The Department of Mathematics at Southern Methodist University seeks a distinguished scholar active in one or more areas of research in applied mathematics, broadly defined, to fill a position at the rank of professor. Candidates should be able to provide leadership to a group of eight applied mathematicians, including four asssitant professors. Commitment to excellence in teaching at all levels is expected. Candidates should be willing to interact with local industry and to direct doctoral dissertations.

Applicants should send a vita and the names of three references to George Reddien, Chairman, Department of Mathematics, Southern Methodist University, Dallas, TX 75275, or call 214-692-2506.

Southern Methodist University is an Equal Opportunity/Affirmative Action Employer.

Assistant Professor
SOUTHERN METHODIST UNIVERSITY

The Department of Mathematics at Southern Methodist University seeks an assistant professor, tenure-track, beginning August 1982. The department offers a Ph.D. in applied mathematics, and candidates are sought with a research specialty in applied mathematics, broadly defined, or who are in an area that can support an applied group. Special attention will be given to those in discrete mathematics. Effective teaching and strong potential in research are expected.

Applicants should send a vita and the names of three references to George Reddien, Chairman, Department of Mathematics, Southern Methodist University, Dallas, TX 75275.

Equal Opportunity/Affirmative Action Employer

NEW MEXICO STATE UNIVERSITY

Department of Mathematical Sciences
Visiting positions and tenure-track assistant professor position in mathematics, numerical analysis or statistics start August 23, 1982. Salary for 1982-1983 academic year: $18,000 or higher and dependent upon rank, qualifications and experience. Ph.D. (or equivalent) and strong commitment to teaching and research essential. Applications are kept on file and positions filled as openings occur. Send vita and arrange for four reference letters to be sent to Carol L. Walker, Head, Department of Mathematical Sciences, New Mexico State University, Las Cruces, NM 88003.

An Equal Opportunity/Affirmative Action Employer

DEPARTMENT OF MATHEMATICS
OREGON STATE UNIVERSITY
CORVALLIS, OR 97331

Applications are invited for possible Assistant Professor, Associate Professor, and Professor positions beginning September 1982. Preference will be given, first to candidates in Numerical Analysis, and second to candidates in Applied Mathematics. A Ph.D. or the equivalent is required. Duties include research activity and teaching six to eight class hours per week. The closing date for applications is January 22, 1982. For further information, write to Dr. Richard M. Schori, Chairman, at the above address.

Pending final approval, one assistant professor position, beginning fall 1982. Ph.D. required. Holder of this tenure-track position to teach courses in probability and statistics and continue a vigorous program of interesting research. Address inquiries to David A. Freedman, Chairman, **DEPARTMENT OF STATISTICS, UNIVERSITY OF CALIFORNIA, BERKELEY**, 94720. Deadline February 15, 1982. The University of California is an Equal Opportunity, Affirmative Action Employer.

POSITIONS AVAILABLE

MATHEMATICS: The Virginia Military Institute, a state supported undergraduate college, anticipates an opening at the instructor or assistant professor level in the Department of Mathematics in August 1982. The applicant should have a strong interest in teaching undergraduates in a military college environment. Send your résumé by February 28, 1982 to Department of Mathematics, The **VIRGINIA MILITARY INSTITUTE**, Lexington, VA 24450. AA/EEO Employer.

UNIVERSITY OF ALABAMA IN HUNTSVILLE. Two or more tenure-track positions beginning September 1, 1982. Rank and salary commensurate with experience and credentials. A Ph.D. degree in mathematics, evidence of excellent research ability, and evidence of active interest in quality teaching are required. Preferred specialty areas are applied mathematics, functional analysis, and algebra. UAH, with over 5,500 students, has advanced degrees in all mathematical science, natural science, and engineering disciplines. Teaching assignments will be at the undergraduate and graduate levels. Send letter of application, vita, graduate transcripts, and three letters of reference to F. L. Cook, Chairman, Department of Mathematics, The University of Alabama in Huntsville, Huntsville, AL 35899. Screening of applicants will begin February 1, 1982. The University of Alabama in Huntsville is an Equal Opportunity/Affirmative Action Institution.

EMORY UNIVERSITY, DEPT. OF MATH & COMPUTER SCIENCE, ATLANTA, GA 30322. Applications invited for position of Chairperson. Candidates should have outstanding research records and a dedication to excellence in teaching. Appointment will be at rank of Professor with tenure. It is hoped that an early appointment can be made so that the successful candidate may participate in selection of faculty for other positions in the department.

Emory is an affirmative action, equal opportunity employer. Deadline January 20, 1982.

Send applications to Trevor Evans, Search Committee.

EMORY UNIVERSITY, DEPT. OF MATH & COMPUTER SCIENCE, ATLANTA, GA 30322. Tenure-track and temporary positions at asssitant professor level beginning September 1982. Candidates should have strong research interests and promise of excellence in teaching. At least one position at senior level. Candidates for this should have proven research records. Interest in participating in computer science program desirable for some positions. A primary interest in computer science will be a great advantage for at least one position.

Emory is an affirmative action, equal opportunity employer. Deadline February 15, 1982.

Send applications to Trevor Evans, Search Committee.

Mathematics/Computer Science

Tenure-track position at assistant or associate professor level. Ph.D. in mathematics or computer science and master's equivalency in the other are required. Primary duties are those associated with teaching of undergraduate mathematics and computer science. Detailed résumé, transcripts, three letters of recommendation and other supportive information should be sent by February 15, 1982, to: Dr. Charles L. Christmas, Department of Mathematics and Computer Science, Georgia Southern College, Statesboro, Georgia 30460. **GEORGIA SOUTHERN COLLEGE** is an EO/AA employer.

FACULTY POSITION
UNIVERSITY OF LOUISVILLE

Entry level, tenure-track position in Department of Mathematics to begin fall, 1982. Requirements include a Ph.D. in mathematics or a related area. Research promise and evidence of good teaching ability will be expected of successful candidates. The position should be filled by someone willing to teach the Department's geometry offerings. Interested candidates should send letter of application, at least three letters of recommendation, and graduate transcripts to Michael S. Jacobson, Department of Mathematics, University of Louisville, Louisville, KY 40292. Consideration will begin on January 15, 1982 and continue until the position is filled. Affirmative Action/Equal Opportunity Employer.

Department of Mathematics and Computer Science
UNIVERSITY OF MIAMI

Applications are invited for tenure-track positions, beginning August, 1982. Ranks and salaries are open, commensurate with qualifications of the applicants. Preference will be given to candidates in the areas of applied mathematics, computer science and analysis. Candidate must have the Ph.D. degree and excellent research record, or a definite research potential, with a strong commitment to teaching and research. Applicants should send vitae and three letters of reference to:

Shair Ahmad, Chairman
Department of Mathematics and Computer Science
University of Miami
Coral Gables, FL 33124

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FLORIDA INTERNATIONAL UNIVERSITY
MIAMI, FLORIDA

Applications are invited for several tenure-track positions at the level of Assistant Professor in the Department of Mathematical Sciences starting August, 1982. Candidates should possess the Ph.D. degree in Mathematics. Duties include teaching at the undergraduate and beginning graduate level, research and service. Preferred area of specialization for one position is Harmonic Analysis. Qualified candidates in other areas will be considered. Salary is competitive. Applicants should send vitae and three letters of reference to:

Dr. Toby S. Berk, Chairperson
Department of Mathematical Sciences
Florida International University
Tamiami Campus, Miami, FL 33199

Florida International University is a member of the State University System of Florida and is an Affirmative Action/Equal Opportunity Employer.

ALBION COLLEGE

The Mathematics Department invites applications for two tenure-track positions, one in computer science and one in mathematics, beginning in mid-August, 1982. Computer Science: Qualifications – Ph.D. in C.S. or Ph.D. in Mathematics with sufficient experience to teach upper-level computer science courses. Mathematics: Ph.D. required. Persons with experience in computer science or an applied area such as operations research or mathematical modeling will be given preference. The rank is dependent on qualifications and the salary is competitive. If you are interested in teaching highly qualified students at a well-established liberal arts college, direct your inquiry to Dr. John A. Wenzel, Chair, Albion College, Albion, Michigan 49224. An equal opportunity employer.

POSITIONS AVAILABLE

The Department of Mathematics of the **UNIVERSITY OF IOWA** is encouraging applications for anticipated visiting positions at all levels. Application, vita, and three letters of recommendation should be sent to Robert H. Oehmke. Selections will be based on evidence of the applicants' effective teaching and research achievements and potential, instructional needs of the Department, and the potential for interaction with the faculty at the research level. The selection process will begin on February 15, 1982. The University of Iowa is an Affirmative Action and Equal Opportunity Employer and specifically encourages applications from women and minorities.

The Department of Mathematics of the **UNIVERSITY OF IOWA** is encouraging applications for anticipated tenure-track positions at the junior level. Application, vita, and three letters of recommendation should be sent to Robert H. Oehmke. Selections will be based on evidence of the applicants' effective teaching and research achievements and potential, instructional needs of the Department and the potential for interaction with the faculty at the research level. The selection process will begin on February 15, 1982. The Universityof Iowa is an Affirmative Action and Equal Opportunity Employer and specifically encourages applications from women and minorities.

FREE UNIVERSITY
AMSTERDAM

The Department of Mathematics and Computer Science of the Free University at Amsterdam has an opening for a full

PROFESSOR OF MATHEMATICAL ANALYSIS

Applicants should have a research interest and experience in the area of complex analysis in several variables. The professor's main tasks will be to conduct and to stimulate both research and teaching in the indicated area. An excellent research record, teaching skills and the ability to organize are required.

The department has a student enrollment of approximately 280 and has 10 professors in mathematics and 3 in computer science and 30 further staff members. The Free University of Amsterdam, The Netherlands, is a fully state-subsidized, private university, and was founded as a non-denominational Christian institute. Its charter speaks of the Christian idea of service as the University's guiding principle.

If desired more information may be obtained by writing to Professor M. A. Kaashoek, Wiskundig Seminarium der Vrije Universiteit, De Boelelaan 1081, P. O. Box 7161, 1007 MC Amsterdam, The Netherlands. Applicants are requested to submit, within 3 weeks after the appearance of this issue, curriculum vitae and list of publications, mentioning number 310-1951: Dienst Personeelszaken, Vrije Universiteit, P. O. Box 7161, 1007 MC Amsterdam, The Netherlands.

COLLEGE OF CHARLESTON
Department of Mathematics, Charleston, SC 29424

ASSISTANT/ASSOCIATE PROFESSORS. Two tenure-track positions, available 8-22-82. Teaching in expanding undergraduate programs in applied and pure mathematics and computer science (up to 12 hrs/wk with a possibility of 6-9 hrs/wk). Requirements: Ph.D. in mathematics or related field, strong commitment to undergraduate instruction and serious interest in continuing research. Preference to those with broad training in pure and applied mathematics. Minority and female applicants are encouraged to apply. The salary depends on experience with a minimum 9-month salary of at least $20,000. Send three letters of recommendation and a resume to W. L. Golightly, Chairman, Search Committee. AA/EOE.

Mathematics. Assistant Professor/Southeastern Campus, Assistant Professor/Hartford Regional Campus. Salary negotiable. To teach elementary and intermediate mathematics at the Southeastern Campus of the University of Connecticut. To conduct research in field of competence. Ph.D. in mathematics and some teaching experience. Some knowledge of computer science desired. Reply to Eugene Spiegel at U-9 **UNIVERSITY OF CONNECTICUT**, Storrs, CT 06268.

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FOR SALE

The 1981 December issue of the *International Journal of Mathematics and Mathematical Sciences* has just been published. The *Journal* is a quarterly journal devoted to publication of original research papers, research notes, research-expository and survey articles with emphasis on unsolved problems and open questions. All areas listed on the cover of *Mathematical Reviews*—such as pure and applied mathematics, mathematical physics, theoretical mechanics, probability and mathematical statistics, theoretical biology—are included within Mathematics and Mathematical sciences.

Information about the Journal can be obtained from Lokenath Debnath, Mathematics Department, East Carolina University, Greenville, NC 27834.

Just published: *Examples of Commutative Rings* by Harry C. Hutchins, 175 pages, hardcover, $13.75. This new book presents 180 examples of rings having various properties and illustrating various concepts. Each example is given an average exposition of 1/2 to 2/3 of a page. The book also has an extensive annotated bibliography. Polygonal Publishing House, 80 Passaic Ave., Passaic, NJ 07055.

A list of Lecture Notes for various undergraduate and graduate courses given at Oxford and which are available for purchase can be obtained from the Assistant Librarian, Mathematical Institute, 24-29 St. Giles, Oxford OX1 3LB, England.

ISTITUTO NAZIONALE
DI ALTA MATEMATICA FRANCESCO SEVERI
ROME – ITALY

Recent publications:

Free boundary problems

Proceedings of a seminar held in Pavia
September-October 1979 by: S. Albertoni, H. W. Alt, A. Ambrosetti, L. Amerio, I. Athanasopoulos, C. Baiocchi, J. Bear, M. Biroli, P. Boieri, C. M. Brauner, H. Brezis, M. Bulgarelli, L. A. Caffarelli, J. R. Cannon, A. Capelo, G. Capriz, V. Casulli, J. Cea, M. Chipot, G. Cimatti, L. Citrini, L. Collatz, V. Comincioli, B. Coppi, P. Cortey-Dumont, C. W. Cryer, B. D'Acunto, A. Damlamian, E. De Giorgi, A. S. Demidov, E. Di Benedetto, J. Douglas, G. Duvaut, A. Fasano, A. Franchi, J. Frehse, A. Friedman, F. Gastaldi, G. Geymonat, G. Gilardi, B. Glowinski, L. Guerri, C. Guillopé, W. Hager, G. D. Ianculescu, R. Jensen, S. Kamin, J. L. Lions, P. L. Lions, G. Maier, U. Maione, G. Meyer, J. C. Miellou, M. Miranda, U. Mosco, B. Nicolaenko, J. A. Nitsche, J. R. Ockendon, G. A. Pozzi, M. Primicerio, G. Prouse, J. W. Rogers, L. I. Rubinstein, G. Sacchi, A. Taroni, R. Temam, F. Tomarelli, A. Torelli, B. Turkington, P. Villaggio, A. Visintin.

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P. O. Box 6248, Providence, RI 02940, U. S. A.

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No listing for a position will be printed if it expresses or implies any preference, limitation, specification, or discrimination based on color, age, sex, race, religion, or national origin in contravention of any federal or state statute prohibiting discrimination in employment on the basis of these criteria. The publisher reserves the right to edit any listing prior to publication which does not conform with federal or state law on discrimination in employment.

All employers in the United States are required to abide by the requirements of Title VII of the Civil Rights Act of 1964, announcing a national policy of equal employment opportunity in private employment, without discrimination because of race, color, religion, sex or national origin. All U.S. listings are accepted with the understanding that the employer complies with federal requirements. Advertisers not subject to U.S. laws are required to sign a statement that they do not discriminate in employment on grounds of age, race, color, religion, sex, or national origin. *Applicants should be aware that institutions outside the U. S. may not be legally bound to conform to these or similar requirements and the AMS cannot assume responsibility for enforcing compliance. Applicants are advised to inform themselves of conditions that may exist at the institutions to which they apply.*

In particular, readers should note that the Equal Employment Opportunity Act (42 U.S.C., §§2000e et seq.), which prohibits discrimination in employment on the basis of sex, race, religion, or national origin, contains (in §2000e–1) an exception from the provisions of the Act for any religious corporation, association, educational institution, or society with respect to employment of individuals of a particular religion to perform work connected with the carrying on by such corporation, association, educational institution, or society of its activities.

The Age Discrimination in Employment Act of 1967 (29 U.S.C., §§621 et seq.), makes it unlawful for an employer to discriminate against any individual between the ages of 40 and 65 because of age. Thus it is legal to seek as an employee someone who is "over 30," but not one "over 50"; neither is it legal to express a preference for someone who is "young," or is a "recent graduate," since the latter tend (on statistical grounds) to be young.

INDIANA STATE UNIVERSITY

The Mathematics and Computer Science Department anticipates several Computer Science tenure track positions for the fall of 1982. The number of positions is subject to budgetary considerations. The department offers a B.S. in Computer Science. Salary and rank are dependent on qualifications. Applicants should have the experience to teach core courses in the program. Preference will be given to applicants with a Ph.D. Send your vita and three letters of recommendation to:

Dr. Jerry Harshany, Chairman
Department of Mathematics
and Computer Science
Indiana State University
Terre Haute, IN 47809

Applications received after March 1, 1982 cannot be guaranteed consideration.

Affirmative Action/Equal Opportunity Employer

UNIVERSITY OF MARYLAND COLLEGE PARK, MD 20742

DEPARTMENT OF MATHEMATICS

A chair position has become vacant in the area of Geometry/Topology. We invite applicants for a **senior position** in the general area of **GEOMETRY** (ranging from **Algebraic Geometry** through **Differential Geometry** to **Geometric Analysis**).

A successful applicant will be expected to generate activity and interact with current faculty in the area. Other duties and salary are negotiable. All inquiries will be treated confidentially.

Application (including Curriculum Vitae) or inquiries should be sent to Walter Neumann, Geometry Search Committee. To ensure full consideration, applications should be received by March 1, 1982.

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Andrzej Schinzel

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WAYNE STATE UNIVERSITY

Detroit, MI 48202

DEPARTMENT OF MATHEMATICS

Applications are invited for the position of Chair of the Department of Mathematics, effective fall, 1982. Candidates for the position should have an established record of excellence in research, commitment to teaching, and the capability for leadership and administration. Applicants should forward a resume and at least four letters of reference to the Search Committee at the above address.

An Equal Opportunity/Affirmative Action employer.

THE MATHEMATICS DEPARTMENT
of the
UNIVERSITY OF FLORIDA

announces the opening of two tenure-track assistant professorships beginning August, 1982. Those applying for these positions should have demonstrable research potential. Of particular interest are applicants with the following research specialties: probability and stochastic processes, numerical analysis, partial differential equations, linear algebra, combinatorics, logic. The academic year salary for each of these positions will be between $18,000 and $22,000. Applicants should provide a resume, a list of publications, and should arrange for at least three letters of reference to be sent to:

Mark L. Teply
Chairman, Search and Screen Committee
Department of Mathematics
University of Florida
Gainesville, Florida 32611

The application deadline is January 25, 1982. The University of Florida is *an equal opportunity employer.*

The Ohio State University
Department of Mathematics

The Department of Mathematics of The Ohio State University hopes to fill the position of full professor created by the impending retirement of Professor Hans Zassenhaus effective Autumn Quarter, 1982. Applications are invited from outstanding research mathematicians. Nominations for suitable candidates are also welcome. Other things being equal, applicants in algebra and number theory will be given priority. Applications will be accepted until the position is filled.

Interested persons should write to:

Professor Dijen K. Ray-Chaudhuri
Department of Mathematics
The Ohio State University
231 W. 18th Avenue
Columbus, Ohio 43210

The Ohio State University is *an affirmative action and an equal opportunity employer.*

UNIVERSITY OF CALIFORNIA
BERKELEY
Department of Mathematics
Berkeley, CA 94720
S. Smale, Vice Chairman for Faculty Appts.

One tenure faculty position anticipated pending budgetary approval, effective Fall 1982 with the rank to be determined by qualifications, in the areas of *algebra, analysis, applied mathematics, foundations, or geometry.* Applicants should have demonstrated substantial achievement in research and teaching.

Send by January 15, 1982, curriculum vitae, list of publications, a few selected reprints or preprints, and the names of 3 referees.

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UNIVERSITY OF UTAH
DEPARTMENT OF MATHEMATICS

invites applications for the following positions

1. Three or four 3-year instructorships. Persons of any age receiving Ph.D. degrees in 1981 or 1982 are eligible. Applicants will be selected on the basis of ability and potential in teaching and research. Starting salary will be $20,000. Duties consist of teaching two courses through the academic year.
2. One visiting position of one year or less. Selection criteria will be teaching ability and potential contribution to our research environment.
3. There may become available one or two permanent positions at a more senior level. The most essential criterion will be the level of research activity, preferable in areas which complement, but do not overlap with, existing areas of research.

Applications should include curriculum vita, bibliography and references and should be sent by February 1, 1982 to:

Ms. Sylvia Morris
Committee on Staffing
Department of Mathematics
University of Utah
Salt Lake City, Utah 84112

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MATHEMATICS

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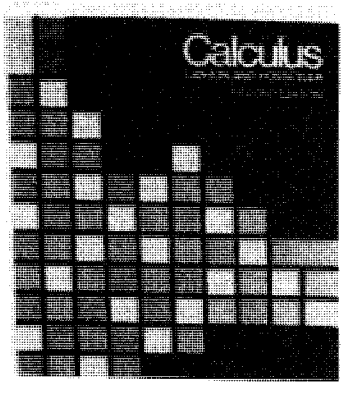

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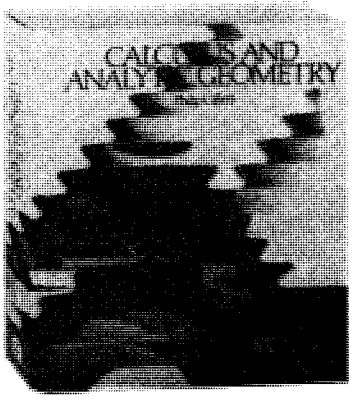

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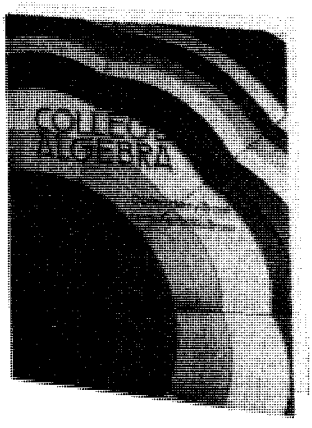

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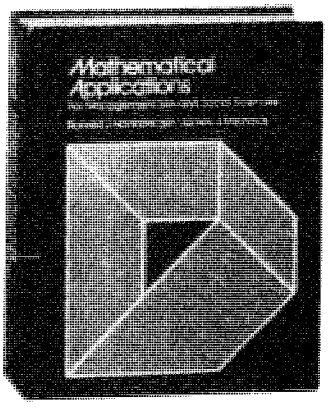

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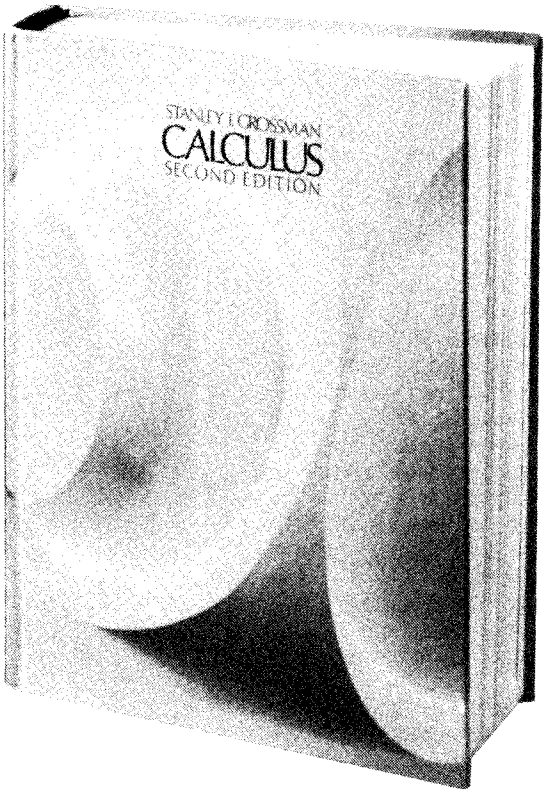

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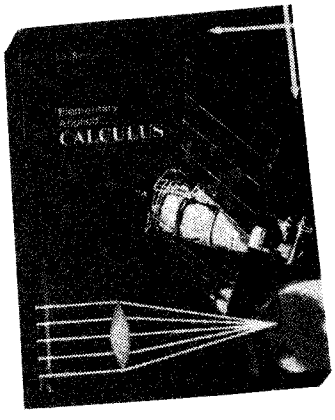

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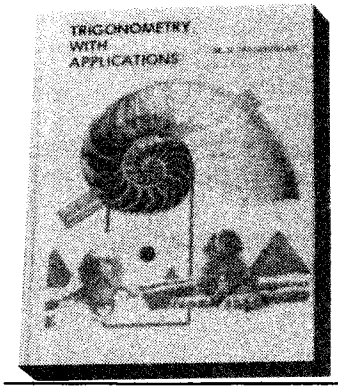

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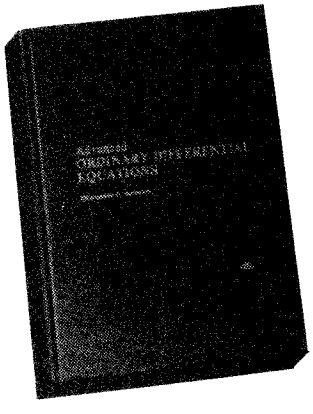

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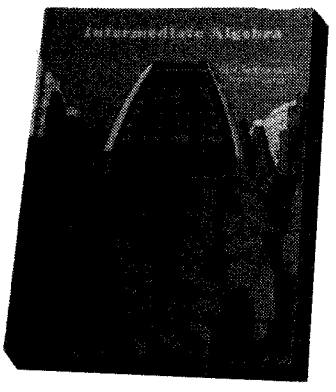

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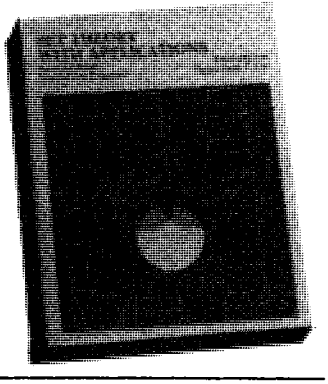

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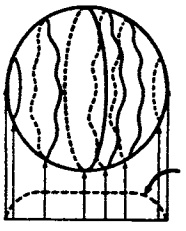

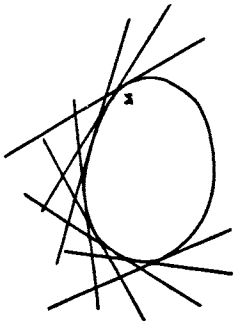

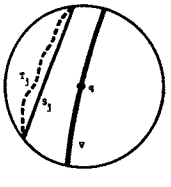

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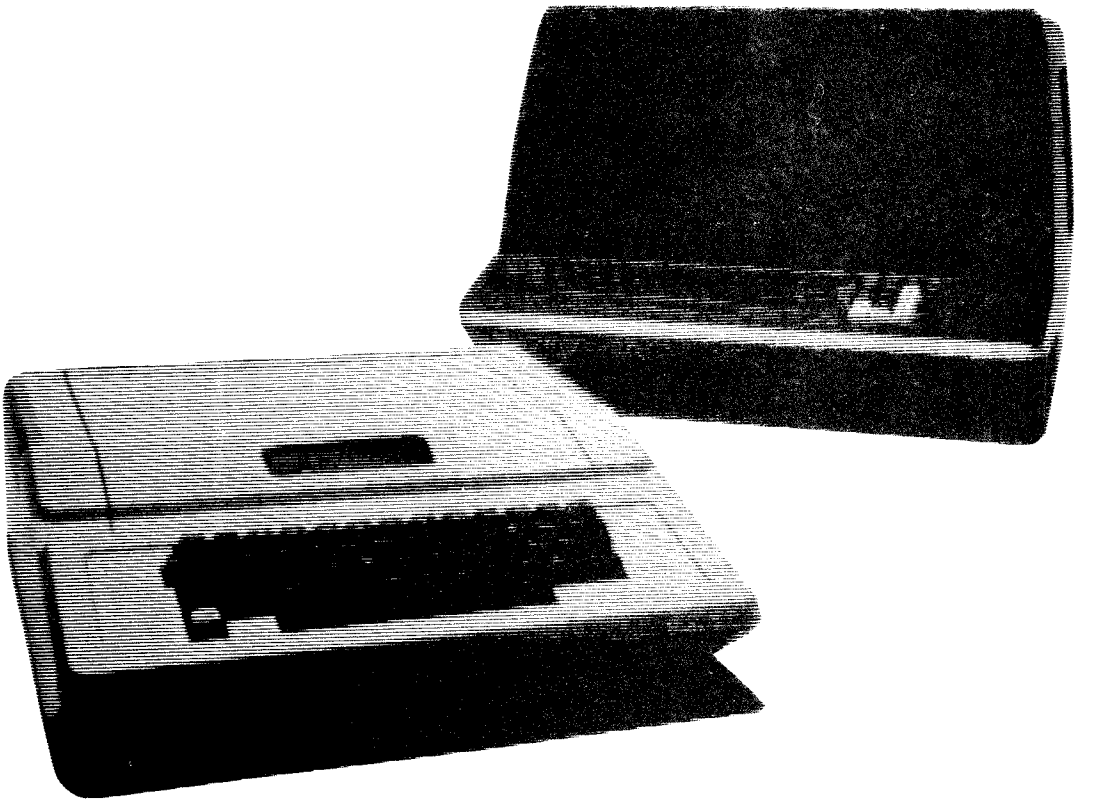

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Multiple Scattering and Waves in Random Media

Proceedings of the U.S. Army Workshop held in Blacksburg, Va., U.S.A., 24-26 March 1980

edited by P. L. CHOW, W. E. KOHLER *and* G. C. PAPANICOLAOU

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Convex Cones

by B. FUCHSSTEINER *and* W. LUSKY

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Continuum Models of Discrete Systems 4

Proceedings of the Fourth International Conference on Continuum Models of Discrete Systems, Stockholm, Sweden, June 29 - July 3, 1981

edited by O. BRULIN *and* R. K. T. HSIEH
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