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 CONTRIBUTED PAPERS should be submitted on special forms which are available in most departments of mathematics; forms can also be obtained by writing to the headquarters of the Society. Abstracts of papers to be presented at the meeting in person must be received at the headquarters of the Society in Providence, Rhode Island, on or before the deadline for the meeting. Note that the deadline for abstracts to be considered for presentation at special sessions is three weeks earlier than that given below. For additional information consult the meeting announcement and the list of organizers of special sessions.

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DEADLINES listed above for abstracts are also the deadlines for other information intended for publication in the same issue: news items and announcements of special meetings. There are separate deadlines for Classified Advertising and for abstracts of papers presented to the Society for publication by title (rather than for presentation in person at a meeting). They are as follows:

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University of California, Santa Cruz, California
Feb 1979 p. 96

August 19-20, 1979  AMS Short Course: Operations Research: Mathematics and Models
University of Minnesota, Duluth, Minnesota
June 1979 p. 211
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Vancouver, June 15–16, 1979, University of British Columbia

Program for the 767th Meeting

The seven hundred sixty-seventh meeting of the American Mathematical Society will be held at the University of British Columbia in Vancouver, Canada, on Friday and Saturday, June 15 and 16, 1979. The meeting will be held in conjunction with sectional meetings of the Mathematical Association of America (MAA) and the Society for Industrial and Applied Mathematics (SIAM).

By invitation of the Committee to Select Hour Speakers for Far Western Sectional Meetings, there will be two invited one-hour addresses. THEODORE FRANKEL of the University of California, San Diego, will lecture on Some geometrical aspects of general relativity at 1:30 p.m. on Saturday. OSCAR E. LANFORD III of the University of California, Berkeley, will speak at 11:00 a.m. on Saturday; the title of his talk is One-dimensional transformations. Both lectures will be in Room 110 of the Henry Angus Building.

By invitation of the same committee, there will be three special sessions. PRISCILLA E. GREENWOOD has organized a special session on Probability; the speakers will be Murray D. Burke, Erhan Çinlar, Laurens de Haan, David R. McDonald, A. O. Pittenger, and Sidney Resnick. STANLEY S. PAGE has organized a special session on Representations and ring theory; the speakers will be Frank W. Anderson, George M. Bergman, Michael A. Fathy, Burton I. Fein, Charles P. Lanksi, Rajendra K. Rai, and Robert B. Warfield, Jr. A special session on Mathematical physics has been organized by LON M. ROSEN; the list of speakers is Michael Aizenman, Guy A. Battle III, Paul R. Chernoff, William G. Faris, Stanley P. Gudder, Garrett S. Sylvester, and M. John Westwater.

There will also be sessions of contributed ten-minute papers. Late papers will be accepted for presentation at the meeting, but will not be listed in the printed program.

At a dinner on Friday evening, the guest speaker will be Constance Reid, author of Hilbert (Springer-Verlag, 1970) and Courant in Göttingen and New York (Springer-Verlag, 1976). Her talk, jointly sponsored by the AMS and MAA, will be of interest to nonmathematicians as well as to mathematicians, and is titled The answer to the question everyone asks. The dinner, a lavish buffet, will begin at 7:15 p.m. in the Graduate Student Center on the university campus. It will be preceded by a no-host cocktail hour at 6:30 p.m. The cost of the buffet is $10 (Canadian) per person. Advance payment for the dinner is not necessary, but persons interested in attending are urged to notify A. H. Cayford, Department of Mathematics, University of British Columbia, Vancouver, British Columbia (V6T 1W5), Canada, so the number of participants can be estimated.

The MAA program will include the following invited speakers: DOUGLAS A. LIND, VED P. MADAN, D. DALE OLESKY, T. PLETCHER, HAZEL JO REED, and KENNETH A. ROSS. The Open University of Britain and the BBC will make a presentation on the teaching of mathematics.

REGISTRATION

The registration area for the meeting will be on the main floor of the Henry Angus Building, in the lounge opposite lecture rooms 104 and 110. (The Henry Angus Building is a modern building on the main mall adjacent to the campus bookstore.) The registration desk will be open on Friday from 8:00 a.m. to noon and from 1:00 p.m. to 4:30 p.m., and on Saturday from 8:30 a.m. to noon and from 1:00 p.m. to 3:30 p.m. Registration fees will be $3 for members of AMS, MAA, or SIAM; $5 for nonmembers; and $1 for students and unemployed persons.

ACCOMMODATIONS

Both on-campus and off-campus accommodations are available. In all cases, the rates are given in Canadian dollars (worth about U.S. $0.84 in February) and are subject to 5 percent provincial hotel tax.

On-campus housing is available in the Walter Gage Residence. This facility offers primarily single accommodations, where six single bedrooms share a common washroom and lounge area. There are four apartments of this type on each floor of the three 17-story towers. For participants preferring twin accommodations, there are a limited number of suites consisting of a bedroom with two twin beds, a lounge with refrigerator and balcony, and a private washroom. The rate structure is: adult in single, $12; couple in adjacent single rooms, $21; children under 12, $6; International Student Card holder, $8.50; suite (single), $24; suite (double), $31. Participants should make room reservations by writing to UBC Conference Centre, University of British Columbia, Vancouver, B.C. (V6T 1W5), Canada.

Deposits are not accepted; however, payment is requested upon check-in. Personal checks are accepted, but credit cards will not be honored. Canadian currency is requested, although the 24-hour reception desk service is prepared to make currency exchange. Participants are advised to use one of the two banks on campus to obtain the current exchange rate (Bank of Montreal and Canadian Imperial Bank of Commerce). Meals will be served on an individual cash basis in the Student Union Building directly across the street from the residence. There are also a few restaurants in the nearby shopping village, about a five minute walk away. Complimentary parking is available for registered guests; no permit is required.

There are no hotels within walking distance of the campus. The following may be reached from campus in approximately 20 minutes by car or 40 minutes by bus. Reservations should be made directly with the hotel or motel.
Bayshore Inn
1601 W. Georgia Street
Telephone: (604) 682-3377
  Single  $51 - $57
  Deluxe Single  55 - 61
  Double  63 - 71
  Deluxe double  67 - 73

Burrard Motor Inn
1100 Burrard Street
Telephone: (604) 681-2331
  Single  $22
  Double  25

Centennial Lodge Apartment Motel
1111 Burnaby Street
Telephone: (604) 684-8763
  Single or double*  $24
  (Each apartment has an additional hide-a-bed and can accommodate an extra roll-away bed at an extra charge of $4 per person.)

Hyatt Regency
655 Burrard Street
Telephone: (604) 687-6543
  Single  $44 - $66
  Double  56 - 78

Sylvia Hotel
1154 Gilford Street
Telephone: (604) 681-9321
  Single  $24
  Single with kitchenette  25
  Double  27
  Double with kitchenette  28

Hotel Vancouver
900 W. Georgia Street
Telephone: (604) 684-3131
  Single  $41 - $53
  Double  53 - 65

TRAVEL
  Vancouver is served by several major airlines. Taxi service from the airport to campus costs approximately $12. Travelers with a small amount of luggage may take the Airport Limo Service ($3 per person) to 41st Avenue and Granville and then take the 41st bus to the campus (50¢ per person in exact change).

  Bus service from downtown runs every 15 minutes and takes about 40 minutes. Bus #10 (10th & UBC) goes directly to the campus; bus #14 (Hastings) returns with the same frequency to downtown.

  Persons arriving in Vancouver by car via Highway 99 from the United States border should proceed over the Oak Street Bridge, continue down Oak Street and turn left at 49th Avenue; 49th Avenue merges with S. W. Marine Drive, which continues to the campus. Persons arriving in Vancouver via the Trans-Canada Highway should take the Grandview exit onto 12th Avenue, which eventually merges with 10th Avenue and leads directly to the campus.

  Budget Rent-a-Car (8665 Barnard Street, telephone (604) 263-2431) will offer $1 off the regular daily rate to all participants of the mathematics meeting. Their current daily rate is $16.95, although this is subject to change prior to June 1. They have a service desk at the airport and reservations are recommended.

PROGRAM OF THE SESSIONS

The time limit for each contributed paper in the 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.

FRIDAY, 9:15 A. M.

Special Session on Mathematical Physics. I, Henry Angus Building, Room 223

9:15- 9:45 (1) The interpretation of quantum mechanics. Preliminary report. Professor PAUL R. CHERNOFF, University of California, Berkeley (767-C3)
9:50-10:20 (2) Embedding quantum logics in Hilbert space. Professor STANLEY P. GUDDER*, University of Denver, and Professor J. MICHEL, Marietta College (767-C1)
10:25-10:55 (3) The FKG inequality for the Yukawα quantum field model. Dr. GUY A. BATTLE III* and Dr. LON ROSEN, University of British Columbia (767-C6)

FRIDAY, 9:15 A. M.

Special Session on Probability. I, Henry Angus Building, Room 225

9:15- 9:45 (4) Regularly varying tail probabilities and point processes. Dr. SIDNEY RESNICK, Colorado State University (767-F3) (Introduced by Professor Priscilla E. Greenwood)
9:50-10:20 (5) The Bernoulli part of a sum of dependent random variables. Dr. DAVID R. MCDONALD, University of Ottawa (767-F5) (Introduced by Professor Priscilla E. Greenwood)
10:25-10:55 (6) On the characterization of Markov processes. Professor ERHAN ÇINLAR, Northwestern University (767-F1)

FRIDAY, 10:00 A. M.

MAA Invited Address, Henry Angus Building, Room 110

An introduction to cognitive mapping (evaluating student potential). T. PLETCHER, Vancouver Community College, Langara, British Columbia

*For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.
FRIDAY, 11:00 A. M.

MAA Invited Address, Henry Angus Building, Room 110

"Furstenberg's proof of Szemeredi's theorem (or, ergodic theory strikes again)."
DOUGLAS A. LIND, University of Washington

FRIDAY, 1:00 P. M.

MAA Invited Presentation, Instructional Resources Center, Lecture Hall 2

"Mathematics in the open university." Presented by a group from the British Open University and the BBC

FRIDAY, 2:00 P. M.

Special Session on Mathematical Physics, II, Henry Angus Building, Room 223

2:00- 2:30 (7) "Progress in correlation inequalities for Ising ferromagnets." GARRETT S. SYLVESTER, New Mexico State University

2:35- 3:05 (8) "Instability of phase coexistence in two-dimensional lattice models." Dr. MICHAEL AIZENMAN, Princeton University (767-C4)

3:10- 3:40 (9) "Markovian evolution of continuous spin systems." Preliminary report. Professor WILLIAM G. FARIS, University of Arizona (767-F7)

3:45- 4:15 (10) "On Edwards' model for polymer chains." Professor M. JOHN WESTWATER, University of Washington (767-C2)

FRIDAY, 2:00 P. M.

Special Session on Representations and Ring Theory, I, Henry Angus Building, Room 225

2:00- 2:30 (11) "Reduced rings and their orthogonal completions." Preliminary report. Mr. RAJENDRA K. RAI, Dalhousie University (767-A2)

2:35- 3:05 (12) "Artinian rings of quotients." Dr. MICHAEL A. FAHY* and Professor J. ZEIMANOWITZ, University of California, Santa Barbara (767-A4)

3:10- 3:40 (13) "Square free rings." Professor FRANK W. ANDERSON, University of Oregon (767-A9)

3:45- 4:15 (14) "The state space of $K_0$ of a Noetherian ring." Preliminary report. Professor KENNETH R. GOODEARL, University of Utah, and Professor ROBERT B. WARFIELD, Jr.*, University of Washington (767-A10)

FRIDAY, 2:30 P. M.

MAA Business Meeting, Henry Angus Building, Room 110

FRIDAY, 3:00 P. M.

MAA Invited Address, Henry Angus Building, Room 110

"Cooperative education in mathematics." D. DALE OLESKY, University of Victoria

FRIDAY, 4:30 P. M.

Session on Algebra and Set Theory, Henry Angus Building, Room 226

4:30- 4:40 (15) "On the prime and semi-prime antiflexible rings." Preliminary report. Professor HASAN A. CELIK, California State Polytechnic University, Pomona (767-A5)

4:45- 5:05 (16) "Semisimple semigroup rings and some problems of J. Weissglass." Dr. MARK L. TEPLOY, University of Florida (767-A8)

5:00- 5:10 (17) "Polynomial group laws." Dr. ZENSHO NAKAO, Southern Illinois University (767-A3)

5:15- 5:25 (18) "Determinateness of certain almost-Borel games." Preliminary report. Dr. ROBERT S. WOLF, California Polytechnic State University, San Luis Obispo (767-E1)

FRIDAY, 7:15 P. M.

AMS-MAA Dinner, Graduate Student Center

Invited talk: "The answer to the question everyone asks." CONSTANCE REID

SATURDAY, 9:00 A. M.

Special Session on Probability, II, Henry Angus Building, Room 223

9:00- 9:30 (19) "Approximations of the product limit estimate under random censorship." Dr. MURRAY D. BURKE, University of Calgary (767-F2) (Introduced by Professor Priscilla E. Greenwood)

9:35-10:05 (20) "Regular birth times for Markov processes." Dr. A. O. PITTENGER, University of British Columbia and University of Maryland, Baltimore County (767-F6)
10:10-10:40  (21)  Tauberian theorems and infinitely divisible Laplace transforms.  A. A. Balkema, J. L. Geluk, and Dr. Laurens de Haan*, Erasmus University, Rotterdam, Holland (767-F4)

SATURDAY, 9:00 A. M.

Special Session on Representations and Ring Theory. II, Henry Angus Building, Room 225
9:00- 9:30  (22)  Strong crossed product division algebras.  Professor Burton I. Fein*, Oregon State University, and Professor Murray Schacher, University of California, Los Angeles (767-A1)
9:35-10:05  (23)  Nilpotent rings, triangular matrix rings, and graded rings.  Preliminary report.  Professor George M. Bergman*, University of California, Berkeley, Mr. T. Bass, Professor D. Britten, and Professor W. F. Lemire, University of Windsor (767-A6)
10:10-10:40  (24)  Algebraic elements in rings with involution.  Preliminary report.  Professor Charles Lanski, University of Southern California, Los Angeles (767-A7)

SATURDAY, 9:30 A. M.

Session on Analysis, Henry Angus Building, Room 226
9:30- 9:40  (25)  A note on unbaireable stratifiable spaces.  Professor Carlos R. Borges, University of California, Davis (767-G1)
9:45- 9:55  (26)  A complex version of Bruhat’s lemma for $SO(1,n)$.  Mary Anderson, University of California, Berkeley (767-G2)
10:00-10:10  (27)  A topological approach to minimizing $\int_b^a f(x, y, y') dx$ in subspaces of the plane.  Dr. Harold Willis Milnes*, H-M Consultants, Lubbock, Texas, and Dr. S. K. Hildebrand, Texas Tech University (767-B1)
10:15-10:25  (28)  Normal forms for contracting diffeomorphisms.  Preliminary report.  Buck Ware, California State University, Chico (767-B3)
10:30-10:40  (29)  Bessel potentials and Lipschitz spaces on local fields.  C. W. Onneweer, University of New Mexico (767-B2)

SATURDAY, 10:00 A. M.

MAA Invited Address, Henry Angus Building, Room 104
Geometrical theorems in slides—an innovative approach for teaching geometry.  Ved P. Madan, Red Deer College, Red Deer, Alberta

SATURDAY, 11:00 A. M.

MAA Invited Address, Henry Angus Building, Room 104
Compartmentalization of mathematical cognition.  Hazel Jo Reed, Evergreen State College, Olympia, Washington

SATURDAY, 11:00 A. M.

AMS Invited Address, Henry Angus Building, Room 110
One-dimensional transformations.  Professor Oscar E. Lanford III, University of California, Berkeley (767-B4)

SATURDAY, 1:30 P. M.

AMS Invited Address, Henry Angus Building, Room 110
Some geometrical aspects of general relativity.  Professor Theodore Frankel, University of California, San Diego (767-D1)

SATURDAY, 2:30 P. M.

MAA Invited Address, Henry Angus Building, Room 110
A probabilistic approach to studying groups.  Kenneth A. Ross, University of Oregon

Kenneth A. Ross
Associate Secretary

Eugene, Oregon
The eighty-third summer meeting of the American Mathematical Society will be held at the University of Minnesota, Duluth, Minnesota from Wednesday, August 22, through Saturday, August 25. All sessions will take place on the campus of the university.

Participants who smoke should be aware that Minnesota has an Indoor Clean Air Act which states, essentially, that indoor smoking in public places is prohibited unless specifically posted smoking permitted. This has been enforced, occasionally to the embarrassment of the smoker.

Colloquium Lectures, consisting of four one-hour talks, will be presented by GEORGE DANIEL MOSTOW of Yale University. The title of the series is Discrete subgroups of Lie groups. The first lecture will be given at 1:00 p.m. on Wednesday; the second at 8:45 a.m. on Thursday; the third at 8:45 a.m. on Friday; and the fourth at 1:15 p.m. on Friday.

The 1979 Leroy P. Steele Prizes will be awarded at a session on Friday, August 24.

Invited One-Hour Addresses. By invitation of the Society’s Program Committee, there will be eight invited one-hour addresses. The speakers, their titles, and the times of their talks are as follows: HERMANN FLASCHKA, University of Arizona, Tucson, Spectrum- or monodromy-preserving deformations of linear differential equations, 11:15 a.m. Friday; ALLEN E. HATCHER, University of California, Los Angeles, On the classification of 3-manifolds, 11:00 a.m. Saturday; JAMES I. LEPOWSKY, Rutgers University, Lie algebras and the Rogers-Ramanujan identities, 10:00 a.m. Friday; I. I. PIATETSKI-SHAPIO, Yale University, Zeta functions and representations, 3:45 p.m. Wednesday; HERBERT E. SCARF, Yale University, Production sets with indivisibilities: A new approach to integer programming, 9:45 a.m. Saturday; JACQUES L. TITS, Collège de France, Affine buildings, arithmetic groups, and finite geometries, 11:15 a.m. Thursday; EUGENE TRUBOWITZ, Massachusetts Institute of Technology, Inverse problems, particle systems, and nonlinear partial differential equations, 10:00 a.m. Thursday; and W. STEPHEN WILSON, Johns Hopkins University, Brown-Peterson cohomology in algebraic topology, 2:30 p.m. Wednesday.

Special Sessions. There will be ten special sessions of selected twenty-minute papers. HAROLD E. BENZINGER of the University of Illinois, Urbana-Champaign, is arranging a special session on Differential operators and diffusion processes, to be held Wednesday and Thursday; the tentative list of speakers includes Harold E. Benzinger, Charles T. Fulton, Yuji Kasahara, M. K. Kwong, Edwin A. Perkins, Edward C. Swensden, and Anton Zettl.

PAUL O. FREDERICKSON of the University of Maryland, College Park, and Lakeland University is arranging a special session on Computational fluid dynamics, to be held Wednesday and Thursday; the tentative list of speakers includes Jim Douglas, Jr., Richard E. Ewing, George J. Fix, Eugene Isaacson, Mitchell B. Luskin, Joseph E. Oliger, S. A. Orzag, and Mary Fanett Wheeler. DAVID S. GRIFFEATH of the University of Wisconsin, Madison, is arranging a special session on Percolation and interacting systems, to be held Friday and Saturday; the tentative list of speakers includes Maury D. Bramson, T. Cox, Richard T. Durrett, Lawrence F. Gray, David S. Griffeath, Stanley A. Sawyer, Robert T. Smythe, and John C. Wierman. JULIAN I. PALMORE of the University of Illinois, Urbana-Champaign, is arranging a special session on Topological methods in the study of dynamical systems, to be held Wednesday and Thursday; the tentative list of speakers includes Hsin Chu, Charles C. Conley, Robert W. Easton, Harvey B. Keynes, Ronald J. Knill, Zbigniew H. Nitecki, and Julian I. Palmore. JOHN G. RATCLIFFE of Massachusetts Institute of Technology and the University of Wisconsin, Madison, is arranging a special session on Homological and combinatorial methods in group theory, to be held Friday and Saturday; the tentative list of speakers includes Richard Z. Goldstein, John G. Ratcliffe, Derek J.S. Robinson, and Louis Solomon.

J. IAN RICHARDS of the University of Minnesota, Minneapolis, is arranging a special session on Analytic number theory, to be held Wednesday and Thursday; the tentative list of speakers includes Ronald L. Graham, Emil Grosswald, Douglas A. Hensley, Richard H. Hudson, Karl K. Norton, Carl Pomerance, Jeff D. Vaaler, and Thomas Vehka. SEYMOUR SCHUSTER of Carleton College is arranging a special session on Combinatorics and graph theory, to be held Friday and Saturday; the tentative list of speakers includes Michael O. Albertson, Richard A. Brualdi, Fan R.K. Chung, Ralph J. Faundee, Jr., Joan P. Hutchinson, Judith Q. Longyear, Stephen B. Maurer, William O.J. Moser, Richard H. Schelp, Arthur T. White II, Dennis E. White, and Thomas Zaslavsky. JOEL H. SHAPIRO of Michigan State University is arranging a special session on Functional analysis in spaces of analytic functions, to be held Friday and Saturday; the tentative list of speakers includes Sheldon Axler, Earl R. Berkson, James E. Brennan, Sun-Yung Alice Chang, Carl C. Cowen, Jr., Daniel H. Luecking, Lee A. Rubel, Walter Rudin, Allen L. Shields, David A. Stegenga, Carl Sundberg, and Thomas H. Wolff. STEVEN I. SPERBER of the Institute for Advanced Study and the University of Minnesota, Minneapolis, is arranging a special session on p-adic analysis in number theory and geometry, to be held Friday and Saturday; the tentative list of speakers includes A. Adolphson, Jack Diamond, Y. Flicker, Benedict H. Gross, William E. Lang, Jonathan...
Operations Research: Mathematics and Models
August 19–20, 1979

The American Mathematical Society will present a one and one-half day short course entitled “Operations Research: Mathematics and Models,” on Sunday and Monday, August 19 and 20, 1979, in Bohannan Hall 90 on the University of Minnesota, Duluth campus.

Operations Research can be defined as the application of scientific methods to decision problems. Various fields of the mathematical sciences have contributed to the successful resolution of a diverse set of decision problems. This short course will emphasize specific application areas and the mathematics used in modeling and solving the related problems.

The program is under the direction of Saul I. Gass, Chairman of the Faculty in Management Science and Statistics, College of Business and Management, University of Maryland, College Park, and Ralph Disney, Department of Industrial Engineering and Operations Research, Virginia Polytechnic Institute and State University. The short course was recommended by the Society’s Committee on Employment and Educational Policy, whose members are Lida K. Barrett (chairman), Alan J. Goldman, Arthur P. Mattuck, Donald C. Rung, Robert J. Thompson, and William P. Ziemer. The short course series is under the direction of the CEEP Short Course Subcommittee, whose members are Alan J. Goldman (chairman), Ronald L. Graham, Cathleen S. Morawetz, and Barbara L. Osofsky.

The program will consist of six seventy-five minute lectures. Each lecture will be self-contained and be devoted to a different area of application: health care delivery systems (William Pierskalla, University of Pennsylvania); fire department allocation and deployment (Warren E. Walker, The Rand Corporation); queueing networks (Ralph L. Disney, Virginia Polytechnic Institute and State University); fishery management (Frederick C. Johnson, National Bureau of Standards); military (Seth Bonder, Vector Research and University of Michigan, Ann Arbor); and agriculture (Robert B. Rovinsky, U.S. Department of Agriculture).


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 Meeting Preregistration and Registration for details.

D. Lubin, William Messing, N. Nygaard, W. Sinnott, and J. Stienstra. FRANKLIN D. TALL of the University of Toronto is arranging a special session on Applications of set theory to topology, to be held Wednesday and Thursday; the tentative list of speakers includes James E. Baumgartner, William G. Fleissner, Fred Galvin, Kenneth Kunen, Arnold Miller, Judith Roitman, and A. Taylor.

Most of the papers to be presented at these special sessions will be by invitation; however, anyone contributing an abstract for the meeting who felt that his or her paper would be particularly appropriate for one of these sessions should have indicated this clearly on the abstract, and should have submitted it by May 22, 1979, three weeks earlier than the normal deadline for contributed papers, in order that it could have been considered for inclusion.

Contributed Papers. There will be sessions for contributed ten-minute papers on Wednesday afternoon, Thursday morning, Friday morning, Saturday morning, and Saturday afternoon. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in departments of mathematics, and should be sent to the American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940, so as to arrive by the abstract deadline of June 12, 1979.

Members are reminded that a charge of $7 is imposed for retyping abstracts that are not in camera-ready form.

Overhead projectors, screens, and blackboards will be in each room used for special sessions or
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 Barbara L. Osofsky, David A. Sanchez, Michael Taylor, and Guido L. Weiss, with the secretary as chairman.

In order that a motion for the Business Meeting of August 23, 1979, receive the service to be offered by the committee in the most effective manner, it should be in the hands of the secretary by July 25, 1979.

Everett Pitcher, Secretary

contributed paper sessions. Presenters of ten- or twenty-minute papers are urged to use the overhead projector rather than the blackboard for their presentation, in order to obtain maximum visibility of the material presented for all members of the audience.

The Society’s Committee on Employment and Educational Policy (CEEP) will sponsor a panel discussion at 7:30 p.m. on Tuesday, August 21, arranged by Alan C. Tucker, SUNY, Stony Brook, who will also serve as moderator. Lida K. Barrett of the University of Tennessee, Knoxville, Peter J. Hilton of the Battelle Memorial Institute, Seattle, and Thomas G. Proctor of Clemson University will be members of the panel. The title of the discussion is Trends in curriculum and employment in the mathematical sciences.

COUNCIL AND BUSINESS MEETINGS

The Council of the Society will meet at 5:00 p.m. on Wednesday, August 22, in the Ballroom of Kirby Student Center. The Business Meeting of the Society will be held in the Marshall Performing Arts Center at 4:00 p.m. on Friday, August 24. 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.

Agenda for the Business Meeting. At the request of the AMS Committee on Human Rights of Mathematicians, the April 20, 1979 Council placed the following resolution on the agenda for the Business Meeting of the Society in Duluth:

This Business Meeting takes note of reports that the Moroccan mathematician, Sion Assidon, was arrested more than seven years ago, apparently for no reason other than his political opposition to the regime, and has been held without trial since that time. It is reported further that his health has deteriorated seriously. The Meeting expresses its concern for the fate of our fellow mathematician, and calls for Sion Assidon to be quickly released unless he is brought to trial and convicted on criminal charges.

This listing constitutes the notification to the membership mentioned in Article X, Section 1 of the bylaws.

For additional information on the Business Meeting, refer to the box above.

OTHER ORGANIZATIONS

The Mathematical Association of America (MAA) will hold its 59th summer meeting on August 21-23, Tuesday-Thursday, in conjunction with this meeting of the Society. The Business Meeting of the Association will take place at 10:00 a.m. on Wednesday, August 22, at which the Carl B. Allendoerfer, Lester R. Ford, and George Pólya Awards will be presented.

Information regarding a series of Minicourses to be offered by the MAA in Duluth is contained in the box on page 213.

There will be a buffet dinner at 7:00 p.m. on Wednesday, August 22, in the Moorish Room of the Hotel Duluth for those who have been members of the MAA for twenty-five years or more. The dinner will be followed by a short program with G. Bailey Price as master of ceremonies. Andrew M. Gleason and Murray S. Klamkin will serve as speakers. At 6:30 p.m., there will be a no-host cocktail party. Similar dinners have been held at each of the last several summer meetings and have proved to be pleasant.
Mathematical Association of America: Minicourses

In order to help mathematicians meet the ongoing need to stay creative while teaching undergraduate mathematics, the MAA has planned a series of minicourses for the meeting in Duluth. The conviction that all undergraduate teachers of mathematics need to be exposed to new problems and to new teaching ideas has led to this sequence of courses.

The sequence of minicourses is open only to persons who have registered for the Joint Mathematics Meetings and paid the registration fee. The minicourse on hand calculators has a separate registration fee of $15, and is limited to 30 participants. Calculators will be provided to all participants for use during this minicourse. Persons who plan to attend the course on calculators should attach a separate check for $15 to their preregistration/housing form. This check should be made payable to the Mathematical Association of America, but should be sent along with the preregistration/housing form to the housing bureau in Providence. If there are more than 30 persons who request to be enrolled in the course on calculators, the course will be filled on a first-come basis, and checks will be returned to those not so enrolled. The minicourses to be offered in Duluth follow:

**MOTIVATION AND ENRICHMENT**

_Tuesday, August 21_

1:00 - 4:00 p.m.

Home Economics 80

This minicourse will feature talks by Warren Page of New York Community College and John Niman of Hunter College. Professor Niman's presentations are titled _Mathematics and art_, and _Mathematics and the geoboard_. Professor Page will make presentations titled _Some alternate modes of instruction_, and _Teaching techniques that enhance creativity and build mathematical muscle_.

Enrollment for this course is not limited, there is no registration fee, and no advance notice of intent to attend the course is required.

**MATHEMATICAL MODELING**

_Wednesday, August 22_

9:00 a.m. – noon

Home Economics 80

This minicourse will feature talks by William F. Lucas of Cornell University, and Alan C. Tucker of SUNY, Stony Brook. There will also be presentations on mathematical models from the collections of materials of UMAP and CUPM. Professor Lucas will give a talk titled _Mathematical modeling_, and Professor Tucker will give a talk titled _Problem solving_.

Enrollment for this course is not limited, there is no registration fee, and no advance notice of intent to attend the course is required.

**PRECalculus AND Calculus WITH HAND-HELD CALCULATORS**

_Thursday, August 23_

1:00 - 4:00 p.m.

Home Economics 203

This minicourse will be presented by Harry P. Allen of Ohio State University. That institution is concluding the second year of a three-year NSF grant to develop a numerically-oriented calculus curriculum. The materials produced thus far provide a geometric approach which strongly supports the building and maintaining of intuition, while establishing standard calculus skills. Much of this is suitable for inclusion in precalculus courses. The workshop will cover an introduction to programming the hand-held calculator; no previous experience is required. Participants will be provided with TI-58 calculators for use during the workshop. The work-discussion topics will include graphing, error estimates, and the definite integral.

Enrollment for this course is limited to 30 participants, and there is a registration fee of $15. Details are given above as to how to complete the required pre-enrollment for this course.

occasions. Twenty-five-year members of the MAA who have reserved tickets may pick them up at the Thermofax section of the registration desk, and should do so prior to 4:30 p.m. on Tuesday. The cost of each ticket is $12, including sales tax and gratuity. Spouses are invited.

For a more detailed listing of the activities of the MAA, see the Summary of Activities, which begins on page 221.

**Pi Mu Epsilon (IME)** will hold its summer meeting on Wednesday and Thursday, August 22-23. The J. Sutherland Frame Lecture will be given by H. Jerome Keisler of the University of Wisconsin, Madison, at 8:30 p.m. on Wednesday. Professor Keisler's title is _Infinitesimals: Where they come from and what they can do_.

The _Association for Women in Mathematics_ (AWM) will sponsor a panel discussion at 4:00 p.m. on Thursday, August 23, on the topic _Mathematics education: A feminist perspective_. Judith Roitman will moderate. The list of speakers will include Lenore Blum and Diane Resek. An open meeting of the AWM Council will take place at 5:00 p.m. on Thursday.

**MATHEMATICAL SCIENCES EMPLOYMENT REGISTER**

The Summer Employment Register at the Duluth meeting will operate on an informal basis.
No interviews will be scheduled by the staff; instead, facilities will be provided for posting both applicant and employer résumés. The Employment Register staff will provide a message desk for individuals to leave messages for one another, requesting interviews. Actual arrangements for interviews will be the responsibility of the employer and applicant. A room will be set aside for the interviews.

Applicants should recognize that the purpose of the Register is solely to provide an opportunity for an initial contact between applicant and employer, but that no guarantee can be made that any employers will, in fact, attend the meetings or participate in the Employment Register.

At the suggestion of the AMS-MAA-SIAM Committee on Employment Opportunities, employers listing in the July and August issues of Employment Information in the Mathematical Sciences will be asked to signify in their listings their intention to participate in the Employment Register at the summer meeting. A mailing requesting this information was sent in May.

Applicants who plan to participate in the summer Employment Register are required to complete the special applicant form included in this issue of the Notices on page A-416 and send it to Providence, together with the meeting preregistration form provided on page A-418. Please be sure to fill in the coded summary strip at the bottom of the applicant form. (See the news item Summer Employment Register and 1979 Summer List of Applicants on page 187 of the April issue of the Notices.) Applicants are not required to participate in the summer Employment Register or attend the summer meeting in order to have their names appear on the list. There is, however, no provision for posting of résumés for applicants not attending the meeting.

Those who plan to participate in the summer Employment Register are required to register or preregister for the meeting. The deadline for preregistration for the meeting and Employment Register is July 27. Further information appears in the May issue of the publication Employment Information in the Mathematical Sciences.

EXHIBITS AND BOOK SALE

The book and educational media exhibits will be displayed in the Tweed Museum of Art (25 on the campus map on page 217) at the following times: Tuesday, August 21, 1:00 p.m. to 5:00 p.m.; Wednesday and Thursday, August 22-23, 8:30 a.m. to 4:30 p.m. All participants are encouraged to visit the exhibits sometime during the meeting.

Books published by the Society will be sold at prices somewhat below the usual mail order prices. The book sale will also be located in the Tweed Museum, and will be open at the following times: Tuesday, August 21, 8:00 a.m. to 4:30 p.m.; Wednesday and Thursday, August 22-23, 8:30 a.m. to 4:30 p.m.

MEETING PREREGISTRATION AND REGISTRATION

Participants who wish to preregister for the meetings should complete the preregistration form on page A-418 of this issue of the Notices. The deadline for receipt of preregistrations in Providence is July 27. Preregistrants will be able to pick up their badges and programs when they arrive at the meeting. Complete instructions on making hotel or residence hall reservations are given in the sections titled RESIDENCE HALL HOUSING and HOTEL ACCOMMODATIONS. Please note that preregistration is required in order to obtain confirmed residence hall housing.

Registration fees. Meeting preregistration and registration fees partially cover expenses of holding the meetings. The preregistration fee does not represent an advance deposit for lodgings.

Please note that separate fees are required for the Short Course and Joint Mathematics Meetings. Those who preregister will pay lower registration fees than those who register at the meeting. These fees are as follows:

AMS Short Course
Operations Research: Mathematics and Models

<table>
<thead>
<tr>
<th>Preregistration</th>
<th>At Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student/Unemployed</td>
<td>$3</td>
</tr>
<tr>
<td>All other Participants</td>
<td>18</td>
</tr>
</tbody>
</table>

Joint Mathematics Meetings

<table>
<thead>
<tr>
<th>Preregistration</th>
<th>At Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members of AMS, MAA, and IIME</td>
<td>$23</td>
</tr>
<tr>
<td>Nonmembers</td>
<td>33</td>
</tr>
<tr>
<td>Student/Unemployed</td>
<td>2</td>
</tr>
</tbody>
</table>

Please also note that, commencing with this meeting, a $2 charge will be imposed for all invoices prepared when preregistration/housing forms are submitted without an accompanying check for the preregistration fee(s), or are accompanied by an amount insufficient to cover the total fee(s).

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

Students are considered to be only those currently working toward a degree, who do not receive compensation totaling more than $7,000 from employment, fellowships, and scholarships.

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.

A fifty percent refund of the preregistration fee(s) will be made for all cancellations received in Providence no later than August 17. No refunds will be granted for cancellations received after that date, or to persons who do not attend the meetings.
Registration dates and locations. Registration for the Short Course only will begin on Sunday, August 19, at 11:00 a.m., outside Room 90 of Bohannan Hall (18 on the campus map). Participants who are not attending the Short Course are advised that no joint meeting information or registration material will be available prior to the time listed below for the Joint Mathematics Meetings registration. The registration desk for the Joint Mathematics Meetings will be located in the Tweed Museum of Art. The desks will be open during the hours listed below:

**AMS Short Course**  
*Operations Research: Mathematics and Models*  
Outside Room 90, Bohannan Hall

<table>
<thead>
<tr>
<th>Date</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunday, August 19</td>
<td>11:00 a.m. - 3:30 p.m.</td>
</tr>
<tr>
<td>Monday, August 20</td>
<td>8:00 a.m. - 2:00 p.m.</td>
</tr>
</tbody>
</table>

**Joint Mathematics Meetings**  
Tweed Museum of Art

<table>
<thead>
<tr>
<th>Date</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday, August 20</td>
<td>2:00 p.m. - 8:00 p.m.</td>
</tr>
<tr>
<td>Tuesday, August 21</td>
<td>8:00 a.m. - 4:30 p.m.</td>
</tr>
<tr>
<td>Wednesday, August 22</td>
<td>8:30 a.m. - 4:30 p.m.</td>
</tr>
<tr>
<td>Thursday, August 23</td>
<td></td>
</tr>
<tr>
<td>Friday, August 24</td>
<td>8:30 a.m. - 1:30 p.m.</td>
</tr>
<tr>
<td>Saturday, August 25</td>
<td></td>
</tr>
</tbody>
</table>

**RESIDENCE HALL HOUSING**

The University of Minnesota, Duluth, is proud of its essentially barrier-free environment, and will assist with arrangements for those with special needs. Participants desiring assistance should accompany their preregistration/housing form with a short description of their particular situation.

Participants desiring confirmed reservations for on-campus housing must preregister prior to July 27. Rooms may be available for those who do not preregister, but this cannot be guaranteed. Early registration is particularly recommended for the apartment units described below, since the supply might not meet the demand. Advance payment for housing is not required; however, full payment for accommodations must be made at check-in time. Cash, personal checks, or travelers’ checks will be accepted; credit cards will not be honored.

Please use the preregistration and residence hall housing request form provided on page A-418 of this issue of the Notices, and return it so as to arrive no later than July 27 to the Mathematics Meetings Housing Bureau, P.O. Box 6887, Providence, Rhode Island 02940, giving as complete information as possible in order that your residence hall assignment can be made correctly.

There will be two types of accommodations available for participants and their families:

**Residence Hall Rooms.** The residence halls are located near the dining center, and within five to seven minutes walking time from the meeting rooms. They are not air-conditioned. Both single and double rooms are available. Each room has two twin beds, two desks, chairs, a bureau, and closet space. Cots are available without extra charge for use by children ten years of age or under, but not more than one cot may be used per double room and at least one parent or adult must occupy one of the beds in rooms where a child ten years of age or under occupies a cot. Cots may not be added for children over ten years of age, who must occupy a bed and pay the adult rate. A limited number of cribs for small children is available. Participants wishing to reserve a crib should check the appropriate box on the preregistration/housing form on page A-418. There will be a nominal rental charge for the cribs. Bed linens, towels, washcloths, soap, and drinking cups are provided. Maid service (making beds and tidying up) and fresh towels will be provided on a daily basis. No private baths are available. Generally speaking, there are two group bathrooms per floor, with individual shower stalls. There are no cooking facilities available in the residence halls.

The rates, including the 8 percent sales tax, are:

<table>
<thead>
<tr>
<th>Type of Room</th>
<th>Rate per Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single residence hall room</td>
<td>$8.64/night</td>
</tr>
<tr>
<td>Double residence hall room</td>
<td>$7.02/night per person</td>
</tr>
</tbody>
</table>

**Apartment Units.** The apartment units are slightly farther from the center of campus than the residence halls, but are still within seven or eight minutes walking time of any place on campus. They are not air-conditioned. Each apartment unit consists of two bedrooms (each containing two single beds), a complete bath, living room, and kitchen, and is designed to accommodate four people. Again, cots are available without extra charge for children ten years of age or under; the same rules apply as for residence halls, except that in an apartment unit the use of two cots is permitted. The kitchens in the apartment units have a stove, refrigerator and sink, but cooking and eating utensils are not furnished. Other furnishings, maid service, and towels are the same as for residence hall rooms.

The rate, including the 8 percent sales tax, regardless of the number of occupants (up to a maximum of four adults and two children ten years of age or under occupying cots), is $27 per night.

Pets are not allowed in on-campus living areas. Apart from applicable state laws (drinking age is 19), there are no restrictions on the use of alcoholic beverages in the residence halls. Free ice is available from an ice machine located at the Griggs-Lake Superior Hall Information Desk. Telephones in the rooms are disconnected during the summer months, but there are pay phones in the lounge areas of the residence halls and apartment buildings.

Participants are encouraged to use all of the facilities in the housing area; tennis, basketball, and volleyball courts are available. Some residence halls have saunas, weight training machines, pianos, and pinball machines. Use of any facility, other than
coin-operated laundry machines, games, and vending machines, is free of charge to participants.

When arriving on campus participants should proceed to the Griggs-Lake Superior Hall Information Desk (on the campus map) to obtain their housing assignment. The desk will be open on a twenty-four hour basis, beginning at 8:00 a.m. on August 17. Residence hall rooms and apartment units may be occupied as early as August 17, or as late as August 29. Again, full payment for accommodations must be made at check-in time by way of cash, personal checks, or travelers' checks.

**FOOD SERVICES**

An air-conditioned dining center, located on the third floor of Kirby Student Center (14 on the campus map) will be serving complete meals during the week of the meetings. The dining hall will open at 10:00 a.m. on Sunday, August 19, and will close after lunch on Saturday, August 25. Apart from these two days, and the evening meal on Tuesday, the schedule will be:

- **Breakfast**: 7:00 a.m. - 9:30 a.m.
- **Lunch**: 11:00 a.m. - 1:30 p.m.
- **Dinner**: 5:00 p.m. - 6:30 p.m.

All meals are on an a la carte basis, and typically cost $3 for breakfast, $3.50 for lunch, and $4.50 for dinner. Weather permitting, on Tuesday, August 21, there will be a cookout and beer party on Kirby Terrace instead of cafeteria service. That evening, dinner will be served between 6:00 p.m. and 7:30 p.m.

Beverages, sandwiches, and snacks will also be available on campus in the VenDen, a vending machine area located in the basement of Bohannan Hall, and from vending machines located in the residence halls. The VenDen is open from 6:00 a.m. to 10:00 p.m. daily.

The areas immediately adjacent to the campus are primarily residential, but there are two restaurants and a doughnut shop near the corner of St. Marie Street and Woodland Avenue, about 12 minutes' walking distance. The nearest nationally-advertised, fast food chain restaurant would require the use of a car for all but the more determined hikers. Participants will receive a list of these and other Duluth restaurants with their registration materials.

**HOTEL ACCOMMODATIONS**

A block of rooms has been set aside for use by participants at the Radisson Duluth Hotel. Participants should make their own reservations early directly with the Radisson or other hotels listed below, and should identify themselves as participants in either the Short Course or Joint Mathematics Meetings. The rates listed are subject to change.

The following codes apply: SP = Swimming Pool; AC = Air Conditioned; TV = Television; CL = Cocktail Lounge; RT = Restaurant. The age limit for children under which there is no charge, providing a cot is not required and they are in the same room as a parent, is shown in parentheses on the same line as the charge for an extra person in the room. In all cases “Single” refers to one person in one bed; “Double” refers to two persons in one bed; and “Twin” refers to two persons in two beds. A rollaway cot for an extra person can be added to double or twin rooms only. Participants will be advised of deposit requirements by the hotels at time of confirmation. The actual mileage and approximate walking times from the hotel to the campus are given in the parentheses following the name of the hotel. All rates quoted are subject to the 8 percent sales tax.

**Radisson Duluth Hotel**
(2.8 miles, 55 minute walk)*
505 W. Superior Street 55802
Telephone: (218) 727-8981
Single: $30.50
Twin Double: 39.50
Extra person in room $7 (18 years)
Code: FP, SP, AC, TV, RT, CL

**Hotel Duluth**
(2.5 miles, 45 minute walk)*
231 E. Superior Street 55802
Telephone: (218) 727-4577
Single: $20
Double/Twin: 25
Extra person in room $5 (12 years)
Code: FP, TV, RT, CL

**Normandy Inn**
(2.7 miles, 50 minute walk)*
209 W. Superior Street 55802
Telephone: (218) 722-1202
Single: $30.50
Double/Twin: 34.50
Extra person in room $10 (18 years)
Code: SP, AC, TV, RT, CL

*Because of the distance of these hotels from campus, and the 400 foot change in elevation, participants wishing to stay in a hotel are advised to provide themselves with a rental car or other means of transportation, unless they are determined hikers.

**ATHLETIC FACILITIES**

All meeting participants and their families may use the outdoor tennis courts in the dormitory area, as well as the outdoor track and tennis courts near the field house. Indoor facilities include gymnasiums, a weight training room, a track, and a swimming pool. Hours for indoor facilities will be posted. Participants should bring their own gear; towel service is provided for swimmers for a small fee. Details on public golf courses and other athletic facilities can be obtained at the Local Information Section of the Joint Mathematics Meetings registration desk.

**BOOK STORES**

The book stores on campus are open between 8:00 a.m. and 4:30 p.m. weekdays. Dalton's, located
UNIVERSITY OF MINNESOTA – DULUTH CAMPUS

Legend

★ GRIGGS – LAKE SUPERIOR HALL – Check in here for Residence Hall assignment

1. Old Main
2. Research Laboratory
3. Washburn Hall
4. Torrance Hall
5. Provost’s Residence
6. Alworth Apartments
7. Alworth Residence
8. Administration
9. CHEMISTRY
11. MARSHALL W. ALWORTH HALL
12. LIFE SCIENCE
13. Mathematics – Geology
14. KIRBY STUDENT CENTER
15. RESIDENCE HALL DINING CENTER
16. SOCIAL SCIENCES
17. Library
18. BOHANNON HALL
19. HOME ECONOMICS
20. MARSHALL PERFORMING ARTS CENTER
21. Industrial Education
22. R. O. T. C.
23. Physical Education Field House
24. Physical Education
25. HUMANITIES & TWEED MUSEUM OF ART
26. A. B. ANDERSON HALL
27. Vermilion Hall
28. Burntside Hall
29. Griggs Hall
30. Lake Superior Hall
31. Health Service
32. The Village
33. Village Service Center
34. Stadium Apartments
35. Stadium & Griggs Field
36. Lund Plant Services
37. School of Medicine
38. Medical Science Library
39. Duluth Fire Station No. 4
40. Sax Brothers Memorial
41. WDSE TV Communications Center

CITY BUS LINES – – – – – – – –
INTER CAMPUS BUS – – – – – – – –
in the Normandy Court downtown, is open from 10:00 a.m. to 9:00 p.m. weekdays, from 11:00 a.m. to 5:30 p.m. on Saturday, and from noon to 5:00 p.m. on Sunday. The Walden Book Store, located in the Miller Hill Mall, is open Monday through Friday from 9:30 a.m. to 9:00 p.m., from 9:30 a.m. to 6:00 p.m. on Saturday, and from 11:00 a.m. to 5:00 p.m. on Sunday. The Book Post, located near the campus at 2311 Woodland Avenue, is open from 10:00 a.m. to 5:30 p.m. Monday through Saturday, and between 2:00 p.m. and 5:00 p.m. on Sunday.

**CAMPING**

Several camp sites have been set aside for participants at Spirit Mountain, approximately 15 miles from the university. These camp sites are equipped with electrical and water hookups, a fireplace and picnic table. Spirit Mountain is an all-season resort, offering skiing in the winter and other outdoor activities during the summer, such as swimming, tennis, hiking, and jogging. The Campground Control Building offers a camp store, laundry, and telephones. There are washrooms and showers, as well as a first aid station. There is also a restaurant and cocktail lounge. The rates for the camp sites are $3.50/day for tents, $5.50/day for a vehicle requiring electrical service only, and $6.50/day for a vehicle requiring electrical and water service. Interested participants should reserve these camp sites in advance by writing before July 20 to Spirit Mountain Campground, 9500 Spirit Mountain Place, Duluth, Minnesota 55810, and by identifying themselves as participants in the mathematics meetings.

**CHILD CARE**

A local nursery school has agreed to open its facilities for children up to eight years old, provided there is sufficient demand. This school is located at the edge of campus within easy walking distance of the residence halls. It is fully equipped and staffed by professionals who will plan appropriate activities, including field trips, for each age group. Cribs are available for infants. The charge will be $2 per hour for children under two-and-one-half years, $1.25 per hour for children two-and-one-half to eight years, with an additional charge for lunch. Interested parents should preregister with a deposit of $5, indicating dates and hours they wish to use this service, by writing Dr. S. S. Anderson, Department of Mathematical Sciences, University of Minnesota, Duluth, Minnesota 55812. A decision will be made on June 15 whether there is sufficient demand to merit opening the facility. The $5 deposit will be refunded only if the facility is not opened. Duluth does not have a professional babysitting organization, but a list of private babysitters will be available at the Local Information Section of the Joint Mathematics Meetings registration desk.

**CRIB RENTAL**

Cribs for small children and infants will be made available for use in the residence halls at a low cost to participants who check the appropriate box on the preregistration/housing form on page A-418.

**ENTERTAINMENT**

The Local Arrangements Committee has planned a number of free or low-cost activities for participants and their families. Tickets for each of the following events, including transportation, will be available at the Local Information Section of the Joint Mathematics Meetings registration desk, unless otherwise specified.

On Tuesday, August 21, and again on Friday, August 24, outings are planned on the Brule River in northern Wisconsin. An outfitter will supply canoes or kayaks and all necessary equipment, and participants will have a choice between a white water or a novice course.

Weather permitting there will be a cookout and beer party on Kirby Terrace on Tuesday, August 21, in lieu of normal cafeteria service that evening. Dinner will be served between 6:00 p.m. and 7:30 p.m., and tickets for the party may be obtained at the door.

On Wednesday, August 22, there will be a trip to Gooseberry Falls State Park. The tour bus will leave at 1:00 p.m. and return about 5:30 p.m., traveling to the park along a portion of Lake Superior's famous and scenic North Shore Drive, with a stop along the way to tour the French River Fish Hatchery.

Thursday evening, August 23, the traditional summer meeting picnic will be held at Spirit Mountain Resort (see area map on page 219). Spirit Mountain is a city-operated ski resort and recreational complex. In the summer it offers hiking, swimming, tennis, horseback riding, camping, and picnicking. The main lodge also contains an excellent restaurant and cocktail lounge. The menu for Thursday evening will include Walleye Pike (all you can eat), corn on the cob, potatoes, beans, salad, and beverage. Tickets will be on sale at the Thermofax Section of the Joint Mathematics Meetings registration desk until noon on Wednesday, August 22, but participants are urged to purchase their tickets in advance when preregistering for the meeting, using the space provided on the form on page A-418. The adult ticket price is $10.25, which includes bus transportation to and from Spirit Mountain, or $9 without the bus transportation. The ticket prices for children 12 years of age and under are $5.75 or $4.50 respectively.

Tour buses will depart from the campus at 1:45 p.m. and 4:15 p.m. Tuesday through Friday to take visitors to the St. Louis County Heritage and Art Center (the Depot) and the harbor area near downtown Duluth. The Depot is a former railroad station that has been converted into a cultural center, and includes an excellent railroad museum, the Chisholm Museum, an art institute, and a county historical museum. The building itself is an interesting example of Norman Revial architecture. Those continuing on to the harbor area may purchase
tickets for the two-hour harbor cruise aboard the Vista Queen or the Vista King.

LIBRARIES

The University Library (17 on the campus map) will be open from 8:00 a.m. to 9:00 p.m. Monday through Friday. The Duluth Public Library, located at 101 West 2nd Street, is open from 9:00 a.m. to 9:00 p.m. on Monday, Tuesday, and Wednesday, and from 9:00 a.m. to 5:30 p.m. Thursday and Friday.

MAIL AND TELEPHONE MESSAGES

All mail and telegrams for persons attending the meetings should be addressed to the participant in care of Joint Mathematics Meetings, Tweed Museum of Art, University of Minnesota, Duluth, Minnesota 55812. Mail and telegrams so addressed may be picked up at the Joint Mathematics Meetings registration desk, located in the Tweed Museum of Art, during the hours that desk is open.

A telephone message center will be located in the same area to receive incoming calls for participants during the hours the desk is open. Messages will be written down, and the name of the participant for whom a message has been received will be posted on a blackboard near the desk until the message is picked up. The telephone number of the message center will be published in the August issue of the Notices.

During those hours when the message center is not open, telephone messages for participants staying on campus may be relayed through the residence hall information desk attendant at (218) 726-7381.

MEDICAL SERVICES

The University Health Service Center (31 on the campus map) is open between 9:00 a.m. and 3:00 p.m. each weekday, with a doctor in attendance. Duluth is served by St. Mary's Hospital at 407 East 3rd Street (emergency telephone 727-4551, extension 291), and by St. Luke's Hospital at 915 East 1st Street (emergency telephone 727-6636, extension 600). Both hospitals maintain emergency service around the clock, and each has a dentist available on an on-call basis 24 hours a day, seven days a week. For police, fire, or ambulance service, dial 911.

PARKING

Participants may park without charge in all of the lots shown on the campus map except for metered, reserved, and designated reserved spaces. In addition, visitor parking permits, which will permit courtesy parking in metered spaces in downtown Duluth, will be available at the Local Information Section of the Joint Mathematics Meetings registration desk.

TRAVEL AND LOCAL INFORMATION

Duluth, a city of 100,000, is located at the western tip of Lake Superior, approximately 150 air
miles northeast of Minneapolis. It is served by North Central Airlines, by Greyhound and Wisconsin Northern bus lines, and by Amtrak, and it is a terminus of freeway I-35 and the focus of numerous other scenic highways.

The Duluth Airport is approximately 7 miles from campus. Car rentals are available at the airport from Avis, Hertz, National, and Budget. Ford and Sears also rent cars locally, but special arrangements will have to be made for pickup and delivery. Advance reservations are strongly recommended for all car rentals.

Citywide taxi service is available, as is limousine service between the airport and downtown hotels. The taxi ride from the airport to the university campus costs $5, and costs may be shared among two or more passengers. City buses do not stop at the airport, but they do connect the campus with the downtown area, about three miles away.

The host institution plans to supplement taxi service between the campus and airport with an informal free shuttle at the times of the most commonly used flights. Those arriving at the airport can obtain shuttle service information and other assistance at an information desk that will be set up near the baggage claim area and staffed at the times of more popular incoming flights. To facilitate the scheduling of the free shuttle, it is important that you supply flight information in the space provided on the pre-registration and housing form on page A-418 of this issue of the Notices. Participants should be aware that if their flights are delayed, they should be prepared to rely on the taxi service, if necessary.

Information about points of interest in the Duluth area, such as the Duluth Zoo, Hawk Ridge Nature Reserve, Mesabi Iron Range, and the Forest Interpretive Center at Grand Rapids, will be available at the Local Information Section of the Joint Mathematics Meetings registration desk. Those passing through the Minneapolis-St. Paul area on the way to or from the meetings might wish to visit the Chanhassen Dinner Theatre, the Minnesota Zoological Gardens, the Guthrie Theatre, or the Minnesota State Fair (August 23 through September 2). Those who might wish to combine a vacation in Minnesota with their trip to the meetings may get further information from the Tourism Division, Minnesota Department of Economic Development, 480 Cedar Street, St. Paul, Minnesota 55101. Inquiries regarding Wisconsin should be directed to the Wisconsin Department of Business Development, Division of Tourism, P.O. Box 7606, Madison, Wisconsin 53707.

WEATHER

The weather in Duluth is notoriously unpredictable. Normal daytime highs in late August are 73°F and normal nighttime lows are 53°F, but wide variations from both figures are common. The maximum and minimum recorded temperatures for the dates of the meetings are 94°F and 39°F, respectively. Average precipitation for August is 3.79 inches, with between 20 percent and 30 percent chance of rain for a typical day. A raincoat or light jacket is practically a necessity, and it might even be prudent to keep an extra sweater handy, since the temperature can drop by as much as 40°F if cool breezes from Lake Superior suddenly replace warm westerly winds.

LOCAL ARRANGEMENTS COMMITTEE


Urbana, Illinois

Paul T. Bateman
Associate Secretary
The purpose of this summary is to provide assistance to registrants in the selection of arrival and departure dates. The program, as outlined below, is based on information available at press time.

### AMERICAN MATHEMATICAL SOCIETY SHORT COURSE SERIES

<table>
<thead>
<tr>
<th>SUNDAY, August 19</th>
<th>OPERATIONS RESEARCH: MATHEMATICS AND MODELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:00 a.m. - 3:30 p.m.</td>
<td>REGISTRATION (Short Course Only)</td>
</tr>
<tr>
<td>2:00 p.m. - 3:15 p.m.</td>
<td>Mathematical modelling of military conflict situations Seth Bonder</td>
</tr>
<tr>
<td>3:30 p.m. - 4:45 p.m.</td>
<td>Fire department deployment analysis Warren E. Walker</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MONDAY, August 20</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 a.m. - 2:00 p.m.</td>
<td>REGISTRATION (Short Course Only)</td>
</tr>
<tr>
<td>9:00 a.m. - 10:15 a.m.</td>
<td>Mathematical modelling of health care delivery systems William Pierskalla</td>
</tr>
<tr>
<td>10:30 a.m. - 11:45 a.m.</td>
<td>Practical aspects of fishery management modeling Frederick C. Johnson</td>
</tr>
<tr>
<td>1:30 p.m. - 2:45 p.m.</td>
<td>Queueing networks: An overview Ralph L. Disney</td>
</tr>
<tr>
<td>3:00 p.m. - 4:15 p.m.</td>
<td>Operations research: Applications in agriculture Robert B. Rovinsky</td>
</tr>
<tr>
<td>4:30 p.m. - 5:00 p.m.</td>
<td>General discussion</td>
</tr>
</tbody>
</table>

### JOINT MATHEMATICS MEETINGS

<table>
<thead>
<tr>
<th>MONDAY, August 20</th>
<th>American Mathematical Society</th>
<th>Mathematical Association of America</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 a.m. - 4:00 p.m.</td>
<td>Board of Governors Meeting</td>
<td></td>
</tr>
<tr>
<td>2:00 p.m. - 8:00 p.m.</td>
<td>REGISTRATION</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>TUESDAY, August 21</th>
<th>AMS</th>
<th>MAA</th>
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</thead>
<tbody>
<tr>
<td>8:00 a.m. - 4:30 p.m.</td>
<td>BOOK SALE</td>
<td></td>
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<tr>
<td>8:00 a.m. - 4:30 p.m.</td>
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<tr>
<td>9:00 a.m. - 9:10 a.m.</td>
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<tr>
<td>9:10 a.m. - 10:00 a.m.</td>
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<tr>
<td>10:10 a.m. - 11:00 a.m.</td>
<td>INVITED ADDRESS</td>
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<tr>
<td>11:10 a.m. - noon</td>
<td>INVITED ADDRESS</td>
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<tr>
<td>11:10 a.m. - noon</td>
<td>INVITED ADDRESS</td>
<td></td>
</tr>
<tr>
<td>1:00 p.m. - 5:00 p.m.</td>
<td>EXHIBITS</td>
<td></td>
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<tr>
<td>1:00 p.m. - 4:00 p.m.</td>
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<tr>
<td>1:30 p.m. - 2:20 p.m.</td>
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<tr>
<td>2:30 p.m. - 3:20 p.m.</td>
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<tr>
<td>3:30 p.m. - 4:20 p.m.</td>
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<tr>
<td>Time</td>
<td>American Mathematical Society</td>
<td>Other Organizations</td>
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</tr>
<tr>
<td><strong>TUESDAY, August 21</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:30 p.m. - 5:00 p.m.</td>
<td></td>
<td>MAA - PANEL DISCUSSION: Continuing education of two-year college mathematics teachers: What should the graduate schools be doing? Donald J. Albers John W. Jewett Robert McKelvey (moderator) James Wernitz, Jr.</td>
</tr>
<tr>
<td>6:00 p.m. - 7:30 p.m.</td>
<td></td>
<td>COOKOUT</td>
</tr>
<tr>
<td>7:00 p.m. - 9:00 p.m.</td>
<td></td>
<td>Pi Mu Epsilon - Reception</td>
</tr>
<tr>
<td>7:00 p.m. - 9:30 p.m.</td>
<td></td>
<td>MAA - FILM PROGRAM</td>
</tr>
<tr>
<td>7:30 p.m.</td>
<td></td>
<td>Caroms - a film of the College Geometry Project</td>
</tr>
<tr>
<td>7:14 p.m.</td>
<td></td>
<td>Probability</td>
</tr>
<tr>
<td>7:30 p.m.</td>
<td></td>
<td>Modelling pollution - a BBC broadcast on part of the Open University's Foundation Course in Mathematics</td>
</tr>
<tr>
<td>7:45 p.m.</td>
<td></td>
<td>I maximize - a film of the MAA Calculus Film Project</td>
</tr>
<tr>
<td>8:00 p.m.</td>
<td></td>
<td>Accidental nuclear war</td>
</tr>
<tr>
<td>8:12 p.m.</td>
<td></td>
<td>Professor George Pólya and students</td>
</tr>
<tr>
<td>8:23 p.m.</td>
<td></td>
<td>MAA - Section Officers Meeting</td>
</tr>
<tr>
<td>7:00 p.m. - 10:00 p.m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7:30 p.m. - 9:00 p.m.</td>
<td>Committee on Employment and Educational Policy - PANEL DISCUSSION: Trends in curriculum and employment in the mathematical sciences Lida K. Barrett Peter J. Hilton Thomas G. Proctor Alan C. Tucker (moderator)</td>
<td></td>
</tr>
<tr>
<td><strong>evening</strong></td>
<td></td>
<td>BEER PARTY</td>
</tr>
<tr>
<td><strong>WEDNESDAY, August 22</strong></td>
<td>AMS</td>
<td></td>
</tr>
<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>REGISTRATION</td>
<td></td>
</tr>
<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>EXHIBITS</td>
<td></td>
</tr>
<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>EMPLOYMENT REGISTER</td>
<td></td>
</tr>
<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>BOOK SALE</td>
<td></td>
</tr>
<tr>
<td>9:00 a.m. - 9:50 a.m.</td>
<td></td>
<td>MAA - THE EARLE RAYMOND HEDRICK LECTURES: The intersection of set theory and topology, Lecture III Mary Ellen Rudin</td>
</tr>
<tr>
<td>9:00 a.m. - noon</td>
<td></td>
<td>MAA - Minicourse on Mathematical Modeling</td>
</tr>
<tr>
<td>10:00 a.m. - 10:50 a.m.</td>
<td></td>
<td>MAA - Business Meeting Presentation of Carl B. Allendoerfer, Lester R. Ford, and George Pólya Awards</td>
</tr>
<tr>
<td>11:00 a.m. - 11:50 a.m.</td>
<td></td>
<td>MAA - INVITED ADDRESS The combinatorial way of thinking Jay R. Goldman</td>
</tr>
<tr>
<td>11:00 a.m. - 11:50 a.m.</td>
<td></td>
<td>MAA - INVITED ADDRESS Women and mathematics: Fact and fiction Edith Luchins</td>
</tr>
<tr>
<td>noon - 1:00 p.m.</td>
<td></td>
<td>IME - Council Luncheon</td>
</tr>
<tr>
<td>1:00 p.m. - 2:00 p.m.</td>
<td>COLLOQUIUM LECTURE I</td>
<td></td>
</tr>
<tr>
<td>2:30 p.m. - 3:30 p.m.</td>
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<tr>
<td>2:30 p.m. - 6:00 p.m.</td>
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</tbody>
</table>

**SESSIONS FOR CONTRIBUTED PAPERS**
## SUMMARY OF ACTIVITIES

**WEDNESDAY, August 22**

<table>
<thead>
<tr>
<th>Time</th>
<th>American Mathematical Society</th>
<th>Other Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:30 p.m. - 6:00 p.m.</td>
<td>SPECIAL SESSIONS</td>
<td></td>
</tr>
<tr>
<td>3:00 p.m. - 5:30 p.m.</td>
<td>DIFFERENTIAL OPERATORS AND DIFFUSION PROCESSES I</td>
<td></td>
</tr>
<tr>
<td>3:45 p.m. - 4:45 p.m.</td>
<td>INVITED ADDRESS</td>
<td>IMA - Contributed Paper Session</td>
</tr>
<tr>
<td>5:00 p.m. - 10:00 p.m.</td>
<td>COUNCIL MEETING</td>
<td></td>
</tr>
<tr>
<td>6:30 p.m. - 8:15 p.m.</td>
<td>IMA - BANQUET</td>
<td></td>
</tr>
<tr>
<td>6:30 p.m. - 10:00 p.m.</td>
<td>MAA - BANQUET FOR 25-YEAR MEMBERS</td>
<td></td>
</tr>
<tr>
<td>7:00 p.m.</td>
<td>TIME - J. SUTHERLAND FRAME LECTURE</td>
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</table>

**THURSDAY, August 23**

<table>
<thead>
<tr>
<th>Time</th>
<th>AMS</th>
<th>Other Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 a.m. - 9:00 a.m.</td>
<td>IMA - DUTCH TREAT BREAKFAST</td>
<td></td>
</tr>
<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>REGISTRATION</td>
<td></td>
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<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>EXHIBITS</td>
<td></td>
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<tr>
<td>8:30 a.m. - 4:30 p.m.</td>
<td>EMPLOYMENT REGISTER</td>
<td></td>
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<tr>
<td>8:45 a.m. - 9:45 a.m.</td>
<td>BOOK SALE</td>
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<tr>
<td>9:00 a.m. - 10:30 a.m.</td>
<td>INVITED ADDRESS</td>
<td></td>
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<tr>
<td>9:00 a.m. - 11:00 a.m.</td>
<td>DISCRETE SUBGROUPS OF LIE GROUPS</td>
<td></td>
</tr>
<tr>
<td>10:00 a.m. - 12:30 p.m.</td>
<td>SESSIONS FOR CONTRIBUTED PAPERS</td>
<td></td>
</tr>
<tr>
<td>10:00 a.m. - 12:30 p.m.</td>
<td>SPECIAL SESSIONS</td>
<td></td>
</tr>
<tr>
<td>10:00 a.m. - 12:30 p.m.</td>
<td>DIFFERENTIAL OPERATORS AND DIFFUSION PROCESSES II</td>
<td></td>
</tr>
<tr>
<td>10:00 a.m. - 12:30 p.m.</td>
<td>COMPUTATIONAL FLUID DYNAMICS II</td>
<td></td>
</tr>
<tr>
<td>10:00 a.m. - 12:30 p.m.</td>
<td>TOPOLOGICAL METHODS IN THE STUDY OF DYNAMICAL SYSTEMS II</td>
<td></td>
</tr>
<tr>
<td>10:00 a.m. - 12:30 p.m.</td>
<td>ANALYTIC NUMBER THEORY II</td>
<td></td>
</tr>
<tr>
<td>10:00 a.m. - 12:30 p.m.</td>
<td>APPLICATIONS OF SET THEORY TO TOPOLOGY II</td>
<td></td>
</tr>
<tr>
<td>11:15 a.m. - 12:15 p.m.</td>
<td>INVITED ADDRESS</td>
<td></td>
</tr>
<tr>
<td>1:00 p.m. - 4:00 p.m.</td>
<td>MAA - MINICOURSE ON PRECALCULUS AND CALCULUS WITH HAND-HELD CALCULATORS</td>
<td></td>
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</tbody>
</table>

*223*
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Other Organizations</th>
</tr>
</thead>
</table>
| 1:30 p.m. - 2:20 p.m. | MAA - INVITED ADDRESS  
Some mathematical challenges of Einstein's dynamic geometry  
John A. Wheeler |                                                      |
| 2:30 p.m. - 3:20 p.m. | MAA - INVITED ADDRESS  
The role of mathematical abstraction in the physical sciences  
S. M. Ulam |                                                      |
| 3:00 p.m. - 5:30 p.m. | IME - Contributed Paper Session |                                                      |
| 3:30 p.m. - 4:20 p.m. | MAA - INVITED ADDRESS  
Some recursive and nonrecursive algorithms and their applications to combinatorics  
D. H. Lehmer |                                                      |
| 4:00 p.m. - 5:00 p.m. | Association for Women in Mathematics  
PANEL DISCUSSION: Mathematics education: A feminist perspective  
Lenore Blum  
Diane Resek  
Judith Roitman (moderator) |                                                      |
| 5:00 p.m. - 6:00 p.m. | AWM - Open Council Meeting |                                                      |
| 6:00 p.m. - 10:00 p.m. | SPIRIT MOUNTAIN PICNIC |                                                      |
| 8:30 a.m. - 4:30 p.m. | REGISTRATION  
EMPLOYMENT REGISTER |                                                      |
| 8:30 a.m. - 4:30 p.m. | COLOQUIUM LECTURE III  
Discrete subgroups of Lie groups  
George D. Mostow |                                                      |
| 8:45 a.m. - 9:45 a.m. | SESSIONS FOR CONTRIBUTED PAPERS  
SPECIAL SESSIONS |                                                      |
| 10:00 a.m. - 11:00 a.m. | INVITED ADDRESS  
Lie algebras and the Rogers-Ramanujan identities  
James Lepowsky |                                                      |
| 10:30 a.m. - 12:30 p.m. | Percolation and interacting systems I |                                                      |
| 10:30 a.m. - 12:30 p.m. | Homological and combinatorial methods in group theory I |                                                      |
| 10:30 a.m. - 12:30 p.m. | Combinatorics and graph theory I |                                                      |
| 10:30 a.m. - 12:30 p.m. | Functional analysis in spaces of analytic functions I |                                                      |
| 10:30 a.m. - 12:30 p.m. | p-adic analysis in number theory and geometry I |                                                      |
| 11:15 a.m. - 1:15 p.m. | INVITED ADDRESS  
Spectrum- or monodromy-preserving deformations of linear differential equations  
Hermann Flaschka |                                                      |
| 1:15 p.m. - 2:15 p.m. | COLOQUIUM LECTURE IV  
Discrete subgroups of Lie groups  
George D. Mostow |                                                      |
| 2:30 p.m. - 4:00 p.m. | PRIZE SESSION |                                                      |
| 4:00 p.m. - 5:00 p.m. | BUSINESS MEETING |                                                      |
| 8:00 a.m. - 1:30 p.m. | REGISTRATION  
SESSIONS FOR CONTRIBUTED PAPERS  
SPECIAL SESSIONS |                                                      |
| 8:00 a.m. - noon | Percolation and interacting systems II |                                                      |
| 8:00 a.m. - noon | Homological and combinatorial methods in group theory II |                                                      |
| 8:00 a.m. - noon | Combinatorics and graph theory II |                                                      |
| 8:00 a.m. - noon | Functional analysis in spaces of analytic functions II |                                                      |
| 8:00 a.m. - noon | p-adic analysis in number theory and geometry II |                                                      |
| 9:45 a.m. - 10:45 a.m. | INVITED ADDRESS  
Production sets with individualities: a new approach to integer programming  
Herbert E. Scarf |                                                      |

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The page contains a summary of activities for the American Mathematical Society meeting on Saturday, August 25. It includes the schedule for invited addresses and sessions for contributed papers. The text also details the organizers and topics of special sessions for various meetings, along with their deadlines.

### Organizers and Topics of Special Sessions

Names of the organizers of special sessions to be held at meetings of the Society are listed below, along with the topic of the session. Papers will be considered for inclusion in special sessions, if their abstracts are submitted to the Providence office by the deadlines given below. These deadlines are three weeks earlier than those for abstracts for regular sessions of ten-minute contributed papers. The most recent abstract form has a space for indicating that the abstract is for a special session. If you do not have a copy of this form, be sure your abstract is clearly marked “For consideration for special session (title of special session).” Papers not selected for special sessions will automatically be considered for regular sessions unless the author gives specific instructions to the contrary.

**768th Meeting**
- Duluth, Minnesota, August 1979
  - Deadline: Expired
  - Differential operators and diffusion processes
  - Computational fluid dynamics
  - Percolation and interacting systems
  - Topological methods in the study of dynamical systems
  - Homological and combinatorial methods in group theory
  - Analytic number theory
  - Combinatorics and graph theory
  - Functional analysis in spaces of analytic functions
  - p-adic analysis in number theory and geometry
  - Applications of set theory to topology

**770th Meeting**
- Kent, Ohio, November 1979
  - Deadline: August 6
  - Graph theory
  - Spectral theory of Hilbert space
  - Algebraic and geometric topology
  - Ring theory
  - Nonlinear partial differential equations
  - Complex analysis
  - Approximation theory
  - Mathematical symbolic manipulations on the computer, and applications

**772nd Meeting**
- Riverside, California, November 1979
  - Deadline: September 3
  - Combinatorial theory

**773rd Meeting**
- San Antonio, Texas, January 1980
  - Deadline: October 1
  - Riesz spaces and positive operators
  - Orthogonal polynomials
  - Stochastic approximation
  - C*-algebras and operator theory
  - Singular integrals and harmonic analysis
  - Cohomology and representations of algebraic groups
  - Nonstandard analysis
  - Societal mathematics

**Boulder, Colorado, March 1980**
  - Deadline: To be announced
  - Nonabelian harmonic analysis
  - Lattice theory and general algebra
  - Topics in mathematical physics
First Announcement of the 769th Meeting

The seven hundred sixty-ninth meeting of the American Mathematical Society will be held on Saturday and Sunday, October 20–21, 1979, at Howard University, Washington, D.C.

The program will feature four invited speakers and eight to ten special sessions.

Anyone interested in organizing a special session should submit a proposal to the associate secretary. There will also be sessions for contributed papers. Abstracts should be sent to the office of the American Mathematical Society at P.O. Box 6248, Providence, Rhode Island, so as to arrive by the deadline of August 23.

Detailed information regarding the program will appear in the August and October issues of the Notices.

Raymond G. Ayoub
University Park, Pennsylvania
Associate Secretary

First Announcement of the 770th Meeting

The seven hundred seventieth meeting of the American Mathematical Society will be held at Kent State University, Kent, Ohio, on Friday and Saturday, November 2 and 3, 1979.

By invitation of the Committee to Select Hour Speakers for Western Sectional Meetings, there will be four invited one-hour addresses. The speakers will be KYUNG W. KWUN, Michigan State University, at 11:00 a.m. on Friday; DANIEL R. LEWIS, Ohio State University, 1:45 p.m. on Friday; ALBERT MARDEN, University of Minnesota, Minneapolis, at 11:00 a.m. on Saturday; PAUL H. RABINOWITZ, University of Wisconsin, Madison, at 1:45 p.m. on Saturday.

By invitation of the same committee, there will be eight special sessions of selected twenty-minute papers. The organizers and topics of these special sessions are: GARY CHARTRAND, Western Michigan University and FRANK HARARY, University of Michigan, Ann Arbor, Graph theory (all correspondence should be addressed to Professor Chartrand); CHANDLER DAVIS, University of Toronto, Spectral theory of Hilbert space; EDWARD Y. MILLER, Massachusetts Institute of Technology, Algebraic and geometric topology; FRANK SANDOMIERSKI, Kent State University, Ring theory; JOEL A. SMOLLER, University of Michigan, Ann Arbor, Nonlinear partial differential equations; LINDA R. SONS, Northern Illinois University, Complex analysis; RICHARD S. VARGA, Kent State University, Approximation theory; PAUL S. WANG, Kent State University, Mathematical symbolic manipulation on the computer, and applications. Most of the talks to be presented in these special sessions will be by invitation. However, anyone submitting an abstract for the meeting who feels that his or her abstract would be particularly suitable for one of these special sessions should indicate this clearly on the abstract, and mail it in time to reach the office of the American Mathematical Society in Providence by August 6, 1979, three weeks before the normal deadline for contributed papers.

Kent is about 35 miles southeast of Cleveland, Ohio, and about 100 miles northwest of Pittsburgh, Pennsylvania. Information about travel and accommodations will appear in the August and October issues of the Notices.

Urbana, Illinois

Paul T. Bateman
Associate Secretary

Invited Speakers at AMS Meetings

The individuals listed below have accepted invitations to address the Society at the times and places listed. For some meetings, the lists of speakers are incomplete.

Duluth, Minnesota, August 1979
Hermann Flashka
Allen E. Hatcher
James I. Lepowsky
George D. Mostow
(Colloquium Lecturer)

San Antonio, Texas, January 1980
Enrico Bombieri
Kenneth R. Goodearl
J. William Helton

Boulder, Colorado, March 1980
Douglas A. Lind

Kent, Ohio, November 1979
Kyung W. Kwun
Daniel R. Lewis

Kent, Ohio, November 1979
Albert Marden
Paul H. Rabinowitz

Urbana, Illinois

Paul T. Bateman
Associate Secretary
1979 AMS ELECTIONS

COUNCIL NOMINATIONS FOR VICE-PRESIDENT AND MEMBER-AT-LARGE

Two vice-presidents and five members-at-large will be elected by the Society in the fall of 1979. The two vice-presidents will serve for a term of two years, effective January 1, 1980. The Council has nominated four candidates for this position. They are:

- Hyman Bass
- David Gale
- Mary E. Rudin
- James B. Serrin

Nominations by petition are acceptable. See the reference above. If the total number of nominees is less than ten, it will be brought up to ten by the Council before the ballot is circulated.

PRESIDENT'S CANDIDATES FOR THE NOMINATING COMMITTEE, 1980-1981

There are four members of the Nominating Committee to be elected in the fall of 1979. President Peter D. Lax has named the following five candidates:

- Martin D. Davis
- Jane Cronin Scanlon
- Stephen J. McAdam
- Karen Uhlenbeck
- Hugh L. Montgomery

President Lax will name at least one more candidate. Nominations by petition are acceptable. Refer to the April 1979 Notices, pp. 180-181, for the rules and form of the petition. If the total number of candidates is less than eight, the number will be brought up to eight by the president.

TWENTY-THIRD ANNUAL AMS SURVEY

The first round of questionnaires for the Annual AMS Survey was distributed within the past few weeks to departments in the mathematical sciences in the U.S. and Canada. The questionnaires which have been sent include:

- The Faculty Status questionnaire (concerned with faculty salaries, the number of faculty members in each rank, the number in each rank with tenure, and the number who are women),
- The Doctorates Granted questionnaires used to compile the list of doctoral theses and the employment statistics on recipients of doctoral degrees within the past year,
- The questionnaire used for the analysis of new doctorates according to sex, citizenship, and minority group.

The information obtained from these questionnaires is reported to the membership in the October issue of the Notices each year.

The Survey is conducted on behalf of the Society's Committee on Employment and Educational Policy (CEEP) by the CEEP Data Subcommittee. The information obtained each year has made it possible to monitor the job market in mathematics quite closely, and has served as the basis for a series of articles which have appeared in the Notices on a regular basis for several years.

This year there is added interest in the data on the hiring of new doctorates, and in the data on the number of faculty members in each academic rank, because these figures are being studied closely by groups concerned with federal support of research in the mathematical sciences. The Society's Committee on Modes of Support of Research has recently been devoting serious attention to the demographics of university faculties. Both this Committee and CEEP urge all departments to complete the questionnaires they have received and to return them to the Providence office of the Society as soon as possible. It has been reported that AMS data on the distribution of faculty members among the various ranks, and in the several classes of departments, have been studied by the NSF in determining the size of the Foundation's Postdoctoral Fellowship Program and of other programs under consideration. In particular, demographic shifts in faculty slots have recently been identified as a relevant factor in determining the size of new programs for support of the mathematical sciences.

For all of these reasons, department heads are especially urged to cooperate as much as possible by completing and returning the questionnaires promptly.

LKD

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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

181. V. Ja. Kreinovič (Pulkovo Special Astrophysical Observatory, 196140 Leningrad 140, U.S.S.R.). In case \( l_1, l_2: R^2 \rightarrow R^+_0 \) are finitary (= supp \( l_i \) is compact) and \( |f^*_1| = |f^*_2| \) (\( f \) means Fourier transform), does it follow that \( l_1 = l_2 \) or \( l_1(\bar{x}) = l_2(\bar{x}) \)?

This conjecture is very important for radio-astronomy; numerical experiments seem to justify it (see Astrophys. J. 223 (1978), 25–36). In case examples for \( l_2 \neq l_1 \) are found, is it a general situation or for "almost all" \( l_1 \) no such \( l_2 \) is possible?


183. David S. Lawrence (135 Ashland Place, Apt. 5D, Brooklyn, New York 11201). Can anyone fully describe an efficient means of solving nonlinear partial differential equations, such as

\[
(f_x)^2 (f_y f_{x y} - f_{x y} f_{y}) + (f_y)^2 (f_x f_{x y} - f_{x y} f_{x}) = u
\]

either by numerical approximation (using the Laplace transform to a convolution integral equation if desired) or by inversion in the class of pseudodifferential or Fourier integral operators or otherwise?

184. Albert A. Mullin (475-B Cooke Drive, Redstone Arsenal, AL 35808). To determine an optimal solution to a linear programming problem (LPP), it is well known that we need only search the extreme points of the convex set generated by the constraints of the LPP. More specifically, a feasible solution of a LPP corresponds to an extreme point iff it is basic. I would appreciate information which clarifies or settles the following three problems: (1) characterize those mathematical programming problems (MPP's) whose optimal solutions are found by searching only the exposed points of the convex sets generated by the constraints of the MPP's. Recall that \( x \in C \) is an exposed point of a convex set \( C \) in a locally convex topological vector space \( V \) over the real field provided there exists a functional \( f \in V^* \) which is greater at \( x \) than at any other point \( y \in C \). Thus, in general, \( x \) depends on both the linear structure of \( V \) and the topology in \( V \). On the other hand, the extreme points of \( C \) do not seem to depend on the topology in \( V \). (2) How (if at all) is optimality of a solution of a general MPP (e.g., nonlinear programming in Banach spaces or nonlinear control theory in locally convex spaces) influenced by the topology in the underlying linear space? (3) Is there a useful role for exposed points in general MPP's?

185. Geoffrey C. Berresford (Department of Mathematics, Long Island University, Greenvale, New York 11548). I would be interested in finding the mathematical origin and significance of the following question, which has been encountered at several times in this country and Great Britain.

Why is a mouse when it spins?

We suspect that it pertains either to an algebraic transformation or to mathematical linguistics.

RESPONSES

The replies below have been received to queries published in recent issues of the Notices. The editor would like to thank all who reply.

152. (vol. 25, p. 252, June 1978, Vayo). The two theorems, Bohi-Bohr and Bohr-Neugebauer, are given as Theorems 5.2 (p. 79) and 5.8 (p. 86) respectively in A. M. Fink's *Almost periodic differential equations*, Lecture Notes in Math., vol. 377, Springer-Verlag, Berlin and New York, 1974. Therein lie the original citations for both theorems as well as some interesting historical notes on them. Bohl-Bohr is found as reference #90 and Bohr-Neugebauer as #96. (Contributed by H. Westcott Vayo)


171. (vol. 26, p. 102, February 1979, Horowitz). To describe the probability that \( ax^2 + bx + c = 0 \) has real roots, one must assume something about the distribution of \( a, b, c \ ); one is then led to the evaluation of integrals related to the set \( b^2 \geq 4ac \). The problem appears in Gnedenko's *The theory of probability*,

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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 the publication of the earliest issue of the Notices in which it could appear. The committee adopted a policy that the Notices does not ordinarily publish complaints about reviews of books or articles, although, following an instruction from the Council, rebuttals and correspondence concerning reviews in the Bulletin will be considered for publication. Letters submitted for consideration by the editorial committee should be mailed to the Editor of the Notices, American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02940.

LETTERS TO THE EDITOR

Blind Refereeing

Since its adoption in January 1975 as an editorial policy of the Proceedings of the AMS, blind refereeing has been the subject of much debate in which I have been a frequent participant. Blacks, women, and other minority members of the AMS, as well as those who are not affiliated with prestigious mathematics departments, have told me consistently that they feel that blind refereeing is one way to insure more equitable treatment professionally.

I have heard two principal arguments against blind refereeing with roughly equal frequency. The first is that the author’s name shouldn’t and doesn’t make any difference and that the policy of suppressing it impugns the integrity of the referee. The second is that the referee is substantially inconvenienced by the suppression of a significant piece of information. While I do not claim to have heard any one person advance both of these arguments, I have not observed any interest on the part of their proponents in exploring the evident contradiction between them.

Ironically, it was at the Council meeting in Biloxi, Mississippi, that most of the white males present voted against the only Black, the only Chicano, and almost all the women, to eliminate blind refereeing for the Proceedings. It is true that a subsequent vote reinstituted blind refereeing as an option for the author. However, inasmuch as an author who wishes to withhold his or her name has to confront the expressed hostility of many editors and referees to the idea of blind refereeing, I suggest urgently to the Council and the membership of the AMS that the matter has not been satisfactorily resolved.

Judy Green
Rutgers University,
Camden

Applied Mathematics

I note with interest the news, reported by Wendell Fleming in his authoritative article on employment in the February 1979 Notices, that “a great deal of the recent growth in the applied mathematical sciences is, in one way or another, related to the revolution in computer technology. The growth has occurred not only in computer science itself, but also in such areas as the coding and statistical analysis of large sets of data, modelling of complicated physical phenomena, and the study of large scale systems in engineering or management science. Present indications are that it is in such directions that growth in mathematics-related employment opportunities is to be expected during the years immediately ahead.”

I believe that our pedagogical and scholarly activities are woefully deficient in preparation for the opportunities noted by Professor Fleming. I have presented my general views in an article on page 145, Volume 1, of the Mathematical Intelligencer, and will not repeat them here. In January 1977 I (along with several colleagues) presented to the Council some suggestions for activities which would correct these deficiencies. These proposals were attacked and defeated by representatives of the groups within the profession who have, for many years, belittled the need for new concepts of “applied mathematics.” The results are documented in the Report on Engineering and Scientific Mathematics, in the October 1978 issue of the Notices.

The Association for Physical and Systems Mathematics has been organized (as a nonprofit corporation) to pursue the tasks of bringing modern mathematics and the “new” applications together. We are now planning some activities for the Summer of 1980, and welcome suggestions and participation from the mathematical community currently at large.

Robert Hermann
Brookline, Mass.
Soviet Mathematics

I recently participated, together with Dr. Jim Langer from Carnegie-Mellon University, Dr. Bill Glaberson from Rutgers University, seven French, one British and about thirty Russian scientists in a most unusual conference in Moscow. Five other American scientists who wished to participate had their visas to Russia revoked ten days before the opening of the meeting. Some Soviet scientists living outside Moscow were similarly prevented from attending and some of the Russian participants did so despite warnings and threats by the Soviet authorities.

Despite this and other serious harassments of Soviet participants, the meeting itself was not disrupted and took place in a very warm atmosphere. The scientific level of the meeting was also remarkable and its proceedings will be published by the New York Academy of Sciences which officially sponsored the meeting. (It was also endorsed by the American Physical Society.) All in all it was probably the most interesting meeting I ever attended. In what follows I wish to relay an important message to Western scientists which I brought back from this meeting. I very much hope that you will find it relevant.

The Third International Conference on Collective Phenomena which took place between December 27 and 29, 1978, in an ordinary apartment building on Vernadskova Prospect, Moscow, U.S.S.R. was no ordinary conference. It was an extension of the Moscow Sunday Seminar which also is no ordinary seminar. Indeed, the latter is commonly referred to by the Soviet authorities as the Nonexistent Conference. The most extraordinary thing about the conference, therefore, was that it did exist, as I can personally testify having both given a lecture myself and listened to over thirty other lectures, while squeezed, along with thirty forty other scientists into the rather small living room of the Moscow apartment of Victor and Irina Brailovsky, “refuseniks” of seven years’ standing.

Since the word refusenik has not yet found its way into the dictionary, a definition may be in order: refusenik, one who has been officially refused an exit permit from Russia for Israel. It is not to be confused with one whose application for an exit permit has not been answered.

Refuseniks are also to be distinguished from “dissidents”—people who do not wish to leave the Soviet Union, but want their country to adopt (or, more precisely, to carry out) a more liberal human rights policy, in particular to permit freedom of expression, freedom of choice of living inside the U.S.S.R. and freedom of travel, and generally to relax the controls it now employs to keep the population in check. (There are reputed to be 50,000 secret police, K.G.B., agents in Moscow alone).

All the three groups mentioned above are obviously considered persona non grata by the Soviet government. One important distinction, however, is that while the first two groups are exclusively Jewish, the third group is mixed including, for example, Shcharansky who is Jewish, and Orlov and Sakharov, who are not.

The Moscow Sunday Seminar was organized about seven years ago by refusenik scientists who, as is standard in the U.S.S.R., lost their scientific positions as soon as they applied to emigrate. Some of them were demoted to minor nonresearch positions while others lost their jobs entirely (and thus have become liable to legal prosecution for “parasitism”). This has meant that any continuation of their scientific work has had to be done in isolation at home. Science, however, requires, as we all know, communication and it was to fulfill this need that the weekly seminar was established. The Sunday Seminar met first in the house of Voronel, then when Voronel was given permission to emigrate) in the house of Azbel, and is now (since Azbel’s departure) held in the home of the Brailovskys. The seminar in Moscow meets every Sunday at noon. The total membership is about 70, of which about 20 to 30 show up each week to hear a presentation by a member or by a Western scientist visiting Moscow on some official or private business who takes the time to visit the seminar. (There is a similar seminar in Leningrad, as well as additional specialized seminars in Moscow.)

There are many reasons why a visit to the seminar from a Western scientist is important to its regular participants. First is their concern with pure science—they need contacts to keep alive as scientists. Then, too, they need to feel in human touch with scientific colleagues in order not to fall into despair because of their bleak situation. And, very urgently, they want the Soviet authorities to know that they are not abandoned by scientists in the West. This, they feel, is their primary, perhaps only, protection against disruption of the Seminar by the authorities despite its legality. They also fear, not without grounds, that even worse things, e.g. labor camps, may lie in store for them if the authorities feel that they can act without evoking a strong response in the West.

It cannot be emphasized enough how much the members of the Seminar value such visits. Since the fields in which the members formerly worked cover practically all of science, any topic on which a visiting scientist wishes to talk will attract an appreciative audience. Necessity has made the Sunday Seminar one of the few (perhaps the only) generalist scientific meeting places. If you are going to the U.S.S.R., I urge you not to pass up the opportunity to attend one of these sessions; you will be doing an extremely important good deed, and you will find it rewarding to you both personally and scientifically. The audience is eager and the discussions are most stimulating. (Nobelists A. Penzias says it was his best audience). If you do not wish to give a talk, a visit to listen and discuss is equally appreciated. No ad-
vance announcement is necessary and there is apparently no danger to you. Even though the Soviet government frowns on this and sometimes tries hard to persuade visiting Western scientists not to mix with these refuseniks, it is not against Soviet law to meet in a private house for lectures and discussion. Some visiting scientists have even used official Soviet government (academy) cars to go to the "nonexistent seminar." No one, as far as we know, has ever suffered any ill consequences from such a visit. And the benefits, both scientific and psychological, to our beleaguered fellow-scientists are many.

If you wish more information on participating in a meeting of the Seminar or how you might help in other ways, e.g. sending preprints to and/or corresponding with members of the Seminar, please contact me or Mr. Mark Mellman, Committee of Concerned Scientists, 9 East 40th Street, New York, New York 10016; (Telephone 212-686-8862). Many scientists have visited the Seminar on more than one occasion—so participation does not seem to interfere with later travel to Russia.

Joel L. Lebowitz  
Rutgers University  
New Brunswick

Mr. M. Yachter states in the letter published in the Notices of February 1979 that "Jewish students are welcome for instance at the University of Novosibirsk." That statement of his is wrong. Its falsity isn't a corollary of another theory explaining everything. It is factually wrong.

Yuri Gurevich  
Beer-Sheva, Israel  
(Former Soviet mathematician)

Catastrophe Theory

I was surprised to see a didactic model from an introductory paper of which I was co-author receive an extensive analysis in a Bulletin review (S. Smale, November 1978 issue, review of Zeeman's Catastrophe theory: Selected papers, 1972-1977). Some clarification is called for, since the purpose of the model went unmentioned in the review, and furthermore it contained misquotations of consequence. The paper in question was presented at the seminar "Use of Models in the Social Sciences," held at the Faculty of Social Sciences of the University of Edinburgh in 1972. We wrote in its first paragraph (p. 303): "The authors of the present article hope that their modest examples may suggest to specialists in the social sciences the possibility of applying catastrophe theory to... phenomena in their fields." I think this stated clearly the expository purpose of the models and the position of the specialists in more systematic work. In page 302, preceding the article, Zeeman wrote that this was an introductory paper describing how catastrophe theory could be used for modelling in the social sciences, and said that to illustrate the method a model would be developed taking as an example the particular war situation referred to by Smale. Though I am not an expert in catastrophe theory, I am certain the area contains material more appropriate for a Bulletin review than models developed for expository ends.

After writing "Let us look at some of the hypotheses that Z and I in fact do make" the reviewer presented two graphs from the paper that, in fact, were not the hypotheses. Our hypotheses were actually what we called Hypothesis 1, ..., Hypothesis 5 in pages 315 and 316. They dealt with a function \( P \) that measured public support for different alternatives of action. Hypothesis 3 said, for instance, that if the cost of the war were high but the threat moderate, then opinion would be split (meaning that \( P \) had two relative maxima). Hypotheses 4 and 5 said that if the cost were high but the threat very great, resp. very small, then opinion would be unified in favor of strong military action, resp. of withdrawal (meaning that \( P \) had one single maximum at a high, resp. low value of \( x \)). I do not think appeal to research in military history is necessary when presenting hypotheses such as these in expository examples.

After the reviewer described the canonical cusp model, with its equation \( x^3 = a + bx \), he said that in the model under discussion \( a, b \) and \( x \) were numerical representations of threat, cost and military action, and that thus we had given a model of a nation deciding upon its level of military action in a war. I should clarify to the uninformed that the letters \( a, b \) and \( x \) represent different things in the two models, related by diffeomorphism, so any impression that for us \( x^3 = a + bx \) was the equation describing the threat-cost-action relation was incorrect.

Finally, it is worth noting that in page 329 we emphasized that our hypotheses were only premises for argument, and that we had not analysed them through numerical data. This, we said there, was work for a social scientist. In fact, I think any importance that catastrophe theory may have to the social sciences is dependent upon the development of specific techniques for working with data, and it is up to those sciences to decide if this is feasible.

Carlos Isnard  
Inst. Matematica Pura e Aplicada  
Rio de Janeiro

Carlos Isnard  
Inst. Matematica Pura e Aplicada  
Rio de Janeiro

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1979–1980 AMS-MAA-SIAM CONGRESSIONAL FELLOW APPOINTED

Robert T. Smythe, associate professor of mathematics, University of Oregon, has been selected as the second recipient of an AMS-MAA-SIAM Congressional Fellowship. (Information on this program will be found in the November 1978 Notices, page 501.) Professor Smythe, a specialist in probability and mathematical statistics, is a graduate of Oberlin College and Oxford University (where he was a Rhodes Scholar), and received a Ph.D. from Stanford. He is a member of Phi Beta Kappa, Sigma Xi, the AMS, and the Institute for Mathematical Statistics.

AMS RESEARCH FELLOWSHIPS AWARDED

Recipients of the AMS Postdoctoral Research Fellowships for 1979–1980 have been announced by the AMS Committee on Postdoctoral Fellowships. The six winners of the fellowship awards are Scott W. Brown, University of California, Santa Barbara; Jeffrey E. Hoffstein, Institute for Advanced Study, Princeton; Jeffry N. Kahn, Ohio State University; James E. McClure, Purdue University; Rick L. Smith, Pennsylvania State University; and Mark Steinberger, Massachusetts Institute of Technology.

The following candidates received honorable mention in the competition: Thomas Patrick Branson, Massachusetts Institute of Technology; Daniel Saul Chess, Princeton University; William J. Floyd, University of California, Los Angeles; Carolyn Colburn Narasimhan, Northwestern University; and Roy Campbell Smith, University of Georgia.

The AMS Research Fellowship Fund was established in 1973 in response to the need for funds for postdoctoral research. The fellowships are awarded to recent Ph.D.'s of any age who are citizens or permanent residents of a country in North America, and are awarded on the basis of mathematical merit. The awards are intended to support research fellows for a period of one year, and at present carry a stipend of $11,000 each with an expense allowance of $500. The competition was under the supervision of the Society's Committee on Postdoctoral Fellowships consisting of Leonard Gillman, Robert C. Hartshorne, Bernard Maskit, Myles Tierney (chairman), William P. Thurston, and Karen Uhlenbeck. The applications in this instance were judged by a panel consisting of Leonard Gillman, James G. Glimm, Irving Kaplansky, Bernard Maskit, Henry P. McKean, Jr., Hugh L. Montgomery, and John W. Morgan.

There were many strong candidates among the forty-four applicants, including some who declined the offer of a fellowship. The number of fellowships awarded is the maximum allowed by the generous contributions of supporters of mathematical research together with Society funds appropriated according to a matching formula. The continuation of the AMS Research Fellowship Program depends on the contributions the Society receives. It is hoped that every member of the Society will contribute to the Fund. Contributions are, of course, 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.

NSF FELLOWSHIP WINNERS

The National Science Foundation has announced the selection of nineteen successful candidates for the first awards in the NSF's new Mathematical Sciences Postdoctoral Research Fellowship program. These fellowships provide talented mathematicians who are U.S. citizens or nationals with the opportunity to select research environments that will enable the recipients to accelerate their scientific development. The Postdoctoral Fellowships provide a stipend of $15,000 per year, for full-time research, for a maximum of two years.

Selections were made on the basis of merit from among 89 applicants. A panel, chosen by the American Mathematical Society, the Institute for Mathematical Statistics, and the Society for Industrial and Applied Mathematics, reviewed and evaluated applications; final selections were made by NSF.

Names of the successful candidates are listed below with their current affiliation, followed in parentheses by the name of the fellowship affiliation: K. R. Bailey, University of Chicago (Stanford University); Scott W. Brown, University of California, Santa Barbara (State University of New York-Stony Brook); Robert L. Bryant, University of North Carolina, Chapel Hill (Institute for Advanced Study); R. Caflisch, Courant Institute of Mathematical Sciences, New York University (Stanford University); Ruth M. Charney, University of California, Berkeley (Institute for Advanced Study); Robert F. Coleman, Princeton University (Institute for Advanced Study); Joseph G. Deken, Princeton University (Stanford University); Paul B. Garrett, Yale University (Yale University); Marlies Gerber, University of California, Berkeley (University of Maryland, College Park); Patrick S. Hagan, California Institute of Technology (Stanford University); Leon Karp, Princeton University (Institute for Advanced Study); Robert V. Kohn, Princeton University (New York University); William E. Lang, Institute for Advanced Study (University of California, Berkeley); Robert H. Latter, University of Chicago (Princeton University); Geoffrey McFadden, Courant Institute of Mathematical Sciences, New York University (Courant Institute of Mathematical Sciences, New York University); Carl E. Mueller, University of California, Berkeley (University of Illinois); Philip E. Protter, Purdue Univer-
The National Science Foundation has announced the award of 144 NSF National Needs Postdoctoral Fellowships and 53 North Atlantic Treaty Organization (NATO) Postdoctoral Fellowships in Science. Eight of the 197 grants went to mathematicians, four under National Needs, and four as NATO awards.

The awards are made to individuals who have recently received their doctorate degree and who are U.S. citizens or nationals. Applications are reviewed by panels of scientists and awards are made on the basis of merit with final selection being made by the NSF.

The National Needs Postdoctoral Fellowship awards are aimed at meeting the national need for talented young scientists to apply their knowledge of science and technology to help solve societal problems. The 144 awardees were selected from 752 applicants. These fellowships provide a stipend of $1,000 a month for up to one year of full-time study or research. An institutional allowance of up to $1,200 is also provided for education and research for those attending U.S. institutions of higher education.

Each applicant presented a plan of study or research designed to gather additional information on some problem of national need. All four mathematicians who received National Needs Fellowships are members of the Society. They are listed below with their present affiliation, followed in parentheses by the name of the Fellowship institution: Robert A. Fefferman, University of Chicago (Princeton University); Robert V. Kohn, Princeton University (Massachusetts Institute of Technology); Mitchell B. Luskin, University of Michigan, Ann Arbor (University of Michigan); and Rick L. Smith, Pennsylvania State University (Cornell University).

NATO Postdoctoral Fellowships go to young scientists for full-time postgraduate study at institutions and laboratories in NATO countries or in countries that cooperate with NATO.

This fellowship program was initiated by NATO in 1959 to advance science and technology and to promote closer collaboration among members and associated countries. Each NATO country administers the program for its own nationals. At the request of the Department of State, NSF administers this NATO-funded program for U.S. citizens and nationals.

A stipend of $920 a month is provided to NATO Fellows for up to one year. In addition, dependency allowances and limited allowance for roundtrip travel will be provided.

The four mathematicians who received NATO Fellowships are listed below with their present affiliation, followed in parentheses by the name of the Fellowship institution: Alan H. Borsing, Stanford University (University of Edinburgh, Scotland); Stanley J. Krollkoski, University of Illinois, Urbana-Champaign (University of Amsterdam, The Netherlands); James F. Reynolds, North Carolina State University (Glasshouse Crops Research Institute, West Sussex, England); and Peter F. Stiller, Texas A & M University (Institut des Hautes Études Scientifiques, France). Professor Stiller is a member of the Society.

GUGGENHEIM FELLOWSHIPS

Sixteen John Simon Guggenheim Fellowships have been awarded in mathematics and related areas for 1979. Nine of those receiving awards are members of the Society. The award winners are: Jean-Loup Baer, University of Washington; Burchet Curtis Eaves, Stanford University; P.D.T.A. Elliott, University of Colorado, Boulder; Ulf Grenander, Brown University; Jack K. Hale, Brown University; Jaakko Hintikka, Florida State University; Herbert B. Keller, California Institute of Technology; Steven L. Kleiman, Massachusetts Institute of Technology; William H. Kruskal, University of Chicago; Erlich L. Lehmann, University of California, Berkeley; Simon A. Levin, Cornell University; Willem V.R. Malkus, Massachusetts Institute of Technology; Robert T. Powers, University of Pennsylvania; Jack Roth, Ramapo College of New Jersey; Joel A. Smoller, University of Michigan, Ann Arbor; and Victor Twersky, University of Illinois at Chicago Circle.

NSF AWARDS

450 GRADUATE FELLOWSHIPS

The award of 450 fellowships for graduate study to students of outstanding ability in the sciences, mathematics, and engineering has been announced by the National Science Foundation. Of these awards, fifty were made to students in the mathematical sciences.

More than 3,750 students competed for these NSF Graduate Fellowships, which were awarded on the basis of merit. Panels of scientists, selected by the National Research Council of the National Academy of Sciences, reviewed and evaluated applications; final selections were made by the Foundation. Of the 450 awards, 112 were made to women and seven to members of ethnic minority groups under-represented in science.

These fellowships provide a stipend of $3,900 per year for full-time study. An annual cost-of-education allowance of $3,400 is provided by NSF, in place of tuition and fees, to the institution of higher education selected by the Fellow. NSF Graduate Fellows may attend any appropriate nonprofit U.S. or foreign institution of higher education.

In addition to these new NSF Graduate Fellowships, 1,064 individuals who received fellowship
awards in previous years may continue their study during the 1979-1980 academic year.

The number of new appointments this year is a substantial drop from the number projected for 1979 by the NSF in January 1978 (January 1978 Notices, p. 68).

Scientific Editors to Hold Second International Conference

The Second International Conference of Scientific Editors is planned for October 13-17, 1980, in Amsterdam, The Netherlands. It is being organized under the auspices of the Elsevier Publishing Company in collaboration with the International Federation of Scientific Editors' Associations. The conference will further the discussions begun at the first meeting on the growth of scientific publications, their social and intellectual functions and diverse techniques.

The theme of this second conference is “Scientific Information Transfer: People, Methods, and Means.” There will be four days of meetings, with lectures, discussion-groups, and poster sessions, as well as exhibits in the fields of publications, standardization, printing, reprography and information retrieval. Offers for lectures and poster contributions are invited, and interested persons or organizations are encouraged to submit questions, problems and topics for discussion.

Contributions may be sent to, and further information obtained from, the conference secretary: Helena Tombre, Elsevier Scientific Publishing Company, P. O. Box 330, 1000 AH Amsterdam, The Netherlands.

Illinois Academy of Science

The Illinois State Academy of Science has announced the formation of a Section on Applied Mathematics and Mechanics. Members of the Society interested in participating in this Section may write to Herbert H. Snyder, Department of Mathematics, Southern Illinois University, Carbondale, Illinois 62901.

National Academy of Engineering Elects New Members

The National Academy of Engineering recently announced the election of 99 engineers to membership in the Academy and of 18 to foreign associate-ship. Three members of the Society were among those who received this highest professional distinction which can be conferred on an engineer. They are Irving S. Reed and Lloyd R. Welch of the University of Southern California, Los Angeles, who became members, and Paul M. Germain of the École Polytechnique, Paris, who was elected to foreign associate-ship.

Seymour Sherman Fund

The Indiana University Mathematics Department has organized a lectureship fund in memory of Seymour Sherman. Contributions should be sent to: Indiana University Foundation, c/o Sherman Memorial Lectureship Fund, P. O. Box 500, Bloomington, Indiana 47401.

Undergraduate Mathematics Applications Project

The Modules and Monographs in Undergraduate Mathematics and Its Applications Project (UMAP) has been operating under a grant from the National Science Foundation to Education Development Center, Inc., of Newton, Massachusetts, since 1976.

One goal of UMAP is to develop, through a community of users and developers, 300 instructional modules and 40 monographs for use in mathematics classes and classes where mathematics is applied. To date the Project has some 95 modules in print and another 120 manuscripts in various stages of development. These modules are written for undergraduate students and enable them to learn professional applications of mathematics in such fields as biomedical sciences, economics, American politics, harvesting, international relations, numerical methods, computer science, earth science, and navigation. All modules are peer and student reviewed, field-tested and revised before being made generally available.

Another goal of UMAP is to organize a consortium of users and developers within the mathematics community to carry on the work of the Project after the funding period. Toward this goal the Project has already enlisted the active participation of more than 750 authors, peer-reviewers, student review advisors, field-testers and module users throughout the country.

The UMAP Catalog and further information about the Project may be obtained by writing to EDC/UMAP, 55 Chapel Street, Newton, Massachusetts 02160.

NSF Report Available on Women in Scientific Research

The National Science Foundation (NSF) has announced the availability of a summary report highlighting data and observations on the participation of women in scientific research with particular attention to male/female differences.

The report, entitled Increasing the Participation of Women in Scientific Research, is based on the findings of a research study project involving 60 women and 60 men who had received science degrees since 1971, and on the results of a conference—The Participation of Women in Scientific Research—held October 17-20, 1977, in Washington, D.C. Both efforts were supported by the NSF and were conducted by the Office of Opportunities in Science, American Association for the Advancement of Science.

The report features a summary of the research project information about NSF programs for women
in science; significant data, charts, and tables prepared by Betty M. Vetter, Scientific Manpower Commission; excerpts from the presentation of major speakers at the conference, including the late Margaret Mead; Philip Handler, National Academy of Sciences; Estelle Ramey, Georgetown University Medical Center; and Eloise Clark, NSF; abstracts of background research papers; a synopsis of policy recommendations to NSF; and an update on S.2550, the proposed Women in Science and Technology Equal Opportunity Act.

Additional copies of the summary report are available from the Planning Policy Analysis Office (OPRM), National Science Foundation, Washington, D.C. 20550. A limited number of copies of the 500-page final technical report in the research study project Participation of Women in Scientific Research is available from the same source.

NSF Release

NEW PUBLICATION:
ACADEMIA IN TRANSITION

A new book, Academia in Transition: Mid-Career Change or Early Retirement, by Carl V. Patton is now available. The report is based on a survey of institutional practices and an assessment of possible options relating to voluntary mid- and late-career changes and early retirement for university and college faculty. The material is based on a study supported by the Office of Planning and Policy Analysis of the NSF. The book is available for $19.50 from Abt Books, 55 Wheeler Street, Cambridge, Massachusetts 02138. (A $1.50 shipping charge will be added to orders which are not prepaid.)

NSF Bulletin

NOTE: See also the June 1978 Notices, p. 257.

RESEARCH INITIATION
IN MINORITY INSTITUTIONS

The National Science Foundation’s Research Initiation in Minority Institutions (RIMI) program supports research by faculty members of those institutions of higher education whose enrollments are predominantly composed of Black, Native-American, Spanish-speaking or other ethnic minorities. Eligible institutions may submit proposals at any time, prepared in accordance with guidelines set forth in the Grants for Scientific Research (NSF 78-41). They will be reviewed by programs in normal fashion. Special features are (1) the principal investigator should be a faculty member at an eligible institution who has not received Federal research support at that institution and (2) grants are nonrenewable.

For further information, request the RIMI announcement 78-71 from the NSF, Washington, D.C. 20550, or contact the NSF program responsible for supporting research in the applicant’s field of interest (see Appendix VII, Grants for Scientific Research).

NSF Bulletin

NSF’S COOPERATIVE PROGRAMS
WITH U.S./BULGARIAN SCIENTISTS

NSF’s International Programs Division is encouraging U.S. scientists in contact with Bulgarian colleagues to make short term visits to that country in order to develop research projects. The first agreement on scientific and technological cooperation between the U.S. and the People’s Republic of Bulgaria, signed February 9, 1978, provides opportunities for the exchange of scientific information, ideas, skills, and techniques. For further information, contact the East European Cooperative Science Program, National Science Foundation, 1800 G. Street, N.W., Washington, D.C. 20550 (202-632-5756).

NSF Bulletin

RUSSIAN TRANSLATORS SOUGHT

The AMS Translations Department is seeking mathematicians and statisticians with a reading knowledge of Russian and good command of English to prepare typewritten English translations on a piecework basis. Interested persons are asked to provide a specific description of their area of mathematical competence (such designations as “algebra” or “analysis” are too general). Those with suitable backgrounds will be assigned a brief sample translation, satisfactory completion of which will result in further work at an average rate of $9 per Russian page.

Responses should be mailed to the Translations Department, American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02940.

FULBRIGHT-HAYS AWARDS
AVAILABLE FOR 1980-1981

The Council for International Exchange of Scholars (CIES) has recently published a brochure listing the Fulbright opportunities abroad for university lecturing and advanced research in mathematics and in the physical sciences for 1980-1981. In recent years from ten to fifteen annual awards have been made to specialists in mathematics and statistics. The CIES expects to grant about 500 awards for Fulbright scholars abroad and another 500 for scholars visiting the U.S. for lecturing and research for 1980-1981.

Openings listed in the new brochure include the following countries: Australia, advanced algebraic and geometric theory and application; Colombia (Spanish required), analysis, topology, functions, operations research, statistics; Finland; Israel, social science statistics; Ivory Coast (French required); Liberia; Malawi; Norway, fluid mechanics; Philippines, science and mathematics education; U.S.S.R.

To obtain a copy of the 1980-1981 announcement send name, address, highest degree, specialization, and country interest to the Council for International Exchange of Scholars, Department N, Eleven Dupont Circle, Washington, D.C. 20036. Applications are due for the American Republics, Australia and New Zealand by June 1, 1979, and for Africa, Asia and Europe by July 1, 1979.

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MEMOIRS OF THE AMERICAN MATHEMATICAL SOCIETY
(ISSN 0065-9290)

NON-SPHERICAL PRINCIPAL SERIES REPRESENTATIONS OF A SEMISIMPLE LIE GROUP
by Alfred Magnus

Representations of semi-simple Lie groups have been of interest for many years. Harish-Chandra has shown that all irreducible unitary representations of these groups are "subquotients" of a certain series of induced representations known as the principal series. Kostant and others have investigated in detail the spherical principal series, which consists of those principal series representations induced by the identity representation on the compact subgroup. This Memoir investigates the principal series representations induced by an arbitrary one-dimensional representation of the compact subgroup. For a rank one group, all unitary representations of this type are found.

Memoir Number 216, vi + 52 pages
List price $4.00, institutional member $2.50
ISBN 0-8218-2216-0; LC 79-10157
Publication date: April 30, 1979
To order, please specify MEMO/216

SYMMETRIC STRUCTURES IN BANACH SPACES
by W. J. Johnson, B. Maurey, G. Schechtman, and L. Tzafriri

This Memoir contains an intensive study of the isomorphic classification of Banach spaces with various symmetric structures. Special attention is devoted to finite dimensional spaces which have "good" symmetric bases and rearrangement invariant function spaces. Two types of questions are studied extensively: (1) Given a Banach space X, classify all subspaces of X which have a certain symmetric structure; (2) If two spaces which have a certain symmetric structure are linearly homeomorphic, must their symmetric structures be identical?

Some theorems are proved several times in increasing degree of generality. For example, in Chapter 1, \( L_p \) is shown to have a unique representation as a rearrangement invariant function space on \((0, 1)\) but not on \((0, \infty)\), and, for \( X = L_p, p > 2 \), question (1) above is completely answered. Various generalizations are discussed in Chapters 5, 6 and 8, while the rather nice case of Orlicz function spaces is treated in Chapter 7.

The proofs use techniques from Banach space theory, interpolation theory, and probability theory.

Memoir Number 217, v + 298 pages
List price $10.00, institutional member $7.50
ISBN 0-8218-2217-9; LC 79-10225
Publication date: April 30, 1979
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AMS TRANSLATIONS—SERIES 2
(ISSN 0065-9290)

TWELVE PAPERS IN LOGIC AND ALGEBRA

The papers and authors are as follows:

M. I. Semenenko, Properties of some subsystems of classical and intuitionistic propositional calculi
A. F. Lavrik, On a theorem in additive number theory
A. F. Lavrik, On the theory of distribution of primes based on I. M. Vinogradov's method of trigonometric sums
A. G. Postnikov and N. P. Romanov, A simplification of A. Selberg's elementary proof of the asymptotic law of distribution of prime numbers
Boris M. Schein [B. M. Šaǐn], On the theory of inverse semigroups and generalized groups
B. M. Schein [B. M. Šaǐn], Lectures on semigroups of transformations
R. L. Šapiro, Irreducible representations of the group \( SU(n) \) of class 1 relative to \( SU(n - 1) \)
N. Ja. Vilenkin and R. L. Šapiro, Irreducible representations of the group \( SU(n) \) of class 1 relative to \( SU(n - 1) \)
R. L. Šapiro, Special functions connected with representations of the group \( SU(n) \) of class 1 relative to \( SU(n - 1) \) \( (n \geq 3) \)
E. M. Levič [E. M. Levič], Irreducible representations of polycyclic groups over an absolute algebraic field of prime characteristic
On torsion-free groups whose irreducible representations over some field are all finite-dimensional

A. I. Mal'cev, Symmetric groupoids

Volume 113, v + 250 pages
List price $24.40, institutional member $18.30, individual member $12.20
ISBN 0-8218-3063-5; LC 79-9994
Publication date: April 15, 1979
To order, please specify TRANS2/113

PROCEEDINGS OF THE STEKLOV INSTITUTE
(ISSN 0081-5438)

GEOMETRIC PROBLEMS IN THE THEORY OF INFINITE-DIMENSIONAL PROBABILITY DISTRIBUTIONS
by V. N. Sudakov

This monograph is a collection of some results, published previously but mostly without detailed proofs, of investigations in the theory of probability distributions. It deals with questions in measure theory related to the geometric character of the methods of investigation used. The first chapter contains auxiliary information. The division of the whole content into two chapters (II and III) corresponds to the two main themes of the investigations. The second and third chapters have in common the geometric character of the problems studied and the related definite unity of methods, although in content these chapters are formally independent of each other. The Table of Contents below lists the major areas of study.

Introduction
CHAPTER I. Auxiliary information
CHAPTER II. Sample functions of random processes. Correlation theory
§1. Statement of the problem
§2. Problem of the size of a convex solid angle in Hilbert space and the infinite-dimensional Cauchy distribution
§3. Cauchy measure and Gaussian measure
§4. The GB property and mixed volumes
§5. Monotonicity of the functional $h_1$
§6. Mixed volumes and the continuity of paths
§7. $e$-entropy conditions
§8. The non-Gaussian case
§9. Remark on Borel realizations

CHAPTER III. Independence and combinations of measurable decompositions of a probability space
§10. The Birkhoff-von Neumann problem
§11. Probability measures on subsets of direct products
§12. Marginal sufficiency of statistics
§13. Conditions for the existence of a one-to-one optimal plan in the problem of transport of mass in Minkowski spaces

Bibliography
Russian Number 141 (1976), v + 178 pages
List price $40.00, institutional member $30.00, individual member $20.00
ISBN 0-8218-3041-4; LC 79-11640
Publication date: June 1, 1979
To order, please specify STEKLO/141

TECHNICAL MANUAL

TEx: A SYSTEM FOR TECHNICAL TEXT
by Donald E. Knuth

This book describes how to use the TEx type-setting system, a computer program intended for the production of books and journals meeting the highest standards of typographic quality. The reader learns how to typeset simple textual matter as well as complex mathematical formulas and tables. TEx's novel methods for dividing paragraphs into lines and for dividing lists of lines into pages are explained in terms of the notions of "boxes" and "glue". Appendices describe how hyphenation is performed, and how layouts can be specified by book designers in a flexible way.

The book is primarily directed towards potential users of TEx. No prior background is required for understanding the contents. (Sections that are intended for specialists only are clearly marked with a "danger" sign.) Previous books were addressed to specialists in the printing industry or on editorial staffs, rather than to mathematicians and their typists.

For information in detail on the possibilities of this system, refer to the Gibbs Lecture "Mathematical typography" by Knuth in the Bulletin of the American Mathematical Society (New Series) Volume 1, Issue 2, March 1979.

ii + 202 pages
List price $8.80; individual price $4.40
ISBN 0-8218-0209-7
Publication date: June 1, 1979
To order, please specify TExM

Prepayment is required for all American Mathematical Society publications.
Send for the book(s) above to: AMS, P.O. Box 1571, Annex Station, Providence, RI 02901.
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 the same as the deadlines for abstracts. They are listed on the inside front cover of each issue.


JUNE 1979

3-5. THE IMPACT OF MINI AND MICRO COMPUTERS ON BIBLIOGRAPHIC DATA BASES, Ottawa, Canada. (April 1979, p. 196)

4-8. CONFERENCE ON NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS IN ENGINEERING AND APPLIED SCIENCES, University of Rhode Island, Kingston, Rhode Island. Support: Office of Naval Research, Boston, Massachusetts.

Program: The conference will feature overview lectures and talks on recent developments in nonlinear partial differential equations by invited lecturers, with emphasis in the areas of solutions, bifurcation, solid and fluid dynamics, nonlinear waves and nonlinear diffusion.

Invited Lecturers (partial list): Mark Ablowitz (Clarkson College); Donald Aronson (University of Minnesota); Alexandre Chorin (University of California, Berkeley); Donald Cohen (Caltech); James Corones (Iowa State University); Roger Dashed (Institute for Advanced Study); George Fix (Carnegie-Mellon University); Paul Garabedian (Courant Institute); R. Glowinski (IRIA, France); Fritz John (Courant Institute); Herbert B. Keller (Caltech); Joseph B. Keller (Courant Institute); Heinz-Otto Kreiss (Caltech); M. D. Kruskal (Princeton); David W. McLaughlin (University of Arizona); Amy Murray-Cohen (Rutgers University); Alan C. Newell (Clarkson College of Technology); Louis Nirenberg (Courant Institute); J. Tinsley Oden (University of Texas-Austin); Edward Reiss (University of Miami); G. Strang (MIT); Hans Weinberger (University of Minnesota).

Organizing Committee: Emilio O. Roxin (Chairman); Anthony J. Kalinowski; Howard E. Levine; John S. Papadakis; Robert L. Sternberg.

Information: Emilio O. Roxin or John S. Papadakis, Department of Mathematics, University of Rhode Island, Kingston, Rhode Island 02881.

4-8. CATASTROPHE THEORY AND ITS APPLICATIONS, Salisbury State College, Salisbury, Maryland. (February 1979, p. 125)

5-8. INTERNATIONAL CONFERENCE ON FUNDAMENTALS OF NUMERICAL COMPUTATION, Technical University of Berlin, Germany. (February 1979, p. 125)


9-23. NATO ADVANCED STUDY INSTITUTE ON MATHEMATICAL MODELLING OF ENERGY SYSTEMS, Bogazici University, Istanbul, Turkey. (April 1979, p. 194)

11-13. SIAM 1979 NATIONAL MEETING, Royal York Hotel, Toronto, Canada. (February 1979, p. 125)


Principal Lecturers: Benjamin Weiss, Hebrew University and Stanford University.

Support: Some support for travel and subsistence will be available.

Information: Nathaniel Friedman, Mathematics Department, State University of New York, Albany, New York 12222.

11-15. MATHEMATICS AND THE MICROCOMPUTER, Salisbury State College, Salisbury, Maryland. (February 1979, p. 125)

11-15. NSF-NSRNS REGIONAL RESEARCH CONFERENCE ON FINITE ELASTICITY, University of Tennessee, Knoxville, Tennessee. (April 1979, p. 194)


11-16. JOINT CANADA-FRANCE COMBINATORIAL COLLOQUIUM, Université de Montréal, Montréal, Canada. (February 1979, p. 125; April 1979, p. 194)

11-July 6. EIGHTEENTH SESSION OF LE SEMINAIRES DE MATHEMATIQUES SUPERIEURES, Université de Montréal, Canada. (April 1979, p. 194)

12-12. MAA OHIO SECTION SHORT COURSE ON THE THEORY OF COMPUTING, University of Akron, Akron, Ohio. (February 1979, p. 125)

12-12. COLLOQUE INTERNATIONAL SUR LES FIBRES VEC­ TORIELS ET EQUATIONS DIFFERENTIELLES, Nice, France. (April 1979, p. 194)

17-23. SECOND INTERNATIONAL CONFERENCE ON FINITE GROUPS AND GEOMETRIES, Han-sur-Lesse, Belgium. (February 1979, p. 126)

18-20. FUNCTIONAL DIFFERENTIAL AND INTEGRAL EQUATIONS CONFERENCE, West Virginia University, Morgantown, West Virginia. (February 1979, p. 126)

18-22. INTERNATIONAL CONFERENCE ON THE GLOBAL THEORY OF DYNAMICAL SYSTEMS, Northwestern University, Evanston, Illinois. (January 1979, p. 72)

18-22. MAA SUMMER WORKSHOP ON APPLICATIONS OF MATHEMATICS IN MEDICINE AND BIOLOGY, University of Maine, Orono, Maine. (April 1979, p. 195)

20-22. 1979 INTERNATIONAL SYMPOSIUM ON FAULT-TOLERANT COMPUTING, Madison, Wisconsin. (October 1978, p. 441)

20-22. THIRD IMACS INTERNATIONAL SYMPOSIUM ON COMPUTER METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS, Lehigh University, Bethlehem, Pennsylvania. (October 1978, p. 441)

25-29. SOME RECENT PROGRESS ON OPERATOR ALGEBRAS, Oakland University, Rochester, Michigan. Principal Speaker: Edward Effros, University of Pennsylvania. Program: Professor Effros will deliver ten lectures. There may be opportunity for informal talks. Invited participants include: C. Akemann, J. Anderson, B. Blackadar, J. Bunce, M. D. Choi, L. Brown, J. Conway, J. Deddens, R. Douglas, R. Herman, A. Hopenwasser, R. Loebi, W. Paschke, J. Phillips, R. Salinas, C. Schochet, C. L. Shen. Information: S. K. Tsui and Steve Wright, Department of Mathematics, Oakland University, Rochester, Michigan 48063. Limited financial aid for participants is expected from the National Science Foundation. (February 1979, p. 126)

25-29. 1979 INTERNATIONAL SYMPOSIUM ON INFORMATION THEORY, Grignano, Italy. (October 1978, p. 441)

25-29. INTERNATIONAL SYMPOSIUM IN DIFFERENTIAL GEOMETRY IN HONOR OF S. S. CHERN, University of California, Berkeley, California. (February 1979, pp. 126, A-264)

26-29. DUNDEE BIENNIAL CONFERENCE ON NUMERICAL ANALYSIS, Dundee, Scotland. (February 1979, p. 126)

27-29. CONFERENCE ON THE NUMERICAL ANALYSIS OF SEMICONDUCTOR DEVICES, University of Dublin, Ireland. (February 1979, p. 126)

27-29. LARS/IEEE SYMPOSIUM ON MACHINE PROCESSING OF REMOTELY SENSED DATA, Purdue University, West Lafayette, Indiana. (February 1979, p. 126)

JULY 1979

1-20. LONDON MATHEMATICAL SOCIETY CONFERENCE ON ASPECTS OF CONTEMPORARY COMPLEX ANALYSIS, Collingwood College, Durham University, England. (January 1979, p. 73)

2-6. CONFERENCE ON LOW DIMENSIONAL TOPOLOGY, University College of North Wales, Bangor, United Kingdom. (February 1979, p. 126)

2-6. WORKSHOP ON CURRENT PROBLEMS IN GENERAL RELATIVITY, Dublin Institute for Advanced Studies, Dublin, Ireland. (April 1979, p. 195)

2-7. AN INTERNATIONAL SYMPOSIUM ON FUNCTIONAL DIFFERENTIAL EQUATIONS AND BIFURCATION, Universidade de São Paulo, Brazil. (April 1979, p. 195)

2-8. CONFERENCE IN ALGEBRAIC GEOMETRY: VARIETIES OF LOW DIMENSION, Université d'Angers, Angers, France. (February 1979, p. 126)

2-20. RECENT DEVELOPMENTS IN NUMBER THEORY, Queen's University, Kingston, Ontario, Canada. (February 1979, p. 126)

3-5. SYMPOSIUM ON FIXED POINT ALGORITHMS AND COMPLEMENTARITY, University of Southampton, Southampton, England. (February 1979, p. 126)

5-6. SYMPOSIUM ON MATHEMATICAL MODELLING IN BIOLOGY AND ECOLOGY, Pretoria, South Africa. Program: The lectures will be delivered by invited speakers. Topics to be covered include the modelling aspects of population dynamics, ecology, renewable resource management, cancer, neuromuscular control, membranes and other cellular structures, phenomena associated with the nerve, epidemiology, plant growth, effluent purification, and selected physiological phenomena. There will be a number of plenary lectures and a number of discussion sessions which will consist of a brief lecture followed by a panel discussion with audience participation. Information: Symposium Secretariat, S 191, Conference Division, CSIR, P.O. Box 395, Pretoria 0001, South Africa.

5-8. WORKSHOP ON THE SOCIAL HISTORY OF MATHEMATICS, Berlin, Federal Republic of Germany. Organizers: Herbert Mehrtens (West Berlin), Henk Bos (Utrech), Ivo Schneider (Munich). Program: The theme of the workshop is social history of nineteenth-century mathematics, and will cover historical development of the mathematical professions; mathematics in early 19th-century society; social history of school mathematics; national developments; mathematics in the currents of general culture. There will be working groups arranged according to the interests of the participants of the workshop. Information: Herbert Mehrtens, Institut für Philosophie, Wissenschaftstheorie, Wissenschafts- und Technikgeschichte, Ernst-Reuter-Platz 7, D-1000 Berlin 10, Germany.

10-21. GEOMETRY AND PHYSICS, Durham, Great Britain. Information: Department of Mathematics, University of Durham, Durham, DH1 3LE, Great Britain.

16-20. SIXTH INTERNATIONAL COLLOQUIUM ON AUTOMATA, LANGUAGES AND PROGRAMMING, Graz, Austria. (January 1979, p. 73; February 1979, p. 126)

16-20. COMPUTATIONAL PROBABILITY LECTURE SERIES, Johns Hopkins University, Baltimore, Maryland. (April 1979, p. 196)

22-August 1. CONFERENCE ON NOETHERIAN RINGS AND RINGS WITH POLYNOMIAL IDENTITY, Grey College, Durham, Great Britain. (February 1979, p. 126)

22-August 1. PROGRESS IN ANALYTIC NUMBER THEORY, Grey College, Durham, Great Britain. (February 1979, p. 126)

22-August 12. CANADIAN MATHEMATICAL SOCIETY ANNUAL SEMINAR, University of Toronto, Toronto, Canada (February 1979, p. 144)

6-10. INTERNATIONAL CONFERENCE ON STOCHASTIC PROCESSES AND THEIR APPLICATIONS, Northwestern University, Evanston, Illinois. (February 1979, p. 127)
Invited Speakers: D. Aldous (Cambridge); E. Arjas (Helsinki); T. Delbaen (Geneva); R. Durrett (Los Angeles); A. Dworzycki (Jerusalem); R. K. Getoor (San Diego); B. V. Gnedenko (Moscow); D. Griffeath (Madison); H. Gzyl (Carcasas); M. Harrison (Palo Alto); D. L. Iglehart (Palo Alto); J. Jacob (Rennes); O. Kallenberg (Goteborg); A. Karr (Baltimore); H. Kunita (Tokyo); A. W. Marshall (Vancouver); T. Maruyama (Missa); M. Metivier (Paris); J. Neveu (Paris); Yu. A. Rozanov (Moscow); E. Seneta (Canberra); A. N. Shiryaev (Moscow); A. V. Skorokhod (Moscow); J. H. A. de Smit (Enschede); L. D. Stone (Philadelphia); and M. Yor (Paris).

6-10. INTERNATIONAL SEMINAR ON FUNCTIONAL ANALYSIS, HOLOMORPHY AND APPROXIMATION THEORY, Universidade Federal do Rio de Janeiro, Brazil. (February 1979, p. 127)

6-10. SECOND SYMPOSIUM ON ALGEBRAIC AND DIFFERENTIAL TOPOLOGY, Pontificia Universidade Catolica Rio de Janeiro. (April 1979, p. 196)

6-10. NSF-CBMS REGIONAL CONFERENCE ON ANALYTIC METHODS IN COMMUTATIVE ALGEBRA, George Mason University, Fairfax, Virginia. (April 1979, p. 196)
Program: Professor Melvin Hochster will deliver a series of ten lectures whose main objective will be to make accessible to an audience of algebraists a variety of very powerful techniques from analysis which have been used recently to settle some purely algebraic problems: problems that have so far resisted algebraic methods. Included in the talks will be applications of the Grauert-Riemenschneider vanishing theorem and recent results of Skoda and Briançon on the integral closure of an ideal in a ring of convergent power series. There will be several invited addresses by other algebraists familiar with the use of analytic techniques. These speakers will include Professors David Eisenbud of Brandeis, Henry Laufer of SUNY at Stony Brook, and Joseph Lipman of Purdue.
Support: Applications for participation and possible support should be submitted by June 1, 1979. Late applications will be considered as space permits.

Information: Persons interested in participating should enclose a brief vita and indication of research interests and write directly to Richard N. Drumer, Conference Director, or M. R. Gabel, Assistant Director, Department of Mathematics, George Mason University, 4400 University Drive, Fairfax, Virginia 22030.

6-16. INTERNATIONAL CONFERENCE ON BANACH SPACES, Kent State University, Kent, Ohio. (February 1979, p. 127)

11-16. FOURTH INTERNATIONAL CONGRESS ON MATHEMATICS EDUCATION, Berkeley, California. (April 1979, p. 195)

13-17. NSF-CBMS REGIONAL CONFERENCE ON RECENT DEVELOPMENTS IN CELESTIAL MECHANICS, Tufts University, Medford, Massachusetts.
Principal Lecturer: Richard McGehee, University of Minnesota.
Program: Professor McGehee will deliver ten lectures on such topics as triple collision in the n-body problem, noncollision singularities, oscillation and capture, and the KAM theorem.
Support: Limited financial support for participants from the region is expected from the National Science Foundation.
Information: R. Devaney or Z. Nitecki, Department of Mathematics, Tufts University, Medford, Massachusetts 02155.

13-17. CSIRO-DMS DIVISIONAL CONFERENCE, Adelaide, Australia.
Information: L. Veitch, CSIRO-DMS, Private Bag No. 2, Glen Osmond, SA 5064, Australia.

13-18. WORKSHOP ON THE PRESENT TRENDS IN REPRESENTATION THEORY, Carleton University, Ottawa, Canada. (April 1979, p. 195)

15-22. SECOND INTERNATIONAL SYMPOSIUM IN WEST AFRICA ON FUNCTIONAL ANALYSIS AND ITS APPLICATIONS, University of Science and Technology, Kumasi, Ghana. (February 1979, p. 127)

16-18. SYMPOSIUM IN REAL ANALYSIS, University of Wisconsin, Milwaukee, Wisconsin. (April 1979, p. 196)

20-25. SECOND INTERNATIONAL CONFERENCE ON REPRESENTATIONS OF ALGEBRAS, Carleton University, Ottawa, Canada. (April 1979, p. 196)

22-29. THE SIXTH INTERNATIONAL CONGRESS OF LOGIC, METHODOLOGY AND PHILOSOPHY OF SCIENCE, Hannover, Federal Republic of Germany. (February 1979, p. 127)

23-September 8. IXème ÉCOLE D'ÉTÉ DE CALCUL DES PROBABILITÉS DE SAINT-FLOUR, Université de Clermont, France. (January 1979, p. 52)

26-September 1. CANADIAN MATHEMATICAL SOCIETY SUMMER RESEARCH INSTITUTE ON MATHEMATICAL METHODS IN CONTINUUM MECHANICS, Quebec, Canada. (February 1979, p. 127)

26-September 1. SECOND AUSTRALIAN NUMBER THEORY CONFERENCE, Macquarie University, Sydney, Australia. (February 1979, p. 127)

27-31. TENTH INTERNATIONAL SYMPOSIUM ON MATHEMATICAL PROGRAMMING, Montreal, Canada. (January 1979, p. 52)

27-31. COLLOQUIUM ON FINITE ALGEBRA AND MULTIPLE-VALUED LOGIC, József Attila University, Szeged, Hungary. (February 1979, p. 127)
SEPTEMBER 1979

3-7. TWELFTH EUROPEAN MEETING OF STATISTICIANS, Varna, Bulgaria. (February 1979, p. 127)

4-9. NINTH IFIP CONFERENCE ON OPTIMIZATION TECHNIQUES, Warsaw, Poland. (November 1978, p. 505)

9-13. SYMPOSIUM ON TRENDS IN APPLICATIONS OF PURE MATHEMATICS TO MECHANICS, Heriot-Watt University, Edinburgh, Scotland. (April 1979, p. 196)

16-18. NON-BIBLIOGRAPHIC DATA BASES, Boston, Massachusetts. (April 1979, p. 196)

16-21. LAMBDA-CALCULUS CONFERENCE, University College of Swansea, Swansea, Wales. (February 1979, p. 127)

18-21. FIFTH EUROPEAN SOLID STATE CIRCUITS CONFERENCE, University of Southampton, Great Britain. Information: Conference Department, Institution of Electrical Engineers, Savoy Place, London WC2R OBL, Great Britain.

19-21. SIXTEENTH MIDWESTERN MECHANICS CONFERENCE, Kansas State University, Manhattan, Kansas. (November 1978, p. 506)

28-29. SEVENTH ANNUAL MATHEMATICS AND STATISTICS CONFERENCE, Miami University, Oxford, Ohio. Program: The theme of the conference will be "Geometry." Speakers will include Branko Grunbaum (University of Washington) and Ernest E. Schult (Kansas State University). There will be sessions of contributed papers. Information: David Kullman, Department of Mathematics and Statistics, Miami University, Oxford, Ohio 45056.

28-29. ANNUAL PI MU EPSILON STUDENT CONFERENCE (OHIO DELTA CHAPTER), Miami University, Oxford, Ohio. Information: Milton Cox, Department of Mathematics and Statistics, Miami University, Oxford, Ohio 45056.

OCTOBER 1979

2-6. SYMPOSIUM ON ILL-POSED PROBLEMS: THEORY AND PRACTICE, University of Delaware, Newark, Delaware. Support: Air Force Office of Scientific Research; Army Research Office. Purpose: To bring together theoreticians and practitioners for the purpose of exchanging information and viewpoints relevant to the theory, applications, and computational methods in various areas of ill-posed problems. Program: There will be overview lectures and talks on topics of current importance by invited speakers. Several sessions will be devoted to the mathematical and numerical analysis of ill-posed problems for partial differential, integral, and operator equations, including mathematical programming, statistical, and software aspects. An equal number of sessions will be devoted to practical ill-posed problems in various fields: atmospheric studies, geophysics, image reconstruction, system identification, control, engineering and technology. There will also be sessions for contributed papers. Deadline for Abstracts: August 15, 1979. Information: Abstracts and inquiries should be addressed to M. Z. Nashed, Symposium Director, Department of Mathematical Sciences, University of Delaware, Newark, Delaware 19711.

8-10. SESSION ON PHYSICAL SYSTEMS SCIENCE, Denver, Colorado. (February 1979, p. 127)


29-31. TWENTIETH IEEE SYMPOSIUM ON FOUNDATIONS OF COMPUTER SCIENCE, San Juan, Puerto Rico. (February 1979, p. 127)

NOVEMBER 1979

8-11. INTERNATIONAL CHRISTOFFEL SYMPOSIUM, Aachen University of Technology, Aachen, and Monschau, Federal Republic of Germany. Purpose: A symposium on the occasion of the 150th Birthday of E. B. Christoffel (1829-1900), who was born in Monschau (near Aachen) and taught in Zurich, Berlin and Strasbourg. Program: There will be about ten invited one-hour lectures and a final round-table discussion on the mathematical work of Christoffel, surveying its impact upon the mathematics and physics that has followed it. Emphasis will be placed on recent developments. Topics to be treated include differential geometry, complex function theory, quadrature formulae, special functions of mathematical physics, partial differential equations. Invited Speakers (tentative): M. Brelot (Paris), P. J. Davis (Providence, R.I.), J. Ehlers (Munich), W. Klingenberg (Bonn), J. Meixner (Aachen), A. Moor (Sopron, Hungary), A. Pfluger (Zürich), C. Pommerenke (Berlin), M. De Wilde (Liège).

Invited Manuscripts: About 35 experts have been invited to contribute manuscripts in honour of Christoffel that are connected with some branch of the wide spectrum of his work. These manuscripts will be collected together with the invited lectures and published in full in the Symposium Proceedings. Co-Sponsors: Deutsche Forschungsgemeinschaft, Minister für Wissenschaft und Forschung des Landes Nordrhein-Westfalen, County of Aachen. Information: P. L. Butzer, Lehrstuhl A für Mathematik, Aachen University of Technology, 5100 Aachen, Federal Republic of Germany.

11-13. CONFERENCE ON MATHEMATICAL LOGIC, University of Connecticut, Storrs, Connecticut. Speakers: Leo Harrington (tentative); Carl Jockusch, Jr.; Mihaly Makkai; Terrence Millar; Michael Morley; Anil Nerode; Gerald Sacks; Joseph Shoenfield; Robert Vaught (tentative). Program: Invited and contributed talks, and a session dealing with open problems. Contributed talks will be limited in number, and should be in the areas of Model Theory or Recursion Theory. Abstracts must be received by October 1, 1979. Information: Manuel Lerman, Department of Mathematics, University of Connecticut, Storrs, Connecticut 06268.
Personal Items

Taqdir Hasain of McMaster University has been appointed Chairman of the new Department of Mathematical Sciences at that institution.

Dale W. Lick of Old Dominion University, became President of Georgia Southern College, July 1, 1978.

Calvin C. Moore of the University of California, Berkeley, is a member of the President's Committee on the National Medal of Science.

Frederick Mosteller of Harvard University has been elected president of the American Association for the Advancement of Science.

PROMOTIONS

To Associate Professor. Brooklyn College: Keith Harrow; University of North Carolina at Chapel Hill: Sue E. Goodman; York College of the City University of New York: Allan Gottlieb.

Deaths

Professor emeritus Michel Loeve of University of California, Berkeley, died on February 17, 1979 at the age of 72. He was a member of the Society for 31 years.

Professor Daniel B. Ray of Massachusetts Institute of Technology died on February 19, 1979 at the age of 49. He was a member of the Society for 20 years.

Professor emeritus J. M. Thomas of Duke University died on January 8, 1979 at the age of 81. He was a member of the Society for 48 years.

AMS REFERENCE WORK

FRENCH MATHEMATICAL SEMINARS—A Union List
by Nancy D. Anderson

This list is the only one of its kind in the United States, and has been assembled with the cooperation of 98 participating libraries, including two French libraries. The list provides necessary information to enable librarians to acquire the seminars and also serves to identify copies existing in North America.

The listing includes only seminars (not courses, conferences, or colloquia) held in the French language in any country. Every listing has been verified and is entered in the form most often cited in the literature. Along with the primary entries there is an even greater number of cross-references, which give other forms of the entry as well as issuing body, location of seminar, series, and a main entry in the form used by the Library of Congress. Names and addresses of publishers may also be given.

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Two-year College Teachers

by Robert Mckelvey, Donald J. Albers, Shlomo Libeskind and Don O. Loftsgaarden

Introduction. The two-year and community colleges have become a major component of American post-secondary education, accounting now for some 40% of all undergraduate enrollment [2]. The two-year college mathematics faculty numbers 6,000 and is young. Two-thirds of the faculty is under 45 years of age; more than one-fourth of the faculty is under 35. Thus, two-thirds of the faculty can look forward to at least twenty more years of teaching. If enrollments do not grow and if technology continues its steady advance, then continuing education for this group of teachers will take on added importance.

During 1977-1978 the Rocky Mountain Mathematics Consortium (RMCC) sponsored a study [3] of the graduate training needs of two-year college (TYC) mathematics teachers, based on an examination of their own views and perceptions. The study team conducted extensive interviews with TYC faculty around the country and then distributed a questionnaire to a carefully designed sample of about 10% of the TYC teachers in the United States. Of these, 79% responded and their answers to a wide variety of questions provide a portrait of the teaching environment in the two-year colleges, the professional lives of the teachers, and their views on graduate programs and continuing education.

Portrait of the Two-Year Teachers. Over 60% of TYC mathematics faculty members have previously taught in high school, with an average of five years of high school experience. Moves from the high schools often seem to have been closely tied to the NSF Institute programs. Some 52% of all TYC mathematics teachers have participated in NSF Institutes, and of those who participated, 59% said the Institutes were a factor in my move from teaching in high school.” Fifty-eight percent said the Institutes were a factor in my decision to get a master’s degree.”

All but 6% of the teachers do hold the master’s degree, and 58% have at least one year of additional course work beyond the master’s. Fourteen percent have the doctorate. There seems to be a very strong correlation between level of education and intensity of professional activity in almost all categories. Holders of the doctorate are the most active, not only in research and journal writing but also in giving talks, working in professional organizations, participating in professional seminars, and writing textbooks. Those with a year or more of course work beyond the master’s are substantially more active professionally than those who have not undertaken the additional schooling. One may interpret the association as “chicken or egg,” but either way the correlation is most striking.

Nearly half (45%) of TYC faculty members have taken university credit courses within the last two years. Each year upwards of fifty TYC mathematics teachers acquire a doctorate, often after years on the job. Since 1970 doctorates in the faculty have increased at more than 1% per year, from 4.5% in 1970 to 14% in 1977. Comparatively few who enter
TYC teaching already have a doctorate. Indeed, because of general slowing of enrollment growths and an increased use of part-time teachers, very few new positions will be opening up for young faculty members entering the system at either the master's or the doctoral level. The present TYC mathematics teachers, like their colleagues in the four-year colleges and universities, were trained in traditional areas of pure mathematics. In responding to our questionnaire the teachers expressed considerable interest in applied mathematics and felt their background to be least adequate to teach applications-business mathematics, linear programming, statistics, computer programming, etc. Of course, it is precisely the applied areas that are becoming most important in post-secondary mathematics education, and nowhere more so than in the two-year colleges with their emphasis on “career-oriented” programs.

The Two-Year College Environment. A major and continuing problem of the TYC mathematic teacher is teaching unmotivated students (so stated by 39%). A closely related problem is being required to cover much more material than students can absorb, i.e., being expected to bring students quickly to a level they have not been able to achieve in twelve years or more of previous schooling.

The explosive growth of two-year colleges in the sixties, coupled with open door admission policies, has changed the complexion of these institutions in significant ways. Gone are the days of the nearly exclusive junior college transfer role, when the colleges simply provided the first two years of standard undergraduate academic training. Many two-year colleges, particularly in the west, have greatly expanded their scope to include a host of vocational programs. The growth of part-time and female enrollment has also changed their clientele in significant ways.

Two-year college teachers have well-defined views on what constitute desirable professional qualities in a teacher. Of most importance are attributes directly tied to classroom activity: It is considered “essential” to think of oneself primarily as a teacher, to be able to move into new areas of teaching as the curriculum evolves, and specifically to be willing to take on remedial courses. It is also considered “very important” to continue to learn new mathematics, to have some contact with real-world applications, and to enjoy hard problems.

Toward some kinds of professional activity, many TYC teachers display ambivalence and even downright disapproval. Least approved is campus administrative work, but publication, research, or obtaining a standard doctorate are thought of as “inappropriate” by a significant group, and are considered to be “unimportant” by an actual majority.

Contrasting ironically with teachers’ perceptions of worthwhile qualities and activities are their perceptions of which activities are actually being rewarded by the colleges, through salary increases and promotions. Administration, taking courses, and obtaining advanced degrees all are believed to be very important in advancement decisions. Public service, textbook writing, and research are low on both lists. Simple longevity is rewarded most of all, but classroom performance is believed to be second.

Our survey showed interesting geographical variations in the colleges:

1. Faculty members in eastern colleges are much yonugue than those in the west. The present TYC teachers increase steadily as one moves eastward across the country, from 8% on the west coast to 24% in the northeast.

2. The percentage of faculty members holding doctorates increases steadily as one moves eastward across the country, from 8% on the west coast to 24% in the northeast.

3. Professional activities of most kinds, except doing additional graduate work, count more heavily for advancement at colleges in the east than at colleges in the west.

Teachers’ Interests in Advanced Training. As reported above, TYC teachers maintain a high interest in continuing education and regularly return to graduate school to take courses. A full 25% expressed a “strong interest” in eventually completing a doctorate. As the college enrollment changes, the teachers believe that they themselves should move out in new directions.

Their recommendation for course work at the graduate level is for increased breadth. TYC teachers should be familiar with all areas of applied mathematical sciences and should know something about the physical, social, or biological sciences as well. There should be a mathematics education component in their training, with an emphasis on nontraditional topics: problem solving à la Pólya, discovery and heuristic techniques, and remediation.

Seven-tenths of respondents felt that practical teaching experience should be required as a condition for receiving an advanced degree. Nearly half felt that an internship could be devised that would be valuable even to experienced teachers.

A strong majority wanted to incorporate into graduate training some experience with the preparation of written classroom materials; a favorite proposal was the designing of a learning module. In fact, of those with a year of course work beyond the master’s (the prime candidates for future doctoral degrees), three-quarters regarded designing a module as a more valuable experience than writing a traditional doctoral thesis—either in mathematics or mathematics education.

Generally, the traditional mathematics doctoral thesis is regarded as “not really useful” for a TYC teacher. This is the view of one-third of those with a year past the masters, and of one-fifth of those who already hold a doctorate.

Recommendations to the Graduate Schools. It seems evident from the survey that there is a substantial clientele among TYC mathematics teachers for continuing postgraduate training, especially additional summer-school course work in the applied mathematical sciences. The two-year college teachers face changing circumstances and genuinely want the guidance of the graduate mathematics community in responding to them. TYC teachers are interested in degree programs beyond the master’s, indeed have been acquiring doctorates at a steady pace. But for the most part they regard the current dissertation requirements (either mathematics or mathematics education) as irrelevant to their needs. The TYC teachers are young, many are energetic and active, and because of enrollment patterns they form a stable professional group that will be around for a long time. The graduate schools should take more notice that they are there.

References


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.

Wendell H. Fleming, Richard Kadison, and Everett Pitcher have been appointed by President Peter D. Lax to the ad hoc Committee on Elected and Appointed Officers.

President Peter D. Lax has reappointed Israel N. Herstein (1981) to the joint AMS-MAA-SIAM Committee on Women in Mathematics. Continuing members of the committee are Jane K. Cullum, SIAM (1979); Etta Z. Falconer, AMS (1979); Mary W. Gray, AMS (1980); Linda C. Kaufman, SIAM (1980); Victor L. Klee, Jr., MAA (1979); Margaret S. Monzing, MAA (1980); Cathleen S. Morawetz, SIAM (1981); Jacqueline C. Moss, MAA (1981); and Alice T. Schafer, AMS, Chairman (1980).

Report of the Committee on Modes of Support of Research

At the annual meeting of the Society in Biloxi the Council of the AMS set up an ad hoc Committee on Modes of Support of Research, whose responsibility is "to collect, examine, formulate, and circulate proposals from the mathematical community for mechanisms to foster progress in research in mathematics and to make recommendations for appropriate action to the Council at its April meeting."

The Committee members are Herbert B. Keller (California Institute of Technology), Calvin C. Moore (University of California, Berkeley), George D. Mostow, chairman (Yale University), Ralph S. Phillips (Stanford University), James D. Stasheff (University of North Carolina, Chapel Hill), Elias M. Stein (Princeton University), and Hans F. Weinberger (University of Minnesota, Minneapolis).

The Committee reported to the Council at its April 20, 1979 meeting, and made the following recommendations:

(1) The Society should submit a proposal to the NSF for administration of ten annual week-long conferences in specialized areas. These would involve about thirty participants each, including a suitable proportion of early career mathematicians.

(2) The Society should submit a proposal to the NSF for a mid-level Postdoctoral Program of fifteen annual awards to mathematicians of Ph.D. age four-to-ten years, modelled after the Sloan Foundation Fellowships.

In addition the Committee reported it has received widespread expressions of support for mini-institutes hosted by mathematics departments, and also for Postdoctoral Research Instructorships at strong mathematics departments. The Committee approves of such modes of support, but does not recommend that the AMS sponsor such programs. Rather, such proposals should be submitted by interested mathematics departments directly to the National Science Foundation.

The Committee welcomes suggestions for alternative new modes of support. Communications may be sent to any of the committee members at their respective institutions, or to William J. LeVeque, Executive Director, American Mathematical Society, P.O. Box 6248, Providence, RI 02940 (401-272-9500).

The Council approved in principle the two proposals of the Committee on Modes of Support of Research, referring them to the Executive Committee and Board of Trustees for further development, and called for publication of this report of the Committee's activities in the Notices. At a workshop for department chairmen called by President Lax for April 21, 1979, there was an expression of interest in the joint preparation of proposals by consortia of departments for multiyear mini-institutes whose locations and topics would change from year to year. The Society offers its services as a clearing house for coordinating efforts to form such consortia. Any department interested in hosting a mini-institute may communicate that interest to Dr. LeVeque, and may request information about other departments interested in consortium proposals.

Reports of Meetings

ANNUAL MEETING IN BILOXI

The eighty-fifth annual meeting of the American Mathematical Society was held in Biloxi, Mississippi, from Wednesday, January 24, 1979 through Saturday, January 27, 1979. Sessions were held in the Mississippi Coast Coliseum and Convention Center, Admiral Benbow Inn, Broadwater Beach Hotel, Holiday Inn and Howard Johnson's Motor Lodge. There were approximately 2,100 registrants, including approximately 1,600 members of the Society.

The fifty-second Josiah Willard Gibbs Lecture was presented by MARTIN D. KRUSKAL of Princeton University. The title of his lecture was What are solitons and inverse scattering anyway, and why should I care?

The Colloquium Lectures were delivered by PHILLIP A. GRIFFITHS of Harvard University. The title of the series was Complex analysis and
By invitation of the Program Committee (Edwin Floyd (chairman), C. Raymond Burgess, James G. Grimm, Donald S. Ornstein, Barbara L. Osofsky, Everett Pitcher, and Harold M. Stark), there were eight invited one-hour addresses. The speakers, their institutions, and the title of their talks were as follows: MICHAEL ARTIN, Massachusetts Institute of Technology, Some applications of algebraic geometry to ring theory; JULIUS L. SHANESON, Rutgers University, Manifolds and submanifolds; JOHN E. FORNAESS, Princeton University, Proper holomorphic mappings; CHARLES S. PESKIN, Courant Institute of Mathematical Sciences, New York University, The heart valve problem of cardiac fluid dynamics and its numerical solution; JACOB FELDMAN, University of California, Berkeley, Time-change in flows; ABRAM H. TAUB, University of California, Berkeley, Spaces-times with distribution valued curvature tensors; HEINZ-OTTO KREISS, California Institute of Technology, Problems with different time scales and their numerical solution; BHAMA SRINIVASAN, Clark University, Representations of classical groups.

The presiding officers at these eight hour lectures were Franklin P. Peterson, Edgar Brown, Jr., Joseph J. Kohn, Henry P. McKean, Jr., Calvin C. Moore, Jerrold Marsden, Joel A. Smoller, and Daniel Gorenstein.

Also by invitation of the Program Committee, there were thirteen special sessions of selected twenty-minute papers. STEFAN BURR of the City University of New York arranged a special session on Number theory and its applications. The speakers were Gary S. Bloom, David M. Bressoud, Persi Diaconis, Paul Erdös, Lawrence Glasser, Ronald L. Graham, David W. Matula, Gerald Myerson, A. M. Odlyzko, and Gustavus J. Simmons.

There were 37 sessions of contributed ten-minute papers, for which the following persons served as presiding officers:

| Local Character of the Solutions of an Atypical Linear Partial Differential Equation Without Solution, Annals of Mathematics (2) 66(1957), pp. 155-158; and On Hulls of Holomorphy, Communications on Pure and Applied Mathematics 13(1960), pp. 587-591. The 1979 Böcher Prize was awarded to Albeto P. Calderón. The prize was awarded by the Council of the Society on the recommendation of a selection committee consisting of Donald Ornstein (chairman), Paul J. Cohen, and Walter Rudin. The citation was for his fundamental work on the theory of singular integrals and partial differential equations and in particular for his recent paper Cauchy Integrals of Lipschitz Curves and Related Operators, Proceedings of the National Academy of Sciences, USA, Vol. 74, No. 4, pp. 1324-1327, April 1977.

On January 22-23 the AMS sponsored a short course on Game Theory and Its Applications under the direction of William F. Lucas of the Center for Applied Mathematics and School of Operations Research and Industrial Engineering at Cornell University. The speakers were William F. Lucas, Lloyd S. Shapley, Robert James Weber, and Louis J. Billera.

New Orleans, Louisiana

Frank T. Birtel

Associate Secretary

Council and Business Meetings

The Secretary's report of the Council Meeting held January 23 and of the Business Meeting held January 25 appeared on page 141 of the February 1979 Notices.

MARCH MEETING IN HONOLULU

The seven hundred sixty-fourth meeting of the American Mathematical Society was held at the University of Hawaii at Manoa in Honolulu, Hawaii, from Friday, March 30, through Sunday, April 1, 1979. There were 179 registrants, including 158 members of the Society.

The meeting was held in conjunction with a symposium on the Geometry of the Laplace Operator, which took place Tuesday through Friday, March 27-30. Support was received from the National Science Foundation under a grant to the American Mathematical Society. The topic was selected by the Committee to Select Hour Speakers for Far Western Sectional Meetings, whose members at the time were Paul C. Fife (chairman), David M. Goldschmidt, Robert Osseman, Rimhak Ree, and Kenneth A. Ross. The Organizing Committee for the symposium, responsible for selecting the speakers and arranging the symposium program, consisted of David Bleeker and Robert Osseman (co-chairmen), Victor Guillemin, Henry P. McKean, Jr., Karen Uhlenbeck, Joel Weiner,

By invitation of the Committee to Select Hour Speakers for Far Western Sectional Meetings, there were two invited one-hour addresses. HENRY A. DYE of the University of California, Los Angeles, lectured on "Orbit equivalence in ergodic theory; he was introduced by Edwin Hewitt. WILLIAM A. HARRIS, JR., of the University of Southern California, spoke on "Laplace integrals and factorial series in singular differential and difference equations." He was introduced by James V. Ralston.

By invitation of the same committee, there were five special sessions of invited twenty-minute papers. CHRISTOPHER J. ALLDAY, HUGH M. HILDEN, and BOB LITTLE organized a special session on "Geometric topology;" the list of speakers included Christopher J. Allday, Ronald A. Fintushel, Cameron Gordon, Hugh M. Hilden, Bob Little, Kenneth C. Millett, Robert A. Oliver, Peter Sie Pao, Nobuyuki Albert Sato, Martin G. Scharlemann, Justin R. Smith, and Ronald J. Stern. RONALD P. BROWN and THOMAS C. CRAVEN organized a special session on "Quadratic forms;" the speakers were Lawrence Berman, Craig M. Cordes, Andrew G. Earnest, Richard S. Elman, Alexander J. Hahn, J. S. Hsia, Jerrold L. Kleinsein, Tsit-Yuen Lam, Murray Marshall, Bernard R. McDonald, Takashi Ono, Paul Ponomarev, Alexander Prestel, Alex Rosenberg, Daniel B. Shapiro, Olga Taussky-Todd, Adrian R. Wadsworth, and Roger P. Ware. WILLIAM P. HANF and DALE W. MYERS arranged a special session on "Countable models;" the list of speakers included Nigel Cutland, Jörg Flum, Edgar G. K. Lopez-Escobar, Michael Makkai, Johann Andreas Makowsky, Terrence Millar, Anil Nerode, Kenneth Schilling, John S. Schlipf, James H. Schmerl, and Robert L. Vaught. NOBUO NOBUSAWA and ARTHUR A. SAGLE organized a special session on "Nonassociative algebras and applications;" the speakers were Georgia M. Benkart, Richard E. Block, Morton L. Curtis, Stephen Joseph Doro, Daniel S. Drucker, Robert Grune, John P. Holmes, Erwin Kleinfeld, Robert H. Oehmke, J. Marshall Osborn, Earl J. Taft, David A. Towers, Chester E. Tsai, Gregory P. Wene, David J. Winter, and Kiyosi Yamaguti.


There were three sessions of contributed papers, chaired by Craig M. Cordes, Peter Sie Pao, and Louis Pigno.

Thomas C. Craven was in charge of the local arrangements.

Kenneth A. Ross

Eugene, Oregon

Associate Secretary
REVIEW ON INFINITE GROUPS
edited by Gilbert Baumslag

This is a compilation of 4563 reviews on infinite group theory, extracted without change from the Mathematical Reviews, covering the years 1940 through 1970 (volumes 1 through 40) with a few related reviews from later years. For the most part only reviews of papers which are primarily concerned with infinite discrete group theory have been included. Thus almost all reviews on topological, Lie and algebraic groups have been excluded as well as a good number of reviews on the classical groups, on representation theory and on homological algebra. In addition reviews on topology, analysis and geometry with a peripheral discrete group-theoretic connection have largely been excluded.


Many reviews which are common to both finite and infinite groups have been included here. The reader should consult the volume by Gorenstein for those reviews which are mainly concerned with finite groups.

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This volume consists of a compilation of 3052 reviews on finite groups, reproduced without change from the Mathematical Reviews, covering the years 1940 through 1970 (Volumes 1 through 40). Some of these reviews pertain to both finite and infinite (discrete) groups; and in a few instances the reviews of certain relevant papers dealing solely with infinite groups have been included. In such cases, the reader should also consult Baumslag’s collection on infinite discrete groups for related reviews.

Reviews of papers in areas bordering finite group theory have been included if their emphasis was on finite group theory and have been excluded otherwise. Thus, for example, in the subject of finite geometries, reviews of papers dealing primarily with collineation groups have been included, whereas those focusing on the underlying geometry have not. In general, reviews of papers on semigroups and loops have been excluded.

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The symposium on Representation Theory of Finite Groups and Related Topics was held in honor of Professor Richard Brauer, whose fundamental work in representation theory lies at the heart of most of the further developments in this topic.

These proceedings contain articles by the participants, based on their symposium lectures. The articles range from brief surveys of results to detailed outlines of proofs, and are intended to indicate the scope of current research in representation theory.

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This book is an outgrowth of the twelfth Summer Mathematical Institute of the American Mathematical Society. It consists of the Institute lecture notes, in part slightly revised, and of a few papers written somewhat later. The program was concentrated around five major themes: linear algebraic groups and arithmetic groups, adeles and arithmetic properties of algebraic groups, automorphic functions and spectral decomposition of $L^2$-spaces of coset spaces, holomorphic automorphic functions on bounded symmetric domains and moduli problems, vector valued cohomology and deformation of discrete subgroups. The lectures fulfilled diverse needs, and accordingly the papers in this book are intended to serve various purposes: to supply background material, to present the current status of a topic, to
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These notes were originally distributed in mimeographed form to the participants in the Summer Institute and it was expected that the individual articles would be published separately. The number of requests for the notes was sufficient to warrant the publication of these proceedings even though some of these articles have appeared elsewhere.

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This volume consists of eleven articles each corresponding to one of the eleven addresses given at the Finite Groups Symposium on April 23 and 24, 1959. The three sessions of the symposium were presided over by A. A. Albert, I. N. Herstein, and I. Kaplansky and formal discussion was led by Olga Taussky-Todd and L. J. Paige, by G. de B. Robinson and D. G. Higman, and by Charles Curtis and Irving Reiner.

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It is in response to developing interest in the theory of semigroups that this book has been written.

The chief difficulty with such an exposition is that the literature is scattered over extremely diverse topics. This situation has been met by confining the book to a portion of the existing theory which has proved to be capable of a well-knit and coherent development. All of Volume 1 and the first half of Volume 2 center around the structure of semigroups of certain types (such as simple semigroups, inverse semigroups, union of groups, semigroups with minimal conditions, etc.) and their representation by mappings or by matrices. The second half of Volume 2 treats the theory of congruences and the embedding of semigroups in groups, including a modest account of the active French school of semigroups (which they call “demi-groupes”) founded in 1941 by P. Dubreil.

Volumes 1 and 2 should be thought of as a single work presenting a survey of the theory of semigroups.

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These notes arose from a series of lectures given by the author at a CBMS regional conference held at Madison, Wisconsin, from August 8–12, 1977. The conference was supported by the National Science Foundation.

The main purpose of the notes was to show how l-adic cohomology of algebraic varieties over fields of characteristic p>l can be used to get information on the representations of finite Chevalley groups.

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The past two decades have seen an extraordinary flowering of finite group theory. This monograph focuses on recent progress in the study of Sylow subgroups and their influence on the structure of the group as a whole. This research has been applied to other areas of finite group theory, including classification of simple groups, but is also of independent interest and does not require extensive background or long proofs.
In 1969, the author gave a report on this topic which appeared in the book _Finite simple groups_ (edited by M. B. Powell and G. Higman, Academic Press, 1971; MR 48 #6228). The present monograph covers progress since 1969. It includes some new results of Yoshida on transfer, a partial analogue for \( p = 2 \) of the author's "\( ZJ\)-Theorem", and the classification of all simple groups which are \( S^4\)-free, i.e., in which the symmetric group of degree four is not involved. It also includes an expository account of recent work of M. Aschbacher, B. Baumann, R. Niles, and others on "failure of factorization"; "pushing-up" arguments, and related subjects.

This is not an expository work. This work should be accessible to advanced graduate students. In particular, a semester's study in finite group theory beyond the M.A. or M.S. degree should be adequate background, e.g., Chapters 1–3 and 5–7 of Gorenstein's _Reviews on finite groups_ (Amer. Math. Soc., 1974; MR 50 #2312). The book supplements the author's report in _Finite simple groups_. Familiarity with this report is recommended but not assumed.

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This book reproduces a course of ten lectures given by the author, Karl W. Gruenberg, at an NSF Regional Conference at the University of Wisconsin–Parkside in July 1974. The aim of the lectures was twofold: to show group theorists how the representation theory of finite groups can nowadays be successfully approached with the help of integral representation theory, and to persuade ring theorists that there was an area of group theory well suited to applications of integral representation theory. The course was constructed so that only a modicum of either group theory or module theory would be presupposed of the audience. He has also drawn on lectures that he gave at the Australian Summer Research Institute held at the University of Sydney in 1971 and at the Australian National University at Canberra in 1974. The author hopes that the present account will be of use to someone wishing to learn the subject.

In Lecture 1 the author describes the group-theoretic setting from which our subject arises. Lecture 2 contains a complete discussion of relation modules over a field. The results here (but not the proofs) go back to a paper of Gaschütz in 1954. Lecture 3 collects elementary material for ease of reference later. Lecture 4 contains a proof of Swan's structure theorem for projective modules. This is given completely modulo only the non-singularity of the Cartan matrix. In Lecture 5 the study of relation modules begins by discussing projective summands and introducing the notion of relation cores and the presentation rank. The latter is studied further in Lecture 6. In Lecture 7 he discusses the question of the number of the abelianised relations: a basic result of Swan is proved and applied to these problems. In the next two lectures he explains the decomposition properties of relation cores. The last lecture places relation cores into the broader context of group theory and connects his results with general facts about extension theory.

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\[
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\]

and the author's report in _Finite simple groups_. Familiarity with this report is recommended but not assumed.

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Lengthy case analyses (based on the maximal order of elements in the loop) are then used to determine what nonassociative Moufang loops of order ≤ 63 must look like. It turns out that all of these loops are in the class considered previously, and that the constructive techniques can be used to show that all such loops actually exist.

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In this Memoir groups which satisfy commutator relations of the type satisfied by Chevalley groups, called here "groups with Steinberg relations", are shown to have certain nonassociative division algebras as parameters. This, in turn, allows an introduction of coordinates into certain polygonal geometries. The titles of the chapters are Groups with Steinberg relations, Groups of type $A_2$, Groups of type $G_2$, A Jordan algebra construction, Groups of type $B_2$, Groups of type $BC_2$, Groups of rank three and larger, Polygonal geometries, Coordinatization of projective planes, Coordinatization of hexagonal geometries, Coordinatization of quadrilateral geometries, A Lie algebra construction, and A construction of hexagonal geometries.

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by Jonathan Leech

This memoir consists of two papers, both of which deal with the heuristic border between group theory and semigroup theory, i.e., the $\mathcal{H}$-coextension problem. By an $\mathcal{H}$-coextension of a semigroup $S_0$ is meant an epimorphism of semigroups $f: S \to S_0$, such that the $f$-induced congruence on $S$ is contained in the Green's relation, $\mathcal{H}$. The $\mathcal{H}$-coextension problem consists of determining how $S$ is built from $S_0$ and from groups.

In the first paper, the $\mathcal{H}$-coextension problem is studied for arbitrary (i.e., not necessarily reduced) monoids. The condition of an identity is added only for convenience, since, if one is careful, this leads to no real loss in generality.

In the second paper of this memoir the $\mathcal{H}$-coextension problem is studied for the case where the underlying semigroup is a band, i.e., a semigroup of idempotents.

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FINITE GROUPS WHOSE 2-SUBGROUPS ARE GENERATED BY AT MOST 4 ELEMENTS
by Daniel Gorenstein and Koichiro Harada

The object of this memoir is to determine all finite simple (and more generally fusion-simple) groups each of whose 2-subgroups can be generated by at most 4 elements. Using a result of MacWilliams, the authors obtain as a corollary the classification of all finite simple groups whose Sylow 2-subgroups do not possess elementary abelian normal subgroups of order 8.

The general introduction provides a fairly detailed outline of the over-all proof of the main classification theorem, including the methods employed. The proof itself is divided into six major parts; and the introductory section of each part gives a description of the principal results to be proved in that part.

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This volume is a translation from the Russian of D. A. Suprunenko’s book which was published in the Soviet Union in 1972. The translation was edited by K. A. Hirsch. The book gives an account of the classical results on the structure of normal subgroups of the general linear group over a division ring, of Burnside’s and Schur’s theorems on periodic linear groups, and of the theorem on the normal structure of $SL(n,\mathbb{Z})$ for $n > 2$. The theory of solvable, nilpotent, and locally nilpotent linear groups is also discussed.

The chapter headings are as follows: “Elements of the theory of permutation groups,” “The general linear group,” “The normal structure of the groups $GL(n, \Delta)$ and $GL(n, \mathbb{Z})$, $n > 2$,” “Reducibility and imprimitivity,” “Solvable matrix groups,” “Periodic linear groups,” and “Nilpotent and locally nilpotent matrix groups.”

The book also contains a subject index and one hundred thirty-three references.

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SOLUBLE AND NILPOTENT LINEAR GROUPS
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Translated by K. A. Hirsch

The author of this book has made an attempt in his articles to develop a systematic investigation of linear soluble groups under various assumptions about the ground field $F$. The following cases are discussed: (1) $P$ is an arbitrary field, (2) $P$ is a finite field, (3) $P$ is an algebraically closed field, (4) $P$ is the field of real numbers. In a number of other papers he has studied nilpotent subgroups of the full linear group.

The present work essentially represents a synthesis of all the author’s papers on linear soluble and on linear nilpotent groups.

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This book has the goal of setting forth the basic aspects of the algebraic theory of semigroups. From the Preface to the third edition: “During the past five years, the rate of development of the theory of semigroups has continued to increase. The theory has enjoyed a substantial enrichment through the large number of new results obtained in its various subdivisions. Nevertheless, just as remarked in the preface to the preceding edition concerning the period from 1958 to 1966, it can be said again that the general aspect and character of the theory is basically unaltered. As a consequence, the earlier presentation can be retained.”

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by Ju. I. Hmelevskii

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Word equations are connected with Diophantine equations. Namely, to each word equation it is possible to assign a Diophantine equation in such a way that there exists a one-to-one correspondence between the solutions of both equations.

The investigation of word equations may be useful in the study of equations in free groups, a problem having great significance for the elementary theory of free groups.

This monograph is intended for advanced undergraduates, graduate students and scientists interested in algorithmic problems.

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Algebra and Theory of Numbers (05, 06, 08, 10, 12–18, 20)


An odd perfect number has at least 8 prime factors. Preliminary report.

Lemma 1. The number \( n \) are divisible by at least 4 or 5 distinct primes \( \equiv 1 \mod 3 \), accordingly as \( 3 \nmid \sigma(m^2) \) or \( 3 \nmid \sigma(m^2) \) respectively.

Lemma 2. If \( 3^6 \nmid \sigma(m^2) \), then \( n \) is divisible by at least 5 distinct primes \( \equiv 1 \mod 5 \).

Lemma 3. Let \( t = 7 \) and \( 3^6 \nmid \sigma(m^2) \).

Theorem A. (termination) If \( x_1, \ldots, x_n \) are \( \mathbb{Z} \)-linearly dependent then Algorithm \( A_n \) applied to \( x = (x_1, \ldots, x_n) \) terminates in the sense that for some \( k \leq 1 \), \( M_k \) is generated in \( \text{GL}(n, \mathbb{Z}) \) such that a column of \( M_k \), \( m \neq 0 \in \mathbb{Z}^n \), \( m \) with relatively prime integer coordinates, is a \( \mathbb{Z} \)-relation for \( x \), \( x_m = 0 \).

Theorem B. (generalized Dirichlet and Kronecker theorems). Let \( l = x_1, \ldots, x_n \) be \( \mathbb{Z} \)-linearly independent real numbers. Let \( N_k \) be the first column of \( P_k \) from Algorithm \( A_n \). Then the matrix \( N_k x - P_k \) approaches zero as \( k \) approaches infinity. Consequently, dividing a row of \( P_k \) by its first element \( q_k \) gives simultaneous rational approximations to \( x \) of the order \( o(1/q_k) \).
for large $k$ give $n$ $R$-linearly independent lattice points each arbitrarily close in absolute Euclidean distance to the line $xR$. A spanning $Z$-module $S$ in $R^n$ is dense in $R^n$ if and only if there exists an arbitrarily small $Z$-basis for $S$. \textbf{Theorem C.} (exclusion) For each $k$, form the extended hyperplane matrix for $x$, $Q_k$, whose columns transposed are the vertices of the intersection polytope $/M_k/n x^n$. There are no $Z$-relations for $x$ in the interior of this polytope. For any $Z$-relation $m$ for $x$, height($m$) $> 1/\text{height}(P_k Q_n)$. Also, $P_k Q_n$ approaches zero as $k$ approaches infinity iff $x_1, \ldots, x_n$ are $Z$-linearly independent. Similar theorems obtain for complex numbers. Algorithm $A_n$ will find the gcd of $n$ integers, may be used to find the minimum polynomial of a known algebraic number and applies to questions of $Z$-algebraic dependence. As a numerical corollary, the height of any quintic polynomial satisfied by Euler's constant exceeds $10^{14}$. (Received February 12, 1979.)

*79T-A104 WITHDRAWN

*79T-A105 JAMES R. SCHATZ, Syracuse University, Syracuse, N.Y. 13210. The 2nd order Reed-Muller code of length $64$ has covering radius $18$.

Let $CR(r,m)$ denote the covering radius of the $r$-th order Reed-Muller code of length $2^m$. The assertion of the title is proved by first noting that $CR(2,6)$ is at most $CR(2,5) + CR(1,5) = 6 + 12$, and then proving that the coset corresponding to the binary function $f(x_1, \ldots, x_6) = (x_6 + 1)(x_1 x_2 x_3 + x_1 x_4 x_5 + x_2 x_3 + x_2 x_4 + x_3 x_5) + x_6(x_1 x_2 x_3 + x_1 x_4 x_5)$ has minimum weight $18$. $CR(r,m)$ is now known for all $m \leq 6$ and $0 \leq r \leq m$. (Received February 22, 1979.)

79T-A106 HENRY ROSE, Vanderbilt University, Nashville, Tennessee 37235. Varieties generated by splitting lattices $Q_1$, $Q_2$, $Q_3$ and $N$.

For the definition of a splitting lattice, and for the examples $Q_1$, $Q_2$ and $Q_3$, $Q$ and $N$ used below, see R. McKenzie, Equational basis for non-modular lattice Varieties, Trans. Amer. Math. Soc. 174 (1972), 1-45. Let $D[a]$ be the lattice obtained from the lattice $D$ by doubling $a \in D$. E.g., taking $D_n = 2^n$ and $a$ an atom, we get a sequence $Q_{2^n} = D_n[a]$ with $Q_2^0 = Q_2$. Another such sequence, $Q_3$, has $Q_3$ and $Q$ as its first two terms. $Q_1$ is the lattice shown in the diagram.

Theorem 1. Each of the varieties $\{N_n\}_n$, $\{Q_2^0\}_n$, $\{Q_3^0\}_n$ and $\{Q_1\}_n$ has a unique join-irreducible cover, the varieties generated by $N_{n+1}$, $Q_2^{n+1}$, $Q_3^{n+1}$ and $Q_1^n$ respectively.

Theorem 2. Suppose $D$ is a finite distributive lattice and $0, 1 \neq a \in D$. Then $D[a]$ is subdirectly irreducible iff (i) every cover of $a$ in $D$ is join-irreducible, (ii) every dual cover of $a$ in $D$ is meet-irreducible, and (iii) every prime quotient in $D$ is projective to some quotient $x/y$ with $x = a$ or $y = a$. (Received February 23, 1979.)

*79T-A107 N. SMYTHE, Australian National University, Canberra, Australia. A presentation for the kernel of $GL(n, Z) \oplus GL(n, Z_2)$.

Let $\Lambda_n$ denote the kernel of the above natural map, i.e. $\Lambda_n$ consists of $n \times n$ invertible integer matrices with odd entries on the diagonal, even entries off diagonal; let $\Gamma_n$ denote the subgroup whose diagonal entries are congruent to $1$ modulo $4$. Then $\Gamma_n$ is normal and $\Lambda_n$ is a split extension of $\Gamma_n$ by the subgroup of diagonal matrices, the latter being an elementary abelian $2$-group.

A-366
\[ \Gamma_n \text{ is generated by matrices } B_{ij}, 1 \leq i, j \leq n, \ i \neq j, \text{ where } B_{ij} \text{ has an entry } 2 \text{ in the (i,j) position and is otherwise the identity. It is shown that a complete set of defining relations for } \Gamma_n \text{ is} \]
\[ B_{ij} = B_{ik} - B_{kj}, B_{ij} = B_{kl} \]
\[ [B_{ij}, B_{ik}] = B_{ik} \]
\[ [B_{ij}, B_{jk}] = (B_{ik} B_{kl})^{-1} \]

for distinct \( i, j, k, l \), where \( [B, C] = BCB^{-1}C^{-1} \) and "\( \cdot \)" means "commutes with". This presentation for \( \Gamma_n \) is easily extended to a presentation for \( \Lambda_n \). (Received February 26, 1979.)

**79T-A108**

LOUIS D. NEL, Carleton University, Ottawa, Ontario, Canada, K1S 5B6.

Adjunctions in enriched categories of topological algebra. Preliminary report.

Let \( \mathcal{W} \) be a convenient category (e.g., convergence spaces, compactly generated spaces) with internal hom \( V: \mathcal{W}^\times \to \mathcal{W} \). Let A be strongly algebraic over \( \mathcal{W} \) i.e. A is equipped with functors \( |\cdot|: \mathcal{A} \to \mathcal{W} \) and \( \Gamma: \mathcal{W}^\times \times \mathcal{A} \to \mathcal{A} \), where \( |\cdot| \) is regular (H. Herrlich, Regular categories and regular functors, Canad. J. Math. 26 (1974) 709-720) and \( |\cdot| \Gamma = V(1d \times |\cdot|) \). Examples of such A: groups, rings, modules etc. formed over \( \mathcal{W} \). Strongly algebraic categories are stable under formation of (regular epi)-reflective subcategories. They allow construction of functors \( V: \mathcal{A} \times \mathcal{A} \to \mathcal{W}, \otimes: \mathcal{W} \times \mathcal{A} \to \mathcal{A}, \otimes: \mathcal{A} \times \mathcal{A} \to \mathcal{A} \) such that the following hold. A is a \( \mathcal{W} \)-category via \( \otimes \) and cotensored by \( \Gamma \). Universal bimorphisms exist through \( \otimes \). When A admits an internal hom \( \Omega: \mathcal{W} \times \mathcal{A} \to \mathcal{A} \) with natural embedding \( \mathcal{A} \otimes \mathcal{B} = |\cdot| \Gamma \mathcal{B} \) and \( |\cdot| \otimes = \otimes \) (e.g. abelian groups, vector spaces or semilattices) then there is a natural isomorphism \( (\mathcal{A} \otimes \mathcal{B}) \mathcal{W} \mathcal{C} = \mathcal{A} \mathcal{B} \mathcal{C} \) and A becomes a closed category. The above enriched adjunctions in general do not exist in classical topological algebra (when the non-closed category of topological spaces forms the base category).

(Received April 3, 1979.)

**79T-A109**

Kenneth S. Williams, Carleton University, Ottawa, Ontario, Canada, K1S 5B6.

The class number of \( Q(\sqrt{-2p}) \) modulo 16.

Let \( p = 1 \mod 8 \) be a prime. Define \( E_p = 1, -2 \) or \( 2 \) according as \( x^2 - 2py^2 = -1, -2 \) or \( +2 \) is solvable in integers. The fundamental unit of the real quadratic field \( Q(\sqrt{-2p}) \) is written

\[ T + U\sqrt{-2p} \]

It is proved that

1. \( h(-2p) = h(2p) \mod 16 \), if \( p = 1 \mod 16 \), \( E_p = -1 \);
2. \( h(-2p) = 0 \mod 16 \), if \( p = 1 \mod 16 \), \( E_p = -2 \);
3. \( h(-2p) = 2h(2p) \mod 16 \), if \( p = 1 \mod 16 \), \( E_p = +2 \), \( h(2p) = 0 \mod 4 \);
4. \( h(-2p) = 2h(2p) - 2U - 4 \mod 16 \), if \( p = 1 \mod 16 \), \( E_p = +2 \), \( h(2p) = 2 \mod 4 \);
5. \( h(-2p) = h(2p) + 4T - 4 \mod 16 \), if \( p = 9 \mod 16 \), \( E_p = -1 \);
6. \( h(-2p) = 2U + 8 \mod 16 \), if \( p = 9 \mod 16 \), \( E_p = -2 \);

where \( h(2p) \) is the class number of the quadratic field \( Q(\sqrt{2p}) \). The case \( p = 9 \mod 16 \), \( E_p = -2 \) cannot occur. (Received March 6, 1979.)

**79T-A110**

MILICA M. DANKOVIĆ, Zetska 6/36, 18000 Niš, Yugoslavia. The number of knot graphs with \( n \) points and \( n, n-1, n-2, n-3 \) pairs of multiple lines.

The knot graph is a graph which is minimal plane projection of the knot. The problem is to determine the number of knot graphs \( G_{n,s} \) with \( n \) points and \( s \) pairs of multiple lines. For \( G_{n,s} \) is \( |G_{n,s}| = 0, n = 2k, k \equiv 2 \); \( G_{n,n} = 1, n = 2k + 1, k \equiv 1 \); \( G_{n,n-1} = 0, G_{n,n-2} = (n-2)/2, n = 2k, k \equiv 2 \); \( G_{n,n-3} = (n-2)/2, n = 2k + 1, k \equiv 1 \); \( G_{n,n-3} = (5(n-4)^2 - 4)/16, n = 4k, k \equiv 1 \); \( G_{n,n-3} = (5(n-4)^2 - 4)/16, n = 4k + 2, k \equiv 1 \);

\[ G_{n,n-3} = (n-5)(7(n-13)/24, n = 6k + 1, n = 6k - 1, k \equiv 1 \); \( G_{n,n-3} = (n-5)(7(n-13)/24, n = 6k + 3, k \equiv 1 \).

(Received March 8, 1979.)
Let $K$ be an arbitrary but fixed field. Denote by $(V,G)$ a representation of a group $G$ in a vector $K$-space $V$ and by $L(V,G)$ the lattice of all $G$-invariant subspaces of $V$. Question: which lattices can be realized as $L(V,G)$ for suitable $(V,G)$?

**Theorem.** For every partially ordered set $\Lambda$ there exists a representation $(V,G)$ such that $L(V,G) \cong 2^\Lambda$.

**Corollary.** For every finite distributive lattice $L$ there exists a representation $(V,G)$ such that $L(V,G) \cong L$.

This theorem is parallel to the main result of H.L. Silcock (Algebra Univ. 7 (1977), 361-372) but its proof is substantially simpler. It is based on the technique of infinite triangle products of group representations (see S.M. Vovsi, Math. Slovaca 27 (1977), 337-358). (Received March 8, 1979.)

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**79T-All2 A.I. BASHKIROV, Warsaw University, Warsaw, Poland; Ivanovo Textile Institute Ivanovo, USSR. Groups of automorphisms of maximal almost-disjoint families.**

A 1-1 map $f$ of $\mathbb{N}$ onto $\mathbb{N}$ is called an automorphism (almost identical) of a maximal almost-disjoint family $R$ (MADF) if $f(\mathbb{N}) = \mathbb{N}$ (if $f$ is an automorphism such that $\exists A \in 2^\mathbb{N}$ such that $f(A) = A$ and $f|_{A^c} = \text{id}_{A^c}$). Here $A = B$ means that the symmetric difference of $A$ and $B$ is finite. The group of all automorphisms (all almost identical automorphisms) of $R$ is denoted by $\text{Aut}(R)$ ($\text{Aut}_a(R)$).

The groups are isomorphic iff the corresponding MADF's are isomorphic. If every MADF is of cardinality $c = \exp \omega$, then there exist exactly $\exp c$ pairwise non-isomorphic MADF's $R$ such that $\text{Aut}(R) \cong \text{Aut}_a(R) \times G$, where $G$ is an arbitrary countable group.

The following is a consequence of generalizations of some our results to higher cardinals: 1. there exist $|X|^+$ (exp $|X|$) pairwise different set-transitive subgroups of $S(X)$ (if exp $m \leq |X|$ for all $m < |X|$), 2. there exist exp$(|X|^+)$ pairwise non-isomorphic maximally transitive subgroups of $S(X)$ if exp$(|X|^+) > |X|$; the number of such subgroups of $S(X)$ is exp exp$|X|$, if exp $m \leq |X|$ for all $m < |X|$.

(Received March 12, 1979.)

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**79T-Al33 MICHAEL MAKKAI, McGill University, Montreal, Quebec, Canada H3A 2K6 Full continuous embeddings of Grothendieck toposes.**

An object $P$ in a (Grothendieck) topos is said to be prime if the least upper bound of the proper subobjects of $P$ is not the maximal subobject of $P$. A topos is prime-generated if its prime objects form a family of generators. A functor between toposes is continuous if it is left exact and has a right adjoint. For more terminology, see SLN in Math., no. 611. **Theorem 1.** Let $E$ be a prime-generated coherent topos, $K$ the category of all continuous functors $E \to \text{SET}$. Then the evaluation functor $E \to (K,\text{SET})$ is a continuous full embedding. In this statement, $K$ can be replaced by suitable small subcategories. **Corollary 2.** (M. Barr, SNL in Math., no. 236) Any small finitely complete regular category has an exact full embedding into $(\text{C,SET})$ for a small category $\text{C}$. For a functor $M: E \to \text{SET}$, End($M$) is the monoid of natural transformations $M \to M$, $\text{Aut}(M)$ the group of automorphisms of $M$. For a submonoid $C \subseteq \text{End}(M)$ and a functor $F: C \to \text{SET}$, $F$ has the finite support property (f.s.p.) if for every $a \in M(X)$ there is $x \in |E|$ and $x \in M(X)$ such that $g_M(x) = h_M(x)$ implies $F(g)(a) = F(h)(a)$ whenever $g$, $h \in C$. A topos is atomic if it is generated by its atoms, i.e., non-zero objects with no non-trivial subobjects; it is connected if the terminal object is an atom (see M. Barr and R. Diaconescu, Atomic Toposes, to appear in J. Pure and Applied Algebra).

**Theorem 3.** Let $E$ be a connected atomic topos, and let $E$ be either coherent or separable. Then there is a $C: E \to \text{SET}$ such that whenever $\text{Aut}(M) \subseteq \text{End}(M)$ then the evaluation functor ev: $E \to (C,\text{SET})$ is a continuous full embedding and $F: C \to \text{SET}$ is isomorphic to ev$(E)$ for some $E \in |E|$ iff $F$ has the f.s.p. property. **Corollary 4.** For $E$ as in Theorem 3, there is a topological group $G$ such that $E$ is equivalent to the category of discrete $G$-sets. Corollary 4 is a version of an earlier result due to A. Joyal. An example due to J. Gregory, J. Symbolic Logic 36(1971), 445-455 shows that there are atomic toposes without any continuous functor to SET. (Received March 12, 1979.)
Representation of certain classes of distributive lattices by sections of sheaves.

Epstein and Horn [P-algebras, an abstraction of Post algebras, Algebra Universalis, 4(1974)] proved that a Post algebra is always a P-algebra and in a P-algebra, prime ideals lie in disjoint maximal chains. In this paper it is shown that a P-algebra L is a Post algebra of order n if the prime ideals of L lie in disjoint maximal chains each with n-1 elements. The main tool used in this paper is that every bounded distributive lattice is isomorphic with the lattice of all global sections of a sheaf of bounded distributive lattices over a Boolean space. Also some properties of P-algebras are characterized in terms of the stalks. (Received March 12, 1979.) (Authors introduced by Dr. D. Suryanarayana).

Formulas for the nth prime.

The following two formulas for the nth prime were derived using Operator Number Theory:

\[ p_n = 1 + (n + 1) \sum_{k=1}^{n} \frac{1}{k} - n + \sum_{k=2}^{n} \frac{k}{2^n} \left( \sin \left( \frac{\pi}{k} \right) \right) + \sum_{k=1}^{n} \frac{1}{k} \sum_{j=1}^{k-1} \left( \sin \left( \frac{\pi}{k} \right) \right) / (2j+1) / 2 \sin \left( \frac{\pi}{k} \right) / (2j+1) \]

\[ p_n = 1 + (n + 1) \sum_{k=1}^{n} \frac{1}{k} - n + \sum_{k=2}^{n} \frac{\left( \left\lfloor \frac{k}{n} \right\rfloor \right) \left( \left\lfloor \frac{k}{n} \right\rfloor - 1 \right) k}{2^n} + 2 \sum_{k=2}^{n} \frac{c_k}{2^n} \left( n - 1 \right) \sum_{j=2}^{n} c_j \]

where \( \left\lfloor \frac{k}{n} \right\rfloor \) is the greatest integer function and \( c_0 = 2 \) is a sequence determined recursively and for \( n = 2 \) to 12, \( c_n \) has the following values: \( -1/2; -1/6; 1/12; 17/60; 3/20; 22/105; 1/840; 1/091/5; 040; 985/3; 024; -1,387/33,264; 56,317/166,320 \). (Received March 13, 1979.)

Classes of completely distributive complete lattices.

Let \( L \) be the class of completely distributive complete lattices and let for \( L \in L \), \( \text{Con}(L) \) denote the complete lattice of congruence relations (with respect to finite and infinite joins and meets). Consider the following subclasses of \( L \): \( \mathcal{L} \), \( \mathcal{R} \) and \( \mathcal{R}^* \). Let \( L \in \mathcal{L} \) is a complete ring of sets for all \( \mathcal{L} \in \text{Con}(L) \) if \( L \in \mathcal{L} \). (Note that complete atomic Boolean algebras and complete (dual ordinals belong to \( \mathcal{L} \).)

Theorems:
1. If \( L \) is a complete chain, then \( \text{Con}(L) \) is a Heyting algebra (but not necessarily a Boolean algebra).
2. If \( L \in \mathcal{L} \) and \( L \) is countable then \( L \in \mathcal{R} \).
3. If \( L \in \mathcal{L} \)
   then \( L \in \mathcal{R}^* \) if \( \text{Con}(L) \) is a power algebra.
4. If \( L \in \mathcal{L} \) then \( L \in \mathcal{R} \) if \( L \in \mathcal{R}^* \) for all \( \mathcal{L} \in \text{Con}(L) \).


Let \( r(n) \) be the number of representations of \( n \) as a sum of two squares, and \( d(n) \) the number of divisors of \( n \). Define the functions \( P(x) \) and \( \Delta(x) \) by the equations:

\[ P(x) = \sum_{n \leq x} r(n) - \pi x \]

and

\[ \Delta(x) = \sum_{n \leq x} d(n) - x \log x - (2\gamma - 1)x, \]

where \( \gamma \) is Euler's constant. One can show that

\[ P(x) = \frac{1}{2} \left( (x \log x)^{1/4} (\log \log x)^{1/3} - (x \log x)^{1/4} (\log \log x)^{1/3} \right) \]

and

\[ \Delta(x) = \frac{1}{2} \left( (x \log x)^{1/4} (\log \log x)^{1/3} (x \log x)^{1/4} (\log \log x)^{1/3} \right), \]

where \( \gamma = \gamma(x) \) is any function which tends to infinity with \( x \). The proof involves a slight modification of the method of Hardy and Landau. In the case of \( \Delta(x) \), the result appears to be "best possible" by this method. (Received March 16, 1979.)
An augmented compact space is defined to be a compact Hausdorff space $X$ together with a set $A$ of closed subsets of $X$ such that $A$ is closed under intersections and each element $C$ of $A$ is the intersection of those elements of $A$ that contain $C$ in their interior. $A$ is said to augment $X$. For example, every compact Hausdorff space is augmented by its closed subsets, every compact convex subset of a locally-convex Hausdorff topological vector space is augmented by its closed convex subsets, and any compact poset is augmented by its closed up-sets.

If $(X,A)$ is an augmented compact space, then $A$ ordered by reverse-inclusion is a continuous lattice. This is a functor from a category whose objects are augmented compact spaces to a category whose objects are continuous lattices and additionally, by a suitable restriction of domain and codomain, this is an equivalence of categories. The codomain of this equivalence has as its objects those continuous lattices in which the set of meet-irreducibles is Lawson-closed. (Received March 19, 1979.)

Suppose graph $G$ has a chromatic number $X$. Let $n$ be the number of vertices of $G$ and $q$ be the number of edges in $G$'s complement $G'$. Further, let $S = n + 2q$ and define $I$ by: $\min(S - n^2/120) = (S - n^2/I)$, where $I$ is taken over all positive integers.

Now represent $G'$ by a quadratic expression $\sum_{i=1}^{n} x_i^2 + \sum_{1 \leq j < k \leq n} 2x_jx_k$, where $x_i$ represents the $i$-th vertex and $2x_jx_k$ represents the edge in $G'$ that joins the $j$-th and $k$-th vertex.

The following two theorems imply the result of this paper, $I \leq X$.

Theorem 1. The least number of perfect squares contained in a quadratic expression representing a graph equals the chromatic number of the graph's complement.

Theorem 2. If $c$ is the least number of perfect squares of a quadratic expression, then $I \leq c$, where $I$ corresponds to the graph represented by the quadratic. (Received March 19, 1979.)

This is a continuation of "Duality in topological algebra" (Bull. Austral. Math. Soc., 18 (1978), 475-480 and 19 (1978), 157-158). Conditions under which the category $P$ of pro-$A$-objects in a complete category $C$ (relative to a small hereditary and finitely productive set $A \subset C$ of "models") is reflective in $C$ are examined; in this case $P$ is equivalent to the limit closure of $A$ in $C$, and the connection with uniformity and objects with no small subobjects is discussed. Definition: If $U: C \rightarrow D$ then $G: A \rightarrow En\alpha$ is called $U$-copresentable if there exists an equaliser diagram of the form: $\text{G} \rightarrow \text{D}(U,-) \rightarrow \text{D}'(U,-): A \rightarrow En\alpha$. The $U$-copresentable functors form a category $G \subset [A,En\alpha]$ of algebras (i.e. finite-limit-preserving functors). In fact the embedding is reflective as a consequence of the Theorem: If $C$ is a full reflective subcategory of some $\mathcal{B}$ where $\mathcal{B}$ is monadic over $\mathcal{D}$ (via an extension of $U$) then there is a duality $P^{op} \cong G$. (Received March 19, 1979.)

Let $X$ be a set, let $C \subset X$, let $m$ be a positive integer, and let $g \subset X \times X$ be a function. At the 1977 Annual Southeastern Conference on Combinatorics, Graph Theory and Computing Science, D. M. Silberger presented a proof of his observation that if $C$ is finite and if $g^m|_{X \times C}$ is a bijection from $X \times C$ onto $X$, then $m$ is a factor of $|C|$. We now announce a related fact. Definition: The quadruple $(X,C,m,g)$ is called liable if $\bigcup_{0 < \ell \leq m} g^\ell([m]) \subset g^m|_{X \times C}$ and $g^m|_{X \times C}$ is injective and $C \subset \text{Dom}(g^m)$. Theorem: If $C$ is finite and if $(X,C,m,g)$ is liable, then $m$ is a factor of $|C|$. (Received March 19, 1979.)
We examine the connections between maximum cardinality edge matchings in a graph and optimal solutions to the associated linear program, which we call maximum f-matchings (fractional matchings). We say that a maximum matching \( M \) separates an odd cycle with vertex set \( S \), if \( M \) has no edge with exactly one end in \( S \). An odd cycle is separable if it is separated by at least one maximum matching. We show that (1) a graph \( G \) has a maximum f-matching that is integer, if and only if it has no separable odd cycles; (2) the minimum number \( q \) of vertex-disjoint odd cycles for which a maximum f-matching has fractional components, equals the maximum number \( s \) of vertex-disjoint odd cycles, separated by a maximum matching; (3) the difference between the cardinality of a maximum f-matching and that of a maximum matching in \( G \) is one half times \( s \); (4) any maximum f-matching with fractional components for a minimum number \( s \) of vertex-disjoint odd cycles defines a maximum matching obtainable from it in \( s \) steps; and (5) if a maximum f-matching has fractional components for a set \( Q \) of odd cycles that is not minimum, there exists another maximum f-matching with fractional components for a minimum-cardinality set \( S \) of odd cycles, such that \( S \subseteq Q \), \( |Q \setminus S| \) is even, and the cycles in \( Q \setminus S \) are pairwise connected by alternating paths. (Received March 19, 1979.)

H. F. MATTSON, JR. (CIS) and JAMES R. SCHATZ, Syracuse University, Syracuse, N.Y. 13210 Solution of a problem of Sloane and Dick. In IEEE Intern. Conf. on Commun. 7 (Montreal 1971), 36-2 to 36-6, Sloane and Dick ask for a characterization of "structure codes" of coset leaders of the binary simplex code of type \((2^m-1, m, 2^m-1)\). The answer is that an \((n, n-k, d)\) code \( A \) with \( 2^m-2 \leq n < 2^n-1 \), \( k \leq m \), and \( d \geq 3 \) is such a structure code iff the maximum weight \( \overline{d} \) of the orthogonal code \( A^\perp \) satisfies \( \overline{d} \leq 2^{m-2} \). We raise and answer the related question, to characterize the structure codes of coset leaders of the punctured 1st-order Reed-Muller code of type \((2^m-1, l+m, 2^{m-1})\). These structure codes are:

(i) the \((n, n-k, d)\) codes \( B \) with \( 2^{m-2} \leq n < 2^n-1 \), \( k \leq m \), and \( d \geq 3 \) iff \( k = m \) and the orthogonal code \( B^\perp \) has minimum weight \( d \geq n-2^{m-2}+1 \) and maximum weight \( \overline{d} \leq 2^{m-2} \), and

(ii) the \((n, n-k, d)\) codes \( C \) with \( 1 \leq n < 2^{m-2} \), \( k \leq m \), and \( d \geq 3 \).

(Received April 3, 1979.)

Francisco Thaine Prada, Instituto de Matematica Pura e Aplicada, Rio de Janeiro, 20,000 Brazil. Polynomials generalizing binomial coefficients and their applications to the study of Fermat's Last Theorem.

We study the operation defined by \( Q(X) \cdot P(X) = \prod_{i=0}^{n} Q(X^i) \) where \( Q(X) \) and \( P(X) = r_0 + r_1 X + \ldots + r_n X^n \) are polynomials over \( N \). We define \( \left[ \frac{P(X)}{k} \right] \) inductively using \( \left[ \frac{P(X)}{k} \right] = \left[ \frac{P(X)}{k} \right] + X \left[ \frac{P(X)}{k-1} \right] \) and express it as a sum of terms of the form \( p(X) t_1 p(X^2) t_2 \ldots p(X^k) t_k \) with suitable coefficients. Let \( p \geq 5 \) be a prime, \( \xi \) a primitive \( p \)-th root of 1, \( a, b, c \) in \( Z \) with \( a^p + b^p = c^p \), and \( A_\xi(p) = \prod_{k=1}^{p-1} (a + b \xi^k)^{p^k} \). Theorems. 1) For each odd \( r \) with \( 1 \leq r \leq p-4 \) either \( p \) divides the Bernoulli number \( B_{r+1} \) or \( A_\xi(p) \equiv a^p \) for some \( a \in Z[\xi] \). 2) Let \( p \) of \( \chi \) be \( \leq \frac{b}{a} \) (mod \( p \)) and \( 1 \leq r \leq p-3 \). Then \( A_\xi(p) \equiv q^p \) (mod \( p(p-1) \)) for some \( q \in Z \) if and only if \( \sum_{k=1}^{p-1} \chi^k = \sum_{k=1}^{p-2} \chi^k = 0 \) (mod \( p \)). The congruences of Kummer-Mirimanoff are easy corollaries. (Received March 26, 1979.) ( Introduced by Professor T. M. Viswanathan.)

W. POGUNTKE and B. SANDS, Lakehead University, Thunder Bay, Ontario. On finitely generated lattices of finite width. A tower of width \( n \) \((n \in \omega)\) is a partially ordered set \( \{ a_{ij} \mid i \in \omega, 1 \leq j \leq n \} \) with the ordering: \( a_{ij} < a_{ik} \) iff \( i > k \). Theorem 1. A finitely generated lattice \( \omega \) is a tower of width \( n \).
lattice of width $n+1$ ($n \geq 2$) cannot contain a tower of width $n$ as a subset. \qed

Using a recent result of H. Bauer and W. Poguntke, we can prove: Theorem 2. Every finitely generated subdirectly irreducible lattice of width three is finite. \qed

Corollary. The variety of lattices of primitive width three is generated by its finite members. (Received March 26, 1979.)

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**79T-A126**
RENUS LASKAR, Clemson University, Clemson, South Carolina 29631
Partial d-space. Preliminary report.

Let $P$ be a system consisting of non-empty collection of objects called $j$-dimensional sets (or $j$-sets) $S_j$, where $0 \leq j \leq d-1$, $j$ and $d$ are integers $\geq 0$, together with an incidence relation. $P$ will be called a partial $d$-space if the following conditions are satisfied: I. Inclusion Property: If $j < k < l$ and if $S_j \subseteq S_k$, $S_k \subseteq S_l$, then $S_j \subseteq S_l$. II. Intersection Property. (a) If for a pair of distinct $k$-sets, $1 \leq k \leq d-1$, say $S_k$ and $S_2$, $j$ is the largest integer with $0 \leq j \leq k$, such that $(S_k \cap S_j) \supseteq S_j$, then there exists a unique $S$ such that $S_k \cap S_j = S$. (b) Given $S_j$ and $S_k$ with $S_j \cap S_k = \emptyset$ and $S_j$ and $S_k$ are co-$k$-set, then the number of $S_j$'s $\geq S_k$ intersecting $S_j$ in a $S_m$ set depends only on the numbers $i$, $j$, $k$, $l$. III. (a) For $j$, such that $2 \leq j \leq d-1$, let $S_j$ be any $j$-set. A partial $j$-space is formed by the $k$-sets, incident with a $S_j$, where $0 \leq k < j$. IV. Duality Property. The principle of duality holds. If $d = 2$, $P$ is a $(r,k,t)$ partial geometry due to Bose. $d = 3$ gives partial geometry of dimension three due to Laskar and Dunbar. Some examples of partial $d$-space are given. (Received March 27, 1979.)

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**79T-A127**
SURINDER SINGH BEDI and JAI RAM, Department of Mathematics, Panjab University, Chandigarh-160014, India. Jacobson radical of skew polynomial rings and skew group rings.

Let $R$ be a ring and $\sigma$ an automorphism of $R$. We prove the following results: (i) $J(R_\sigma[x]) = \sum_{i=1}^{d(A)} T_i$ where $T_i \in J(R)$, and $T_i \subseteq J(R_\sigma[x])$. Further if order of $\sigma$ is finite then $J(R_\sigma[x]) \cap R$ is nil and $J(R_\sigma[x]) = J(R_\sigma[x]) \cap R_\sigma[x]$ (ii) $J(R_\sigma < x >) = (J(R_\sigma < x >) \cap R_\sigma[x]$). As an application of the first result we prove that if $A$ is a nil algebra over a nondenumerable field and $\sigma$ is an automorphism of $A$, of finite order, then $A[x]$ is nil. We use the second result to prove that if $G$ is a solvable group such that $G$ and $R$, $+$ have disjoint torsion then $J(R) = 0$ implies $J(R[G]) = 0$. (Received March 29, 1979.)

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**79T-A128**
Ludvik Janos, Mathematical Reviews, Ann Arbor, Michigan 48109. On a degree of noncommutativity in groups.

If $X$ is a set and $n$ a positive integer we denote by $X^{[n]}$ the set of all subsets of $X$ with cardinality $n$. Let $G$ be a group and $n$ a fixed integer. To every $A = \{e_1, e_2, \ldots, e_n\} \subseteq G^{[n]}$ we assign an integer $d(A)$, called the degree of noncommutativity of $A$, as the number of distinct values of the product $e_{i_1}(1) \cdot e_{i_2}(2) \cdots e_{i_n}(n)$ where $i_1$ varies through all the $n!$ permutations of $\{1, 2, \ldots, n\}$. Using the Ramsey combinatorial theorem for infinite cardinals we obtain Theorem. Given an infinite group $G$ and an integer $n$, there exist an infinite subset $I \subseteq G$ and an integer $r$ with $\leq n!$ such that $d(A) = r$ for every $A \subseteq G^{[n]}$. Corollary. If $G$ is an infinite group without infinite abelian subgroups, (the existence of such groups has been proved recently) then there exists an infinite subset $I \subseteq G$ of pairwise non-commuting elements; this means $e_1 e_2 e_1$ and $e_1 e_2$ implies $e_1 e_2 e_1 e_2$. Question. What is the largest possible cardinality for the set $I$? (Received March 30, 1979.)

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**79T-A129**
Ronald J. Evans, University of California at San Diego, La Jolla, California 92093.
The $2^r$-th power character of 2.

Let $p$ be a prime $= 1 (mod 2^r)$. In this paper, the $2^r$-th power residue character of $2 (mod p)$ is determined. In 1775, Lagrange proved that $2^{(p-1)/2} \equiv (-1)^{(p^2-1)/8}$ and thereby solved the case $r = 1$. The cases $r = 2$ and 3 are easily handled by the supplement to the quartic reciprocity law, if one
notes that $2 = -i(1+i)^2$. The quartic reciprocity law and its supplement were announced by Gauss in 1831. More than a century later, with the aid of class field theory, the cases $r = 4$ and $5$ were solved, respectively by Aigner (in 1939) and Hasse (in 1958). In 1971, Muskat wrote down a remarkably elegant formula which he conjectured would yield the $2^r$-th power character of 2 for every $r > 4$. This formula reduces to the formulas of Aigner (for $r = 4$) and Hasse (for $r = 5$). In the present paper, Muskat's conjecture is proved, and it is also shown how one can thereby provide an unambiguous supplement to the general rational reciprocity law. (Received March 30, 1979.)

#79T-A130

Let $R$ be an associative unitary artinian ring of index two and $Q$ be its maximal left quotient ring. Then (i) $\text{ind} (Q) \leq 3$, (ii) $\text{ind} (Q) \leq 2$ if and only if $Q_R$ is projective, and (iii) the following are equivalent, provide that $R$ is ring-indecomposable: (a) $R$ is left rationally complete. (b) $R$ is right corationally complete. (c) The projective cover of every injective left simple is an injective hull of a non-projective left simple. (d) The injective hull of every projective right simple is a projective cover of a non-injective right simple. (Received April 3, 1979.)

#79T-A131
IVO G. ROSENBERG, Université de Montréal, Montréal, Québec H3C 3J7, Canada. Functionally complete algebras in congruence distributive variety.

We say that $\rho \leq A^h$ is central if $(a_1, ... , a_h) \in \rho$ whenever $a_i = a_j$ for some $1 \leq i < j \leq h$, $\rho$ is invariant under permutations of coordinates and $\rho \supseteq C\langle A^h \rangle$, $\rho$ is central. We prove: A finite at least three element algebra $A = \langle A; F \rangle$ in a congruence distributive variety is functionally complete if and only if $A$ is simple, monotonic with respect to no bounded partial order on $A$ and $A^h$ admits no central subalgebra for $h = 2, ... , |A|-1$. For two-element algebras the condition simplifies to nonmonotonicity. If the variety $K$ satisfies $\alpha_2(K)$, the absence of central subalgebras of $A^h(h = 2, ... , |A|-1)$ may be restricted to $h = 2$. (Received April 5, 1979.)

#79T-A132

The numbers $694503810.2^{2304} \pm 1$ and $1159142985.2^{2304} \pm 1$ are prime. Of these two pairs, the second is larger than the first. (Received April 5, 1979.)

#79T-A133
DAVID ZEITLIN, 1650 Vincent Ave., North, Minneapolis, MN, 55411. An extension to real numbers of integer sequences defined by linear difference equations of order two.

Let $W_{n+2} = PW_{n+1} + BW_n$, $n = 0, 1, ... ; P, B, W_0, W_1$ are integers. If $W_0 = 0, W_1 = 1$, set $W_n = Z_n$. For $u > 0$, we define $Z_u = \sum_{k=0}^{\infty} \left( \frac{u-1-k}{2} \right) B^k u^k + 2k$. If $0 < u \leq 1$, then we have

(1) $Z_{u+1} - P Z_u - B Z_{u-1} = \left( \frac{u-2}{2} \right) (u-2) + 2u-1 < u \leq 2u+1$. If $0 < u \leq 1$, then we have

thus $Z_{u+n} = P^{n-1} \sum_{k=0}^{\infty} \left( \frac{u-2}{2} \right) Z_{u+2k}$. If $0 < u \leq 1$, we define $W_{u+n} = W_u Z_{u+n} + B W_{u+n-1}$. Then, for $n = 1, 2, ... ,

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There exists a finite, equationally complete algebra of finite similarity type that fails to have a finite base for its identities. (This answers a question of R. McKenzie, On minimal, locally finite varieties with permuting congruence relations.) An algebra is variable-uniform, or regular, if \( t \) and \( \sigma \) contain the same variables for each identity \( \tau \equiv \sigma \) of \( A \). The algebra of the theorem can be taken to be the image \( F(A) \) of an arbitrarily chosen variable-uniform, finite, but non-finitely based groupoid \( A \) under a certain functor \( F \) from the category of all groupoids. \( F \) is constructed from \( A \) and its essential property is that with each identity \( \tau \equiv \sigma \) of \( F(A) \) is associated a finite set \( \pi_i \equiv \rho_i \), \( i < n \), of identities of \( A \) such that, for any groupoid \( B \), \( F(B) \equiv \tau \equiv \sigma \) iff \( B \equiv \pi_i \equiv \rho_i \) for all \( i < n \). The functor \( F \) can also be used to construct a locally finite, equationally complete variety that fails to have the amalgamation property.

(Received April 9, 1979.)

**Theorem.** There exists a locally finite, equationally complete variety \( \mathcal{V} \) that fails to be residually small (i.e., the subdirectly irreducible members of \( \mathcal{V} \) form a proper class). This answers a question of D. Clark and P. Krauss (Algebra Universalis, 6(1976)). The proof makes use of the functor \( F \) mentioned in the preceding abstract. By a result of R. Quackenbush (Algebra Universalis, 1(1971)) the variety \( \mathcal{V} \) of the Theorem must contain infinitely many pairwise non-isomorphic, finite, subdirectly irreducible algebras each of which generates \( \mathcal{V} \). But the functor \( F \) itself provides an explicit construction of such algebras which are, moreover, simple. This gives another solution to Problem 67 of G. Birkhoff, Lattice Theory (1967). (Received April 9, 1979.)

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Large Carmichael numbers with three prime factors.

An integer \( n \) is called Carmichael if it is composite and satisfies \( a^{n-1} \equiv 1 \pmod{n} \) for every a relatively prime to \( n \). A Carmichael number is known to be the product of 3 or more distinct primes \( p \), and \( (p-1) \) is Carmichael (believed to be the largest known to date). The factors \( p, q, \) and \( r \) can be proved prime since \( (q-1)(q+2)/2 \) yield factors of a 102 digit probable Carmichael and \( 4p-3 \) and \( r-1 \) a 199 digit probable Carmichael. (Received April 10, 1979.)
D □ X the implication \( s = x a_i \rightarrow x \square y = x(x \square a_i \square y) \), where \( \square \) is one of the operations \( \cdot, \cap, \cup \) and \( X \) one of the limits \( \cup, \cap \). Call \( \mathcal{J} \) archimedean iff \( \mathcal{J} \) satisfies the implication \( (\forall a \in R; t^a = a \rightarrow (ta = a = at)) \). Say that \( \mathcal{J} \) has maximal units if \( \forall a \not\in \mathcal{J}: (ae_a = a = e_a) \land (a = au \lor va = u = a \not\in \mathcal{J}) \). Then for \( d \)-seminoids the following theorems hold: (1) \( \mathcal{J} \) satisfies \( D \square X \) iff \( \mathcal{J} \) satisfies \( D \square X \). (2) Every archimedean \( d \)-seminoid is commutative. (3) Every conditionally complete \( d \)-seminoid with maximal units is commutative. (4) Every conditionally complete totally ordered \( d \)-seminoid is commutative. (Received April 10, 1979.) (Author introduced by Professor H. Werner).


Let \( \chi \) be a complex irreducible character of a finite group of exponent \( n \). Let \( A(\chi, Q) \) denote the simple component of the group algebra \( QG \) corresponding to \( \chi \). An algebraic number field \( L \supset Q(\chi) \) is a splitting field for \( \chi \) if the class of \( A(\chi, Q) \) \( Q(\chi)L \) is equivalent to \( L \) in the Brauer group \( B(L) \) of \( L \). The minimum of \( |L : Q(\chi)| \) taken over all splitting fields \( L \) of \( \chi \), is the Schur index \( m_Q(\chi) \) of \( \chi \). As a result of R. Brauer's theorem stating that \( Q(e_n^0) \) is a splitting field for \( \chi \) (where \( e_n^0 \) is a primitive \( n \)th root of unity), it has been questioned whether there exists a splitting field \( L \) as above, whether \( \chi \) has been questioned whether there exists a splitting field \( L \) such that

\[
Q(e_n^0) \Rightarrow L \supset Q(\chi) \text{ and } |L : Q(\chi)| = m_Q(\chi).
\]

In this paper sufficient conditions which guarantee the existence of a splitting field \( L \) as above, are obtained. Moreover we link the class number of \( Q(\chi) \) to the existence of such an \( L \), and known results pertaining to the existence of \( L \) are obtained as consequences. (Received April 11, 1979.)

#79T-A139 JUE W. FISHER, University of Cincinnati, Cincinnati, Ohio 45221 and JAE KEOL PARK, Busan National University, Busan, Korea 607. Gabriel Dimension of Normalizing Ring Extensions.

Let a ring \( S \) be a ring with a finite normalizing basis \( \{1 = x_1, x_2, \ldots, x_n\} \) over ring \( R \) with the same identity. Let \( M \) be a right \( S \)-module. Then if \( M \) has a Gabriel dimension as an \( S \)-module, then \( M \) has a Gabriel dimension as an \( R \)-module and \( G-dim_R(M) \approx G-dim_S(M) \). (Received April 13, 1979.)

#79T-A140 ITALO J. DEJTER, Universidade Federal de Santa Catarina, 88000, Florianópolis, SC, Brazil, Coefficients of Paracycloctic Polynomials.

Let \( P_0, \ldots, P_r \), where \( p_0, \ldots, p_r \) are integers \( \geq 1 \) and pairwise coprime, be given by \( \emptyset \) empty set \( (t) = 1-t \) and \( P_0, \ldots, P_r \) \( (t) = P_1, \ldots, P_r \) \( (t) \). In Smooth \( S^1 \)-manifolds in the Homotopy Type of \( CP^3 \), Mich Math J, vol 23 we determined the coefficients and orders of \( P_0, P_1 \). Theorem: The coefficients of \((1-t)P_0, P_1, P_2 \) \( (t) \) are \((-1)^i \) for \( i = 0,1 \) and the orders of monomials with coefficient \((-1)^i \) can be arranged in four 3-dimensional paralelloetope or L-shaped arrangements (differences of paralelloetope matrices with a common edge) of integers \( a(c)+a(n) \), where \( a(0,1)^3-z, z; 3 \)-areas are given by \( a(c_0, c_1, c_2) = c_0^z a_1, z(n_0, n_1, n_2) = n_0 p_1 p_2 + n_1 p_2 p_0 + n_2 p_0 p_1, 0 \leq n \leq m \) and a triad \( c, m, 1 \) corresponds uniquely to each arrangement. If \( b(0,1)^3-z, z(b(c) = 1, \beta(p_1-1)-a(c), then \( a(c)+a(m) = \beta(c) \) and \( a(c^3) + a(m^3) = \beta(c) \). Thus, there exists a correspondence between arrangements for coefficients with opposite signs. (Received April 16, 1979.)

#79T-A141 ROBERT JAMISON-WALDNER, Louisiana State University, Baton Rouge, LA 70803. A convexity characterization of ordered sets. Preliminary report.

After the ordinary notion of convexity in real linear spaces, the most common occurrence of "convex sets" is in partially ordered (PO) sets. A subset \( K \) of a PO-set \( X \) is order convex provided that whenever \( K \) contains a pair of comparable points, \( K \) contains all points between them. This
defines an alignment on X—that is, a family of abstract "convex" sets which is closed under arbitrary intersections and nested unions. It is possible to characterize those alignments on a set X which arise from orderings of X in terms of natural convexity properties. It is also possible to provide a characterization in terms of "forbidden" subspaces as in the Kuratowski planar graph theorem. For the case of total orders, there are only a finite number of forbidden subspaces since an alignment is determined by a total order if this is the case for every 4 point subspace. (Received April 16, 1979.)

*79T-A142 HENRY J. SCHULTZ, University of Michigan, Dearborn, Michigan 48128. Bounds for a density of the sum of divisors function.

Let \( A(x) \) represent the number of values (counting multiplicity) of the sum of divisors function which are less than or equal to \( x \). Define the density \( D = \lim_{x \to \infty} A(x)/x \). Dressler (J. Number Theory 4(1972), 532-536) has shown that \( D > 3/5 \). We improve this estimate to show that \( .6726 < D < .6728 \). (Received April 12, 1979.)

*79T-A143 G.J. REIGER, Universität, D-3000 Hannover. On a theorem of Estermann's concerning sums of squares of square-free numbers.

In his interesting paper (Proc. London Math. Soc. (2) 53, 125-137, 1953), Estermann proves the expected asymptotic formulas for the number of representations of integers \( n \) as sums of \( s \geq 4 \) squares of square-free numbers; the condition on \( n \) is that \( n = x_1^2 + \ldots + x_s^2 \mod 32 \) is soluble with \( 4 \mid m_j (1 \leq j \leq s) \). For \( s = 5 \), especially all \( n \equiv 2 \mod 8 \) are excluded. We are interested in related representations of large \( n \) without exclusions. Theorem 1. Let \( t \geq 4 \). Every large integer \( n \) can be represented as \( n = x_1^2 + \ldots + x_t^2 + y^2 \) with square-free \( x_j \) \((1 \leq j \leq t)\) and integral \( y \); the singular series is uniformly greater than \( 0 \), and the (expected) asymptotic formula for the number of such representations holds with the relative error term \( O(n^{-1/2}) \). Theorems 2. Every large integer \( n \) can be represented as \( n = p^2 + x_1^2 + x_2^2 + x_3^2 + y^2 \) with prime \( p \), square-free \( x_j \) \((1 \leq j \leq 3)\) and integral \( y \); the singular series is uniformly greater than \( 0 \), and the (expected) asymptotic formula for the number of such representations holds with the relative error term \( O((\log \log n)/\log n) \). The proofs use the Hardy-Littlewood-Vinogradov method. (Received April 16, 1979.)

*79T-A144 KENNETH W. SPACKMAN, University of Kentucky, Lexington, Kentucky 40506. On the number and distribution of simultaneous solutions to diagonal congruences.

A parameter is introduced to measure the non-singularity of the coefficient matrix of a system of diagonal equations \( \sum_{j=1}^t a_{ij} x_j = 0 \) \((i = 1, 2, \ldots, n; a_{ij} \in \mathbb{GF}(q))\) having \( N \) simultaneous solutions with components in \( \mathbb{GF}(q) \). Specifically, an \( n \times t \) matrix over \( \mathbb{GF}(q) \) is called \( \mu \)-weakly non-singular if and only if for each natural number \( k \leq n \) satisfying \( \mu(k-1) + 1 \leq t \), among any \( \mu(k-1) + 1 \) columns of the matrix there are at least \( k \) \( \mathbb{GF}(q) \)-linearly independent ones. The character sum approach is used to exhibit the dependence of \( N \) on the parameter \( \mu \). The following theorem is proved. Let \( n, t, \mu \) be natural numbers satisfying \( \mu \geq 2 \) and \( t > \mu(n-1) \). If \( |a_{ij}| \) is \( \mu \)-weakly non-singular over \( \mathbb{GF}(q) \), then
\[
N = q^{-n} + O(q^{(t+(\mu-2)(n-1))/2})
\]
A regularity of distribution of these solutions is exhibited in the prime finite field case, with applications concerning the existence of "small" simultaneous solutions. For example, if \( |a_{ij}| \) is \( \mu \)-weakly non-singular over \( \mathbb{GF}(p) \), \( p \) prime, \( d_j \geq 2 \) and \( t > \mu(n-1) + 2 \geq 2n \) then there exists for sufficiently large \( p \) a solution \((x_1, x_2, \ldots, x_t)\) for the given system having \( 1 \leq x_j \leq kp^x + (\mu(n-1)+2t)/2t \log p \) \((1 \leq i \leq t)\), for some constant \( k \) depending only on \( d_1, d_2, \ldots, d_t, \) \( t \) and \( n \). (Received April 16, 1979.)

Analysis (26, 28, 30-35, 39-47, 49)

79T-B85 S. ZAIDMAN, Department of Mathematics, Université de Montréal, Montréal, Québec, Canada.

Well-posed weak Cauchy problem for abstract differential equations.

We consider continuous weak solutions of the initial value problem in a Banach space \( X \) for the differential equation \( u'(t) = Au(t), \) \( 0 \leq t \leq T \), where A is a densely defined (unbounded) linear operator in \( X \), and \( u(t), 0 \leq t \leq T \) is a strongly continuous function, with \( u(0) \) arbitrarily given in \( X \). We establish continuous
dependence of the solutions on the initial data, as a consequence of an "existence-uniqueness" assumption. Next, we prove that existence-uniqueness in an interval \([0, T]\) implies well-posedness of the Cauchy problem on the positive real line. Finally, we associate a \(C_0\)-semigroup to our weak Cauchy problem and, under the supplementary condition that \(A\) has at least one regular point we conclude that \(A\) is in fact the infinitesimal generator of the associated semigroup. (Received August 15, 1978.)

87T-B86 Elmer E. Rosinger, Haifa Technion, Israel, Dept. of Computer Science. Resolution of singularities and stability of weak solutions for polynomial nonlinear PDEs

The weak solutions of polynomial nonlinear PDEs are defined as elements in algebras of classes of sequences of continuous functions on domains in Euclidian spaces. That approach offers two advantages. First, the resolution of singularities concentrated on arbitrary closed subsets of zero Lebesque measure. Second, a direct and explicit answer to the stability problem of weak solutions, a problem which in the case of nonlinear PDEs, is quite often overlooked. (Received February 8, 1979.)


Theorem 1. Let \(X\) be KB-space (=the space of Kantorović–Banach) which is not AL-space. Then there exists an order bounded null sequence \(\{x_n\} \subset X\) and \(T \in L(X, X)\) (=the space of all linear continuous operators) such that \(\{Tx_n\}\) is not order bounded, Theorem 2. Let \(X\) be an atomic Banach K-space with order continuous norm. Then for any Banach lattice \(Y\) the space \(L^\infty(X, Y)\) of all regular operators is a vector lattice. When \(X = l_1\) we have additionally \(L^\infty(l_1, Y) = L(l_1, Y)\). Proposition 3. The space \(L(c_0, c_0)\) is K-space.

Proposition 4. (a) If \(Y\) is AL-space and \(T \in L^\infty(X, Y)\), then there exists \(T^* \in L^\infty(Y^*, X^*)\) such that \(T^* \neq \Pi_1(Y^*, 1^*)\). (Instead of \(l_1\) we can also take any nonreflexive space \(X\) which is KB-space.) Proposition 5. Let \(Y\) be Banach space with order continuous norm but without monotone complete norm. Then there exists \(T \in L(l_2, Y)\) such that \(T^* \in \Pi_1(Y^*, 1^*)\), \(T \notin L^\infty(l_2, Y)\). Proposition 6. Let \(X\) be a nonreflexive KB-space. Then \(\Pi_1(X, Y) \neq S(X, Y)\) where \(S(X, Y)\) is the space of cone-summing operators. (Received February 9, 1979.)

87T-B88 PAUL STEWART SCHNARE, University of Petroleum and Minerals, Dhahran Airport, P.O. Box 144, UPM no. 172, Dhahran, Saudi Arabia. Maximum principle for non-commutative Banach algebras.

The terminology and notation is that of P. Henri, Applied and Computational Complex Analysis, Vol. I, Wiley, 1974. Let \(\mathfrak{B}\) be an arbitrary Banach algebra over \(\mathbb{C}\), the field of complex numbers, and \(f\) a function \(f: \mathbb{D} \rightarrow \mathfrak{B}\), where \(\mathbb{D} \subset \mathfrak{B}\). DEFINITION. \(f\) is analytic at \(Z_0\) iff there exists \(P \in \mathfrak{B}\), the integral domain of formal power series with complex coefficients, such that \(f(Z) = P(Z - Z_0)\) on some neighborhood, \(N(Z_0, \rho) \subset \mathbb{D}\), \(0 < \rho \leq \rho(p)\) = radius of convergence of \(P\). We say that \(f\) is represented by \(P\) at \(Z_0\).

The main result of this paper is that what Hille has called the "Third Form of the Maximum Principle" holds for \(\mathfrak{B}\), which is not assumed to be commutative. THEOREM. Let \(f\) be analytic and represented by \(P\), a non-constant power series at \(Z_0\). Then, every neighborhood of \(Z_0\) contains a point \(Z_+\) such that \(\| f(Z_0) \| < \| f(Z_+) \|\) and if \(f(Z_0) \neq 0\), a point \(Z_-\) such that \(\| f(Z_-) \| < \| f(Z_0) \|\). (Received February 12, 1979.)

87T-B89 PEI YUAN WU, National Chiao Tung University, Hsinchu, Taiwan, Republic of China. On the reflexivity of \(C_0(\mathbb{N})\) contractions. Preliminary report.

In this paper we first show that for \(C_0(\mathbb{N})\) contractions the property of reflexivity is preserved under quasi-similarities. As a by-product of the proof we also show that for such contractions, \(T\) is preserved, as a lattice, under quasi-similarities. Hence for the reflexivity of \(C_0(\mathbb{N})\) contractions it suffices to consider their Jordan models. We prove: Theorem. If \(T\) is a \(C_0(\mathbb{N})\) contraction and \(J = S(\varphi_1) \oplus \cdots \oplus S(\varphi_k)\) is its Jordan model, then \(T\) is reflexive if and only if \(S(\varphi_i/\varphi_j)\) is. This condition was first formulated by C. Foias for general \(C_0\) contractions. (Received February 12, 1979.)
In an earlier paper (it was announced here in A-486 (1978) was accepted by the Indiana University Journal of Math). We showed that the point (p,p) is a weak restricted point but not a strong restricted point for the kernel \( t \in \mathbb{R} \)

\[
K_p(t) = |t|^{-1/p} \phi(t), \quad \phi(t) = e^{it(\log|t|)\eta} (\log(2 + |t|))^{-\delta}
\]

\[0 < \eta < 1, \quad \delta = \frac{1}{2}(1-\eta) \quad \text{and} \quad 1 < p \leq \frac{2}{1 + \eta}.
\]

Here, we prove that the point (p,p) is in fact a weak point.

This gives us the complete \((L^p,L^q)\) 'mapping picture' for the kernels \( K_p \), where \( 1 \leq p \leq q \leq \infty \).

(Received February 23, 1979.)

A conjecture of Ulam on the invariance of measure in the Hilbert cube.

Ulam conjectured that if there is a bijection between two Borel subsets \( E \) and \( F \) of the Hilbert cube \( [0,1]^2 \), preserving one of the metrics \( d(x,y) = (\sum a_i^2(x_i - y_i)^2)^{1/2} \), where \( a_i \) is positive for all \( i \) and \( \sum a_i^2 \) is finite, then \( E \) and \( F \) have the same product probability measure. I prove Ulam's conjecture under the additional assumption that the \( a_i \) tend to zero as \( i \) tends to infinity.

J. Mycielski gave some partial results in Studia Math. 60 (1977) pp. 1-10. I draw on his methods and some results of mine (abstract 78T-B23 of the October 1978 Notices) on approximate isometries. (Received February 23, 1979.)

Gap Fourier series of automorphic forms. Preliminary report.

Let \( \Gamma \) be a fuchsian group acting on \( \mathbb{H} = \{ \text{Im} z > 0 \} \) and having a smallest translation of period 1, but not cyclic parabolic. Theorem 1. If an automorphic form \( F \) on \( \Gamma \) has a Fourier series with Hadamard gaps, beginning with a term \( a_1 \exp 2\pi n_1 z, \ n_1 \geq 1 \), then \( F = 0 \). One can, however, produce nonzero automorphic forms such that the surviving exponents have density < \( \epsilon \) (but not 0). Theorem 2. For \( \epsilon > 0 \) there exist an \( m \) and nonzero forms on \( \Gamma_0(m) \), in whose Fourier series the surviving exponents have density < \( \epsilon \). Such forms are not forms on \( \Gamma_0(m') \) with \( m' \not\leq m \). There is a theorem analogous to Th. 1 for \( \Gamma \) acting on the unit disk, also for automorphic functions. (Received April 6, 1979.)

Topologically Equivalent Measures in The Cantor Space. Preliminary report.

The Cantor space is realized as a countable product of two-element sets. The probability measures \( \mu \) and \( \nu \) in \( X \) are equivalent if there is a homeomorphism \( h \) of \( X \) onto itself such that \( \mu = vh \). Let \( F \) be the family of product measures in \( X \) which are shift invariant. The members \( \mu(r) \) of \( F \) are in one-one correspondence with the real numbers \( r \) in the unit interval. F.J. Navarro-Bermúdez has proved that if \( r \) is a rational or transcendental and \( \mu(s) \) is topologically equivalent to \( \mu(r) \) then \( s = r \) or \( s = 1 - r \). Theorem. If \( r \) is a real algebraic integer of degree \( n \) and \( \mu(s) \) is topologically equivalent to \( \mu(r) \), and \( s = p + qr \) with \( p, q \) are rationals then \( s = 1 - r \) or \( s = r \). Corollary. If \( r \) is a real algebraic integer of degree 2 and \( \mu(s) \) is topologically equivalent to \( \mu(r) \) then \( s = 1 - r \) or \( s = r \). (Received March 2, 1979.) (Author introduced by B.D. Mauldin).

Consider the neutral functional equation.

\[
(1) \quad \frac{d}{dt} D(t,x_e) = A(t,x_e) \quad (2) \quad \frac{d}{dt} \left[ D(t,x_e) - G(t,x_e) \right] = A(t,x_e) + F(t,x_e).
\]
where $D$ and $A$ are bounded linear operators from $C = C([-\infty, \infty])$ into $E^m$ for each $t \in \mathbb{R}$, $F = F_1 + F_2$, $|F_1(t, \phi)| \leq v(t)|\phi|$, $v(t) \geq 0$; there is a $c$ such that $|F_1(t, o)| \leq c|\phi|$, $G$ and $D$ are uniformly monotone at zero. The authors prove the following result: If the solution $x(t, o, \phi)$ of (1) is such that $|x(t, o, \phi)| \leq e^{-\gamma(t-t_0)}|\phi|$, $t \geq t_0 \geq 0$, $\phi \in C$ then there exist a $K > 0$, $\gamma > 0$ such that the solution $x(t, o, \phi)$ of (2) satisfies

$$\|x(t, o, \phi)\| \leq Ke^{-\gamma(t-t_0)}|\phi|,$$

provided $\lambda = \int_{t_0}^{t} v(t) dt < \infty$, where $K = K(K, \lambda)$.

The result strengthens a previous result by Hale and Ince, Proc. Am. Math. Soc. 28 (1971) 100-106. (Received March 5, 1979.)

**#79T-B95**  
SEHIL PARK, Seoul National University, Seoul, Korea and B.E. RHOADES, Indiana University

Let $X$ be a topological space, $x \in X$. Let $O(x, w) = \{x, f(x), f^2(x), \ldots\}$ denote the orbit of $x$. A function $G: X \rightarrow R$ is called $f$-orbitally lower semicontinuous at a point $p \in X$ if, for any sequence in $O(x, w)$, $x_n \rightarrow p$ implies $G(p) \leq \liminf G(x_n)$. Let $f$ be a self map of a topological space $X$, $d$ a lower semicontinuous, nonnegative, real valued function defined on $X \times X$ such that $d(x, y) = 0$ implies $x = y$. If there exists a point $u \in X$ such that $\lim_{n \rightarrow \infty} d(m^{n+1}(u), m^n(u)) = 0$, and if each $m^n(u)$ has a convergent subsequence with limit $p$, then $p$ is a fixed point of $f$ if and only if $G(x) = d(x, f(x))$ is $f$-orbitally lower semicontinuous at $p$. This, and related results of the paper, extend some fixed point theorems of Danés, Hegedüs, Hicks, and Rhoades. (Received March 8, 1979.)

**#79T-B96**  
E. B. Saff, University of South Florida, Tampa, FL 33620 and R. S. Varga, Kent State University, Kent, OH 44242, On Incomplete Polynomials II.

For fixed integers $0 \leq \mu_1 < \ldots < \mu_k < m$, define for $n = 0, 1, 2, \ldots$, $e_n = \inf \{\|x^n(x^{\mu_1}, \ldots, x^{\mu_k})\| : (c_1, \ldots, c_k) \in \mathbb{R}^k\}$, where $\|\cdot\|_A$ denotes the sup norm over $A$. Theorem. $\lim_{n \rightarrow \infty} e_n = E_k \sup_{j=1}^k \{m - \mu_j\}$, where

$$E_k = \inf \{\|e^{-t} - q_{k-1}(t)\| : (0, \ldots), q_{k-1} \text{ a polynomial of degree } \leq k - 1\}.$$ As a consequence we sharpen recent results of Borosh, Chui, and Smith. Let $\lambda_n = (\lambda_1(n), \ldots, \lambda_k(n))$, where the integers $\lambda_j(n)$ satisfy $0 \leq \lambda_1(n) < \ldots < \lambda_k(n) < n$, and set $E(\lambda_n) = \inf \{\|x^n - \sum_{j=1}^k \lambda_j d_j x^{\lambda_j(n)}\| : (d_1, \ldots, d_k) \in \mathbb{R}^k\}$.

Corollary. If $n - \lambda_1(n) \leq D$ and $n - \lambda_k(n) \geq C$ for all $n$ large, where $C, D$ are integers, $C \geq 1$, then

$$\left(\frac{C + k - 1}{k}\right) E_k \leq \lim_{n \rightarrow \infty} \frac{n^{kE\lambda_n}}{n^{kE\lambda_{n}}}, \quad \frac{D}{k} E_k.$$ The inequalities are best possible. (Received March 19, 1979.)

**#79T-B97**  
Simeon Reich, University of Southern California, Los Angeles, CA 90007.

A nonlinear Hille-Yosida theorem in Banach spaces.

Let $E$ be a Banach space. Assume that the norm of $E$ is uniformly Gâteaux differentiable and that the norm of its dual $E^*$ is Fréchet differentiable. (a) If $A \subseteq E \times E$ is $m$-accretive, then $C = cl(D(A))$ is a (sunny) nonexpansive retract of $E$, $-A$ generates a semigroup $S$ on $C$ (via the exponential formula), and the strong (negative) generator of $S$ is $A^0$. (b) If $C$ is a nonexpansive retract of $E$ and $E$ is a semigroup on $C$, then there is a unique $m$-accretive $A \subseteq E \times E$ such that $-A$ generates $S$ (via the exponential formula), $cl(D(A)) = C$, and $A^0$ is the strong (negative) generator of $S$. (c) $A_0$ is the strong (negative) generator of a semigroup $S$ on a nonexpansive retract of $E$ if and only if $A_0 = A^0$ for an $m$-accretive $A \subseteq E \times E$ such that $C = cl(D(A))$. A-379
This theorem establishes a biunique correspondence between $m$-accretive sets in $E \times E$ and semigroups on nonexpansive retracts of $E$. It includes the Hilbert space result (due to M. G. Crandall and A. Pazy), and provides affirmative answers to two questions of T. Kato (cf. H. Brézis, Comm. Pure Appl. Math. 24 (1971), 1-6). (Received March 23, 1979.)

**79T-996** W. B. JURKAT, Syracuse University, Syracuse, NY 13210; and G. SAMPSON, State University of New York at Buffalo, Buffalo, NY 14214. The complete solution to the $(L^p, L^q)$ mapping problem for a class of oscillating kernels.

In our work we are interested in determining all pairs $(p, q)$ for which $\|Kf\|_q \leq B\|f\|_p \ \forall f \in L^m_0$ and where $B$ is a positive constant independent of $f$.

In earlier work, we discussed the $(L^p, L^q)$ mapping problem for the kernels (1) $K(t) = \frac{e^{\frac{t}{\|t\|^a}}}{1 + \|t\|^b}$, $a > 0$, $b < 1$ and $t \in R$. We solved the $(L^p, L^q)$ mapping problem for these kernels when $1 \leq p < q \leq \infty$.

In the case where $p = q$, we were only able to prove that the end points satisfy weak restricted estimates. Here we fill the gap by solving the $(L^p, L^q)$ mapping problem for kernels in (1). As an auxiliary result, we prove that the kernels $K(t) = \frac{e^{\frac{t}{\|t\|^a}}}{1 + \|t\|^b}$ for $a > 0$ are such that they map $H^1$ into $L^1$, i.e. $\|Kf\|_1 \leq B\|f\|_{H^1}$ if $B$ is a positive constant independent of $f$ ($f \in H^1$ i.e. $f(x) = \sum \lambda_j b_j(x)$ where $b_j(x)$ are $(1,2)$ atoms and $\sum |\lambda_j| < \infty$). (Received March 27, 1979.)

**79T-999** ABRAHAM UNGAR, Rhodes University, Department of Applied Mathematics, Grahamstown 6140, South Africa. Variation of Parameters in Parametric Solutions of LPDEs.

Let (1) $f(x, \lambda)e^{sh(x)}$, $x = (x_1, x_2, \ldots, x_n)$, be a parametric solution of a linear partial differential equation (LPDE) in the variables $x$, where $\lambda$ and $s$ are parameters which do not appear in the LPDE. Let $A$ and $B$ be two arbitrary, suitably differentiable functions of the specific function $h(x)$ and let (2) $f(x, B[h(x)])A[h(x)]$

be obtained from (1) by replacing the parameter $\lambda$ by an arbitrary function $B[h(x)]$ and the specific function $e^{sh(x)}$ by the arbitrary function $A[h(x)]$. Then (2) satisfies the LPDE under consideration in a domain of the $x$-space iff (1) satisfies the LPDE in a domain of the $x$-space and for some interval. Example (ax+by+cz)-1F(R-t), $R^2 = x^2 + y^2 + z^2$, $a^2 + b^2 + c^2 = \infty$, is a parametric solution of the wave equation $\nabla^2 \phi = \phi$ where $a$ and $b$ are arbitrary complex constants.

Therefore, a more general solution to the same wave equation is $\frac{xa(R-t)+yb(R-t)+zc(R-t)}{a^2+b^2+c^2 = \infty}$, where $a$ and $b$ are arbitrary, twice differentiable functions of $R-t$. (Received March 27, 1979.)

**79T-800** M. HERRERO - J. L. VAZQUEZ, Dpto. de Ecuaciones Funcionales, Fac. de CC. Matemáticas and Dpto. de Métodos Matemáticos de la Física, Fac. de CC. Físicas; Univ. Complutense. Madrid-3, Spain: "On a class of nonlinear diffusion parabolic equations". Preliminary report.

We study general nonlinear diffusion problems of the type:

$$\begin{cases} \frac{\partial u}{\partial t} + Au + \alpha(u) = f & \text{in } R^N \times (0,T) \\ u(0) = u_0 & \text{in } R^N, \end{cases}$$

where $Au = - \sum_{i=1}^{N} \frac{\partial}{\partial x_i} \left( \beta \left( - \frac{\partial u}{\partial x_i} \right) \right)$. Here $\beta$ stands for a continuous monotone function, which satisfies an Orlicz-type condition at infinity in order to get existence and uniqueness of solutions for $(P)$ by means of variational methods. When $\alpha$ is a suitable monotone function we prove results concerning the evolution of the support of the solutions, as the instantaneous shrinking of the support, and its complete vanishing in a finite time. We show also the existence of a finite speed of propagation, both in the case $\alpha \neq 0$ and $\alpha = 0$ under suitable assumptions on $\alpha$ and $\beta$. For $\alpha = 0$ and spatial dimension $N = 1$, this last result was announced by Díaz-Herrero. When $N = 1$, we show that the support at time $t$, $S(t)$, is connected, and the interface curves are monotone non-decreasing. (Received March 29, 1979.) (Authors introduced by Professor Alfonso Casal).
Let \( E \) denote the unit disc and \( H(E) \) the class of all holomorphic functions \( f \) on \( E \) with \( f(0) = 0 = f'(0) - 1 \). The class \( S_n^* \) of star-like functions with respect to symmetric points consists of functions \( f \in H(E) \) satisfying the condition \( \text{Re}\left(\frac{zf'(z)}{f(z)-f(-z)}\right) > 0, |z| < 1 \). We define two subclasses \( R(\alpha) = \{ f : \text{Re}\left(\frac{f(z)-f(-z)}{f(z)+f(-z)}\right) < \alpha, 0 < \alpha \leq 1 \} \) and \( T(\alpha) = \{ f : \text{Re}\left(\frac{f(z)}{f(z)-f(-z)}\right) - \alpha |z| < \alpha, \alpha > 1 \} \), where \( f(z) = 2zf'(z)/f(z) - f(-z) \). The radius of convexity is determined for each class and other properties like coefficient estimates, behavior of certain integral operators on the members of these classes, distortion theorems, have been studied. (Received March 29, 1979.) (Author introduced by Professor T. S. Bhanu Murthy).

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**79T-B101** J. THANGAMANI, The Ramanujan Institute, University of Madras, 600-005, South India. On star-like functions with respect to symmetric points. Preliminary report.

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**79T-B103** William D. L. Appling, North Texas State University, Denton, Texas 76203. Absolute Continuity and Minimum Functional Values

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**79T-B104** W. Fleissner, University of Pittsburgh, Pittsburgh, PA 15260, and S. Negrepontis, Athens University, Athens, Greece. Haydon's counterexample with not CH. Preliminary report.

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Pelczynski conjectured that if \( L_{\omega^+} \) embeds in \( \mathbb{X} \), then \( L_{\omega^+} \) embeds in \( X \). Argyros has shown that, assuming Martin's Axiom plus not Continuum Hypothesis (CH) the conjecture is true. Haydon, (Israel J. Math. 31 1978, 142-152), assuming CH, constructed a counterexample via an inverse limit of length \( \omega_1 \). Theorem: There is a model of set theory in which \( \omega^+ < 2^\omega < 2^{(\omega^+)} \) and there is a sequence \( (N_\alpha)_{\alpha<\omega_1} \) of null subsets of the Cantor set such that every compact null set is contained in some \( N_\alpha \). With these assumptions, Haydon's construction can be repeated. Thus Pelczynski's conjecture is not equivalent to not CH. (Received April 3, 1979.)
Let $f$ be analytic in the unit disc $E$ with $f(0) = 0 = f'(0)-1$ and $f(z)f'(z)/z \neq 0$ for $z$ in $E$. In this paper the class $C(\kappa, \Lambda)$ of functions $f$ satisfying in $E$, the condition $\left|\frac{f(z)-1}{f(z)+1}\right| < \lambda$, $0 < \Lambda \leq 1$, where $H(z)=(1-\kappa)(z'f'(z))/f(z)+\kappa(z'f'(z))/g'(z)$, for some $g$ starlike in $E$ and $\kappa$ a non-negative real number, is introduced. It is proved that $C(\kappa, \Lambda) \subset C(0, \Lambda)$. An integral representation for $f \in C(\kappa, \Lambda)$ and estimates for the first few coefficients of $f \in C(\kappa, \Lambda)$ are obtained. Further, some subclasses of $C(\kappa, \Lambda)$ have been studied. (Received March 30, 1979.) (Author introduced by Professor D. Sundaraman.)

The technique employed in the proof of the theorem appearing in these Notices, January 1979, 763-28-5, is used to provide the following. Theorem. If $\Sigma_\omega$ is a subalgebra of an algebra of subsets $\Sigma$ of a set $S$, then there is $h: ba(S, \Sigma_\omega) \to ba(S, \Sigma)$ such that (1) $\mu_\omega = h(\mu_\omega)|_{\Sigma_\omega}$ (the restriction of $h(\mu_\omega)$ to $\Sigma_\omega$), for each $\mu_\omega$ in $ba(S, \Sigma_\omega)$; (2) $h$ is linear; (3) $h$ is one-to-one; (4) $h$ is order preserving; (5) if $\|\cdot\|$ denotes the variation norm, then $\|\mu_\omega\| = \|h(\mu_\omega)\|$, for $\mu_\omega$ in $ba(S, \Sigma_\omega)$; (6) if $\lambda$ is in $ba(S, \Sigma)$ such that $0 \leq \lambda \leq h(\mu_\omega)$, for some $\mu_\omega$ in $ba(S, \Sigma_\omega)$, then $\lambda = h(\mu_\omega)$ for some $\mu_\omega$ in $ba(S, \Sigma_\omega)$. Corollary. If $\mu_\omega$ and $\mu_0$ are members of $ba(S, \Sigma_\omega)$, then (1) $\mu_\omega$ is two-valued implies that $h(\mu_\omega)$ is two-valued; (2) $\mu_\omega$ is absolutely continuous with respect to $\mu_0$ ($\mu_\omega \ll \mu_0$) implies that $h(\mu_\omega) \ll h(\mu_0)$. (Received April 9, 1979.)

Bruce E. Blackadar, University of Nevada, Reno, Nevada 89557. A $C^*$-Algebra Counterexample.

Let $B$ be a unital GCR $C^*$-algebra such that $\hat{B}$ is not $T_2$, and let $A$ be the $C^*$-algebra of sequences of elements of $B$ which converge to a scalar multiple of the identity. Then $A$ is GCR(CCR if $B$ is) and $\hat{A}$ is the one-point compactification of $\mathbb{N} \times \hat{B}$. The point at infinity is separated in $\hat{A}$ but is not contained in any $T_2$ open subset of $\hat{A}$. This solves problem 4.7.9 of Dixmier, Les $C^*$-Algèbres et Leurs Représentations. An interesting $B$ is the one in 4.7.19 of Dixmier. Also, if $B = \mathcal{K}(\mathcal{H}) + c_0$, this is an easy counterexample for problem 4.7.8, first solved by P. Green in Proc. Amer. Math. Soc. 73 (1979), 209-210. (Received April 12, 1979.)


A $C^*$-dynamical system $(\mathcal{B}, \alpha_t)$ consists of a $C^*$-algebra $\mathcal{B}$ and a continuous one-parameter group of $*$-automorphisms $\{\alpha_t : t \in \mathbb{R}\}$. For $s \in \mathbb{R}$ the spectral subspaces $\mathcal{B}(s, \omega)$ are defined in W.B. Arveson's paper [Ar], On groups of automorphisms of operator algebras, Journal of Functional Analysis 15(1974), p.271-83. The non-selfadjoint subalgebras $A = \mathcal{B}(0, \omega)$ and $A_0 = \left(\bigcup_{t > 0} \mathcal{B}(t, \omega)\right)^*$ generalize familiar algebras of analytic functions in the commutative case. Set $A = \mathcal{A}(a : a \in \mathcal{A})$ and $D = A \cap A^*$. If $\rho$ denotes an invariant state of $(\mathcal{B}, \alpha_t)$, i.e. $\rho \circ \alpha_t = \rho$ for all $t \in \mathbb{R}$, we say that $\rho$ is a weak-* Dirichlet algebra if $\rho(ab) = \rho(a)\rho(b)$ for all $a, b \in A$. Answering a question raised in [Ar], and generalizing a result of P.S. Muhly for the case where $\mathcal{B}$ is commutative, we see that $\rho$ is a weak-* Dirichlet algebra if $\rho$ satisfies a $\beta$-KMS condition for some $0 \leq \beta < \infty$ and is extremally $\alpha_t$-invariant (i.e. is an equilibrium state for inverse temperature $\beta = 1/kT$ and ergodic).

For $\mathcal{B}^*$-dynamical systems, i.e. $\mathcal{B}$ is a $\mathcal{B}^*$-algebra, and the group $\alpha_t$ point ultraweakly continuous, the following stronger theorem holds: Let $\rho$ be a faithful normal state which is extremally invariant (ergodic), and assume that $D$ is abelian and contained in the centralizer $C_\rho$ of $\rho$. Then $\mathcal{B}$ is a weak-* Dirichlet algebra. $C_\rho/D_0$ is a $\mathcal{B}^*$-algebra. (Received April 13, 1979.)
After reviewing earlier work of Barnhill, Gregory, Laurent, Mansfield, Nielson, and others, the paper offers new instances of splines, instances in which the observation of the unknown function consists of a number of derived functions and scalars. The spaces $A$ are the basis of the construction.

The paper will appear in the Proceedings of the Conference, Mehrdimensionale konstruktive Funktionentheorie, Oberwolfach, February, 1979. (Received April 13, 1979.)


E. Y. Rodin suggested using Miura's transformation for the Korteweg-de Vries equation (KDV)

$$u_t - 6u_x + u_{xxx} = 0$$

to obtain the following: \textbf{THEOREM:} If $F(x,t)$ is a solution of the Associated Equation $F_t + F_{xxx} - 3F_x F_x = F \int_0^x \frac{G(t)}{F} \, dx$ (AE) where $G(t)$ is arbitrary, then $u(x,t) = \frac{F_x}{F}$ solves KDV and $v(x,t) = F$ solves the modified KDV $v_t - 6v_x v_x + v_{xxx} = 0$. Explicit solutions of AE can be found for certain choices of $G(t)$. By considering traveling wave solutions to AE with $G(t) = 0$, one easily obtains the well-known one-soliton solution and the classical cnoidal wave. Similarity solutions of AE yield KDV solutions as quotients of Airy Functions and its derivatives and as quotients of the Second Painlevé Transcendent ($\mathcal{M} = 0$) and its derivatives. An Associated Equation can be found for the non-homogeneous KDV equation. (Received April 16, 1979.)


It is well-known that for a finite matrix $A$ with trace $A = 0$ there exists an o.n. (orthonormal) basis $\{b_j\}_{j=1}^n$ s.t. $(Ab_j, b_j) = 0, j = 1, \ldots, n$. (see, e.g., Halmos, 

\textit{Finite-Dimensional Vector Spaces}, p. 109) We prove the following: Let $A$ be a bounded operator on a complex separable Hilbert Space and $\{e_k\}$ an o.n. basis. Let $S_n = \sum_{k=1}^n (Ae_k, e_k)$. Suppose there exists a subsequence $\{S_n\}_{n=1}^\infty$ such that $S_n \rightarrow 0$. Then there exists an o.n. basis $\{b_j\}$ with $(Ab_j, b_j) = 0$ for all $j$. In addition, some related questions are discussed. (Received April 16, 1979.)

Extension of uniformly continuous mappings. Preliminary report.

\textbf{Theorem.} Assume that $f:M \rightarrow R$ is a bounded uniformly continuous map of the metric space $M$. Then for every $\varepsilon > 0$, there is a Lipschitz map $L:M \rightarrow R$ such that $||L-F||_\infty \leq \varepsilon$.

\textbf{Theorem.} Let $K$ be a convex set in a Banach space $B$ and $H$ a Hilbert space. Then for every uniformly continuous map $f:K \rightarrow H$ and every $\varepsilon > 0$, there exists a Lipschitz map $L:K \rightarrow H$ such that $||L-f||_\infty \leq \varepsilon$. \textbf{Definition.} If $M$ is a metric space and $X \subseteq M$, we say that $X$ is \textit{U-embedded} in $M$ if each uniformly continuous map $f:X \rightarrow R$ extends to a uniformly continuous map $f:M \rightarrow R$. For each $f:X \rightarrow R$, let $e_f = \inf \{\varepsilon > 0 : ||f-L||_\infty \leq \varepsilon \text{ for some Lipschitz map } L \text{ on } X\}$. \textbf{Theorem.} TFAE for $X \subseteq R$. (i) For each uniformly continuous map $f:X \rightarrow R$, $e_f = 0$. (ii) For each uniformly continuous map $f:X \rightarrow R$, $e_f < \varepsilon$. (iii) $X$ is U-embedded in $R$. (iv) $X$ is not the union of an infinite uniformly discrete family of sets.

\textbf{Examples.} (i) There exists a regular-closed path connected subset of $R^2$ that is not U-embedded. (ii) There exists a nontrivial nonconvex star-like region in $R^2$ which is U-embedded. (iii) There exists a star-like region in $R^2$ which is not U-embedded. (Received April 16, 1979.)
Exact solutions for a nonlinear electric circuit.

The differential equation for a series RLC-circuit having nonlinear resistance and inductance is
\[ \frac{d^2 F(x)}{dt^2} + \frac{dV(x)}{dt} + x(t)/C = 0, \]
where \( x(t) \) is the current, \( C \) the (constant) capacitance, \( F(x) \) the 'magnetic flux linkage' current characteristic of the inductor \( L \), and \( V(x) \) the voltage-current characteristic of the resistor \( R \); the initial capacitor potential difference is \( V \), and at \( t=0 \) the capacitor commences to discharge. We assume:
\[ F(x) = a_2 x^2 + b_2 x^5, \]
and \( V(x) = cx - dx^3 \), where \( a, b, c, d, h \) are positive parameters. Setting \( y = \frac{dF(x)}{dt} \), the trajectories in the \((x, y)\) phase plane satisfy the nonlinear equation
\[ \frac{dy}{dx} = 3dx^2 - c -(a_2 x - 3hx^3 + 5b_2 x^5)/(Cy). \]
Exact solutions for \((E)\) are obtained when some of the parameters are interrelated. E.g., for \( h = (4/3)(5/3)ab \), and \( ad = (5/3)b^2 \), the solution in terms of a parameter \( u \) is:
\[ y = -av \exp((m-u)/2r) \cos u, \]
\[ dx^3 = - (v/r) \exp((m-u)/2r) \sin(u-m) = 0, \]
where \( a \cos m = cC \), \( a \cos m = cC \), and \( r = ((a/ \sqrt{c^2}) - \frac{1}{2}) \). The initial point is \( x = m \), and \( u \) increases with \( t \). (Received February 16, 1979.)

Symmetric Quasi-Newton update formulas.

The Moore-Penrose pseudo-inverse is used to show that a general symmetric solution of the so-called quasi-Newton equation \( \Delta s = p \) is given by
\[ \Delta B = \frac{p s^T}{s^T} V s^T - \left( \frac{d^T s}{s^T} V s^T + I s^T V s^T \right) \left( \frac{I - s^T V s}{s^T V s} \right), \]
where \( \Delta B, V, I \) and \( M \) are matrices, \( p \) and \( s \) are vectors, \( T \) denotes the transpose, \( V = V^T \), \( M = M^T \), \( V \) is positive definite, \( I \) denotes the Identity and \( M \) is arbitrary. As a direct consequence of the above representation it follows that \( \Delta B \) with \( M = 0 \) minimizes the trace of the matrix \( V^{-\frac{1}{2}} \Delta B V^{-\frac{1}{2}} \). Various choices of \( V \) lead to most known symmetric minimum trace quasi-Newton update formulas, which include a large subclass of the Broyden (1970) and Davidon (1975) families. (Received February 23, 1979.)

Response of Penetrable Bodies to Electromagnetic Pulses.

The permeability \( \mu \), permittivity \( \varepsilon \), and conductivity \( \sigma \) used in the constitutive relations relating \( B \) to \( H \), \( D \) to \( E \), and \( J \) to \( E \) are functions of the frequency \( \omega \) of an incoming wave whose time dependence has the form \( \exp(i\omega t) \). If \( E \) and \( H \), regarded as functions of time, are in the space \( S \) [Hormander, Linear Partial Differential Operators, (1963), p. 18], then Maxwell's equations may be written in the form
\[ \text{curl}(E) = F^{-1}(\mu) \ast ((\partial/\partial t)H) \] (1)
\[ \text{curl}(H) = F^{-1}(\varepsilon) \ast ((\partial/\partial t)E) + F^{-1}(\sigma) \ast E, \] (2)
where the \( F^{-1}(\mu), F^{-1}(\varepsilon), \) and \( F^{-1}(\sigma) \) used in the above equations are the inverse Fourier transforms of \( \mu, \varepsilon, \) and \( \sigma \), respectively, which are regarded as temperate distributions, and where \( \ast \) denotes a convolution integral. If \( E_n \) and \( H_n \) are sequences which converge to \( E = E_0(x, y, z) \exp(i\omega t) \) and \( H = H_0(x, y, z) \exp(i\omega t) \), then equations (1) and (2) imply that
\[ \text{curl}(E) = -i\omega \mu (\omega) H \] (3)
\[ \text{curl}(H) = \epsilon(\omega) i\omega E + \sigma(\omega) E, \] (4)
which are the usual forms for Maxwell's equations for time harmonic fields. (Received March 5, 1979.)
For each nonnegative integer \( m \), the Poisson kernel is defined as follows:

\[
K(m, x) = \sum_{n=0}^{\infty} \frac{\cos n \alpha}{n^2 - 2x \cos \alpha + 1}
\]

The following formula is useful for computing the gravitational potential at points in a disk of radius \( R \), due to wave-like density disturbances in the complement of the disk. If \( 0 < r < R \) and \( \text{Re} k > 0 \), then

\[
\int_0^\infty k \pi \frac{1}{m} H_m^{(j)}(kR) d\xi = -H_m^{(j)}(kr) 2^{m+1} \int_0^{\infty} \frac{I_m \left( \frac{\xi R}{k} \right) K_m \left( \frac{\xi R}{k} \right) d\xi}{\xi^2 + (kr)^2}.
\]

\( H_m^{(j)} \) is a standard Bessel function of the third kind; \( I_m \) and \( K_m \) are Bessel functions of imaginary argument. The symbol \( (\cdot)' \) denotes the derivative. (Received March 1, 1979.)

This is a direct continuation of our previous Abstract (See Notices of the A.M.S, January 1979, Subject Classification 85) announcing that the results stated there are due to D.G. Saari (See Singularities and Collisions of Newtonian Gravitational Systems, Archive for Rational Mechanics and Analysis, Vol. 49, No 4, 1973, P. 311-320)

The purpose of our work is to give new (topological), proofs of Saari's theorems and to obtain new results on the singularities of the n-Body problem. (Received March 5, 1979.)

An algorithm is developed for the special case when \( m=1 \). It may sometimes be used for finding a minimum of a continuously differentiable convex function with the advantage of requiring possible fewer line searches than an ordinary minimization method. (Received March 4, 1979.)

We construct a sequence of polytopes \( P_0, P_1, \ldots \), \( R \) a sequence \( x_0, x_1, x_2, \ldots \), and two sets \( D_1, D_2 \) such that (i) \( D_1 \) and \( D_2 \) are unions of faces of \( P_0 \) (so each corresponds to a disjunction of facial constraints) (ii) \( x_1 \) is an extreme point of \( P_1 \) not in \( D_1 \cap D_2 \) (iii) \( P_{i+1} \) is obtained from \( P_i \) by using a cutting plane corresponding to the (unique) facet of the convex hull of \( P \cap D_j \) which cuts away \( x_j \) (\( j=1 \) and 2 alternately).

This example shows that algorithms based on adding as deep a cut as possible may not converge.

It is related to work announced in the Nov. 1978 Notices p. A-704. (Received March 16, 1979.)
V(\delta) = A(\delta) \exp(i \theta(\delta)). In VLBI one measures A(\delta) sufficiently precisely, but instead of \theta(\delta) one can measure only "closure phase" \theta(x) + \theta(y) - \theta(x + y) for different x, y. Assume a \equiv b (mod 2\pi) means that a - b = 2\pi n for some integer n. Theorem 1. If for all x, y : \theta_1(x) + \theta_1(y) - \theta_1(x + y) = \theta_2(x) + \theta_2(y) - \theta_2(x + y) (mod 2\pi), then for all x : \theta_1(x) = \theta_2(x) + kx (mod 2\pi) for some k, and I_2(\delta) = I_1(\delta - k). So modulo inessential translation of the origin I can be uniquely restored from amplitude and closure phase.

We prove that (1) the solution \theta(x) = \theta_1(x) - (\theta_2(x) + kx - 2\pi n) < \epsilon. (Received March 26, 1979.)

We construct an intentional logic I(\delta) in which an intention (mental act) is analyzed as an ordered pair \langle C_{P_1}, p_1 \rangle of elements of the universe M of mental entities, and C_{P_1} the core, is an element of the set C_{\delta} of \delta and P_1 the fringe, is a proper subset of the domain P_1 of M. \langle C_{P_1}, p_1 \rangle is obtained when \nu[C_{P_1}, p_1] = t, and C_{\delta} \subseteq P_1. The fulfillment of an intention in (performative) behavior is analyzed as an ordered triple \langle R_{P_1}, p_1, P_1 \rangle of elements of the universe P of physical entities, where \nu[C_{\delta}, R_{P_1}, p_1, P_1] = t if and only if \nu[C_{P_1}, p_1, P_1] = t for C_{P_1} an element of the set P and P_1 a subset of P, and M is a model of P, C_{P_1} \subseteq P_1, and R is a complex operator representing a lattice on the Norris graph-theoretic maximal rectangular neural net. The mental act and its fulfillment in performative behavior becomes a set of ordered n-tuples, \langle C_{P_1}, p_1, P_1 \rangle > \delta."


Investigation of convergence for Fort-Yee method. Preliminary report.

(1) Fort and Yee in Astronomy and Astrophys. 50(1976), 19 proposed the following iterative method for solving the problem (useful for VLBI) "given A(\delta) \equiv 0, find I(\delta) \equiv 0 such that |FT(I)| = A" (FT means Fourier transform); I_0 = 0 arbitrary; if FT(I) = A \cdot \exp(i \theta I), then I_{i+1/2} = FT^{-1}(A(s) \cdot \exp(i \theta(I_0))), I_{i+1} = max[I_{i+1/2}, 0], but did not investigate its convergence. (2) This method can be justified as follows: want to
find I belonging to both $S_1 = \{ I \mid I \neq 0 \}$ and $S_2 = \{ I \mid FT(I) = A \}$. We take any $I_0 \in S_1$, for $I_{1/2}$ take the point of $S_2$, nearest to $I_0$ in $L^2$, for $I_1$, the point of $S_1$, nearest to $I_{1/2}$, etc. In case this method converges, it converges to the solution. (3) We show that for 1-component sources, when Fort and Yee advise Gaussian for $I_0$, this method diverges for almost all $I$ (namely, such that $FT(I)$ is not everywhere $\neq 0$; namely, then $I_{1/2} = I_1 = \cdots = I_2 = \cdots$). (4) This fact makes convergence of the modification of this method (using closure phase) given in the same paper doubtful. (Received March 29, 1979.)

79T-C49 E. Sontag and H. Sussmann, Rutgers University, New Brunswick, NJ 08903. Not even pole-shifting is in general possible over rings. Preliminary report.

Reachability implies coefficient assignability over fields and restricted kinds of rings [Sontag, Ric. di Automatica, July 1976] and for systems which satisfy rather strong conditions [Byrnes, Amer. Journal of Math., Dec. 1976]. Poles can be assigned arbitrarily, on the other hand, when working over a principal-ideal domain and certain other one-dimensional rings. Until now the question of pole-assignment over more general rings was open.

COUNTEREXAMPLE. Let $R = \mathbb{R}[x,y]$, and consider the reachable pair $(F, G)$ with:

$$F = \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}, \quad G = \begin{bmatrix} y+x & y^2x-1+xy^2+xy^2 \\ y-x & y^2-x^2-y^2 \end{bmatrix}$$

For this example there exists no feedback matrix $K$ with coefficients in $R$ such that the characteristic polynomial of $F-GK$ becomes $(z-a)(z-b)$, for any pair of distinct real $a$, $b$, or of complex conjugate $a$, $b$, distinct from $1+i$, $1-i$.

The above counterexample can be strengthened considerably, in that one may construct analogues for $R = \text{ring of functions continuous on an open subset of } \mathbb{R}$. The latter applies to the case of two-parameter families of linear systems, while the example with $\mathbb{R}[x,y]$ applies to the case of delay-differential systems with two noncommensurate delays. (Received April 16, 1979.)

79T-C50 HENRY C. TUCKWELL, University of British Columbia, Vancouver, B.C., Canada. Simplified reaction-diffusion equations for spreading cortical depression.

The model for the evolution of ionic concentrations in brain structures which predicts solitary waves as found in spreading cortical depression consists of several coupled nonlinear reaction-diffusion equations (Tuckwell & Miura, Biophys. J. 23, 257 (1978)). These equations contain source functions which have very complicated dependence on the ion concentrations. Let $U(x,t)$ and $V(x,t)$ be the extracellular concentrations of potassium and calcium ions. Simple source functions were constructed whose values at various parts of the $(U,V)$-plane are similar to those of the original system and which give rise to the same critical points. With the origin chosen as the stable resting state the simplified system may be written:

$$U_t = U_{xx} + U(U - c_1 - c_2 V^2), \quad V_t = D V_{xx} + c_3 (V - c_4 U)(V - c_5 U)$$

where $D$, $c_i$, $i = 1, \ldots, 5$, are positive constants. Numerical calculations have shown that this system has solitary waves with properties similar to those of the original system. (Received April 3, 1979.)


Let $I(p) = \int p(x)dx$ over $[A \leq x \leq B]$. The flux box method for $\partial \frac{p}{x} = \partial \frac{p}{x}$ yields the equation:

$$I(p) = \Delta (p, A - F, p, B) + k^{+1} \text{ "discretization error" when this and a similar electron equation is used to eliminate } I(s), I(p) \text{ from the integrated } P-B \text{ equation - } \frac{\partial}{\partial x} k^{+1} + \frac{\partial}{\partial x}$$

$$k^{+1} = - (I(p) - I(x) + N) + \text{"discretization error" and a quadrature for } I(\cdot) \text{ selected we get a consistently approximated perturbed } P-B \text{ equation. These equations after a physically meaningful, local change of dependent variables yields a fully implicit, completely linearized, Newton, exactly number conserving algorithm for solving the electron-hole transport equations. (Received April 12, 1979.)}$$
**Geometry (50, 52, 53)**

*79T-D7* ROBERT A. BLUMENTHAL, Université de Lille I, B.P. 36 - 59650 Villeneuve D'Ascq, France. The base-like cohomology of a class of transversely homogeneous foliations.

Let $M$ be a closed manifold and let $G$ be a compact connected Lie group. Let $F$ be a smooth foliation of $M$ transversely modeled on a simply connected homogeneous space $G/K$ of $G$. It is shown that $F$ is cohomologically a fibration:

**Theorem.** The base-like cohomology algebra of the foliated manifold $(M,F)$ is isomorphic to the de Rham cohomology algebra of $G/K$. (Received February 26, 1979.)

*79T-D8* Philip H. Turner, Wesleyan University, Middletown, CT 06457. On the smoothness of profiles.

The following theorem generalizes Theorems 1 and 2 previously announced in Abstract 765-D3 of these Notices.

**Theorem:** Suppose $K$ is a compact convex body in $\mathbb{R}^2$. Then any profile $\gamma_\lambda$ of $bd K$ is the boundary of a smooth compact convex body $\Gamma_\lambda$ containing $K$. Furthermore, $K$ is a caustic for billiards in $\Gamma_\lambda$. (Received April 26, 1979.)

**Logic and Foundations (02, 04)**


Th. 1: It is consistent with $\text{ZFC + SH}$ that there is a non special Aron, tree.

Th. 2: It is consistent with $\text{ZFC + G.C.H.}$ that $\mathfrak{p}^3$ fail. Moreover there are $\omega$-sequences $\eta_\delta$ converging to $\delta$ for every limit $\delta < \omega_1$, such that for every $k < \omega$ $A_\delta \subseteq k$, $|A_\delta| < k/2$, there is $h: \omega_1 \to k$ such that for every $\delta$, $h(\eta_\delta(n)) (n < \omega)$ is eventually a constant $\in A_\delta$. (Received November 20, 1978.)

*79T-E27* WITHDRAWN

Let \( \kappa \) be a regular cardinal. An ordered field \( F \) is a BW(\( \kappa \))-field just in case the cofinality of \( F \) is \( \kappa \) and every bounded subset of cardinality at least \( \kappa \) has a limit point. In 1948, Sikorski was able to produce BW(\( \kappa \))-fields of cardinality \( \kappa \) for each uncountable regular cardinal \( \kappa \). Sikorski asked if there are BW(\( \kappa \))-fields of cardinality greater than \( \kappa \) for uncountable \( \kappa \).

Theorem. It is consistent (relative to the consistency of inaccessible cardinals) that BW(\( \omega_1 \))-fields of cardinality at least \( \omega_2 \) do not exist.

This result is closely related to recent results (Fund. Math. 1978) of Juhasz and Weiss concerning \( \omega_1 \)-metrizable, Lindelöf spaces. Indeed, our theorem can be derived from their results.

(Received February 26, 1979.)

J. A. SGRO, 1400 N. W. 10th Ave., #8F, Miami, FL 33136. Interpolation fails for the Souslin-Kleene closure of the open set quantifier logic.

In this paper we show that the Souslin-Kleene closure of the open set quantifier logics fail to have interpolation. We also show that the notion of a \( T_0 \)-topological space is not definable in this logic. This gives a natural proof that it is strictly weaker than the interior operator logics.

(Received February 26, 1979.)

BOHUSLAV BALCAR, CKD-Polovodice, 140 03 Prague, Czechoslovakia and PETER VOJTAS, Mathematics Institute of the Slovak Academy of Science, KomňŠekho 14, 041 54 Kosice, Czechoslovakia. Almost disjoint refinement for ultrafilters on \( \mathbb{N} \).

The following is proved only in ZFC, without any additional set theoretical assumptions. Theorem. For every uniform ultrafilter \( U \) on the set of natural numbers \( \mathbb{N} \), there is almost disjoint refinement for \( U \), i.e. a family \( \{ v_x : x \in U \} \) of pairwise almost disjoint infinite sets such that \( v_x \subseteq x \) for each \( x \in U \). From the topological point of view it means that every point of \( \mathbb{N} - \mathbb{N} \) is a \( 2^{\omega} \)-point. This gives the affirmative answer to a problem raised by Comfort and Hindman. The proof develops a method used in a paper of B. Balcar and R. Frankiewicz, "Ultrafilters and \( \omega_1 \)-points in \( \mathbb{R} - \mathbb{N} \), Bull. Acad. Polon. Sci. (to appear). (Received January 8, 1979.) (Author introduced by)


Let \( L = \{ e_1, ..., e_n \} \) be a many-sorted relational language and \( J \) the set of all sorts of \( L \). Then \( (\sigma, q) \) is an \( L(Q) \) structure if \( \mathcal{M} \) is an \( L \) structure and \( q \) is a function with domain \( J \times \sigma \) such that \( q(i,a) \) is a monotone quantifier that lives on \( a \) (see Barwise, "Monotone Quantifiers and Admissible Sets," in Fenstad et al., Generalized Recursion Theory II, North Holland, 1978.). Let \( A \) be a countable admissible set. We modify the definition of Consistency Property to reflect the presence of \( Q \) and of bounded quantifiers \( \forall x \in a, \exists x \in a \); the Model Existence Theorem follows as usual. We then prove the analog of Feferman's Interpolation Theorem (Feferman, "Applications of Many-sorted Interpolation Theorems," in Proceedings of the Tarski Symposium, AMS, 1974.). Extending Feferman's notation in the natural way we have Theorem 1: Suppose \( \phi, \psi \in L_A(Q) \) are sentences and \( \exists \phi \rightarrow \psi \). Then there is an interpolant \( \theta \) as in Feferman's theorem such that in addition UnbdUn(\( \phi \)) \subseteq UnbdUn(\( \phi \)), UnbdEx(\( \phi \)) \subseteq UnbdEx(\( \psi \)) and Qu(\( \phi \)) \subseteq Qu(\( \phi \)). An application is Theorem 2: If \( J = \{ j \} \), \( \phi \) is a sentence of \( L_A(Q) \) and \( \phi \) persists for end extensions then \( \phi \) is equivalent to a \( \subseteq \) sentence of \( L_A(Q) \). Theorem 1 generalizes a theorem of Shelah (in Bruce, "Ideal models and some not so ideal problems in the model theory of \( L(Q) \)," JSL, 43, no. 2.). (Received March 1, 1979.) (Author introduced by James Henderson.)
An r.e. degree \( \varnothing \) is called branching if there are incomparable r.e. degrees \( \beta \) and \( \gamma \) such that \( \varnothing \) is the g.l.b. of \( \beta \) and \( \gamma \) (written \( \varnothing \triangleright \beta \cup \gamma \)). An r.e. degree which is not branching is called nonbranching degree. Nonbranching degrees \( \varnothing' \) were constructed by Lachlan. (For a construction, see Ch.18 of Shoenfield, Degrees of Unsolvability, North Holland, 1971).

Theorem (Density of Nonbranching Degrees): If \( \varnothing \triangleright \beta \) are r.e. degrees, then there is a nonbranching degree \( \varnothing \) with \( \varnothing \triangleright \beta \). Corollary (Splitting by Nonbranching Degrees): If \( \varnothing \) is a nonzero r.e. degree, then there are incomparable nonbranching degrees \( \beta \) and \( \gamma \) such that \( \varnothing \) is the l.u.b. of \( \beta \) and \( \gamma \) i.e. \( \varnothing \triangleright \beta \cup \gamma \). The corollary follows from the theorem and the Sacks splitting theorem. Density for the r.e. degrees was proven by Sacks. It follows from the corollary that the nonbranching degrees generate the r.e. degrees under \( \cup \), and hence form an automorphism base in the sense of Lerman. They are the first nontrivial definable subset of the r.e. degrees to be shown to be dense and hence to generate the r.e. degrees. If, as suggested by Jockusch and Lerman, the r.e. degrees are given the order topology where a typical subbasic open set has the form \( \{ \varnothing \varnothing \} = \{ \beta : \beta \varnothing \} \) or \( \{ \varnothing \varnothing \} = \{ \beta : \beta \varnothing \} \), then the branching degrees, together with \( \varnothing' \), are precisely the isolated points. It follows from the theorem that the Cantor-Bendixson rank of the r.e. degrees with this topology is \( 1 \). (Received March 2, 1979.)

Let \( \varnothing \) be the class of closed prenex formulas with prefixes \( \forall \varnothing \exists \varnothing \exists x_1 \ldots \exists x_n \) of the first-order predicate calculus extended by inclusion of the identity sign "=".

Theorem. There is no primitive recursive (p.r.) decision procedure for \( \varnothing \). Let \( \varnothing \) be an r.e. function such that \( \varnothing \) has the g.l.b. of \( \varnothing \) and \( \varnothing \). An r.e. degree which is not branching is called nonbranching degree. Nonbranching degrees \( \varnothing' \) were constructed by Lachlan. (For a construction, see Ch.18 of Shoenfield, Degrees of Unsolvability, North Holland, 1971).

Theorem (Density of Nonbranching Degrees): If \( \varnothing \triangleright \beta \) are r.e. degrees, then there is a nonbranching degree \( \varnothing \) with \( \varnothing \triangleright \beta \). Corollary (Splitting by Nonbranching Degrees): If \( \varnothing \) is a nonzero r.e. degree, then there are incomparable nonbranching degrees \( \beta \) and \( \gamma \) such that \( \varnothing \) is the l.u.b. of \( \beta \) and \( \gamma \) i.e. \( \varnothing \triangleright \beta \cup \gamma \). The corollary follows from the theorem and the Sacks splitting theorem. Density for the r.e. degrees was proven by Sacks. It follows from the corollary that the nonbranching degrees generate the r.e. degrees under \( \cup \), and hence form an automorphism base in the sense of Lerman. They are the first nontrivial definable subset of the r.e. degrees to be shown to be dense and hence to generate the r.e. degrees. If, as suggested by Jockusch and Lerman, the r.e. degrees are given the order topology where a typical subbasic open set has the form \( \{ \varnothing \varnothing \} = \{ \beta : \beta \varnothing \} \) or \( \{ \varnothing \varnothing \} = \{ \beta : \beta \varnothing \} \), then the branching degrees, together with \( \varnothing' \), are precisely the isolated points. It follows from the theorem that the Cantor-Bendixson rank of the r.e. degrees with this topology is \( 1 \). (Received March 2, 1979.)

The G"odel Class with identity is not primitive recursively decidable.

Let \( \varnothing \) be the class of closed prenex formulas with prefixes \( \forall \varnothing \exists \varnothing \exists x_1 \ldots \exists x_n \) of the first-order predicate calculus extended by inclusion of the identity-sign "=".

Theorem. There is no primitive recursive (p.r.) decision procedure for \( \varnothing \), that is, no p.r. function \( \varnothing \) such that, for each formula \( F \) in \( \varnothing \), \( \varnothing(F) = 0 \) iff \( F \) has a model. The proof involves, first, the explicit construction for each \( n \) of a satisfiable formula \( F \) in \( \varnothing \) all of whose models have cardinality \( \geq n \), where \( n \) is a function that grows faster than any p.r. function; and, second, the use of the formulas \( F \) in an encoding by formulas of \( \varnothing \) of the problem, for each Turing machine \( T \) and each \( n \), of whether or not \( T \) halts in time \( \leq n \). The theorem contradicts G"odel's claim (Monatshefte für Math. und Physik, vol. 40 (1933), p. 443) that the decision problem for \( \varnothing \) may be settled by the same method as for the subclass of \( \varnothing \) formulas not containing "=". It is not yet known whether there is a (general recursive) decision procedure for \( \varnothing \), or whether \( \varnothing \) contains a satisfiable formula that has no finite models. (Received March 2, 1979.) (Author introduced by Professor Burton S.Dreben).

An Aronszajn type is an uncountable linear ordering with the property that no uncountable subset is well-ordered, conversely well-ordered, or embeddable in the reals. Theorem 1. The following is consistent with ZFC+\( \varnothing \): (a) there is no \( \sigma \)-dense (splitting) poset of power \( \varnothing \), (b) every \( \varnothing \)-LOTS of density \( \varnothing \) has a \( \sigma \)-disjoint uniform base; (c) every perfectly normal non-Archimedean space of weight \( \varnothing \) is metrizable. Theorem 4. (MA+\( \varnothing \)) Every graph on \( \varnothing \) one has \( \varnothing \), which contains no Shelah subgraph has chromatic number \( \varnothing \). Theorem 5. There exist exactly \( 2^{\varnothing} \) isomorphism types of totally rigid normal Aronszajn trees. (Received March 15, 1979.)

Arnold W. Miller, University of Wisconsin-Madison, 53706. The Baire category theorem and cardinals of countable cofinality.

Let \( \varnothing \) be the least cardinal for which the Baire category theorem fails for the real line, \( R \). That is, \( \varnothing \) is the least \( \varnothing \) such that there are nowhere dense \( X \) for \( \varnothing < \varnothing \) with \( R = \cup \{ X \varnothing : \varnothing \varnothing \} \) (\( X \varnothing \) nowhere dense means that the interior of the closure of \( X \varnothing \) is empty).

Theorem 1. \( \varnothing \) does not have countable cofinality (in particular \( \varnothing \neq \varnothing \)). This answers a question of Fremlin. It is proved by noting that a weak form of \( \varnothing \) is true, namely for countable partial orders and families of dense sets of cardinality less than \( \varnothing \).
Theorem 2. It is consistent with ZFC that \( \kappa_B (\omega^1) = \kappa_\omega \). The model is gotten by adjoining \( \kappa_\omega \) Cohen reals to a model of GCH.

For a \( \mathcal{E} \)-ideal \( I \) of subsets of \( X \) define \( \kappa(I) \) to be the least \( \kappa \) such that there are \( X_\alpha \in I \) for \( \alpha < \kappa \) such that \( X = \bigcup \{ X_\alpha : \alpha < \kappa \} \).

Theorem 3. It is consistent with ZFC that there exists an \( \omega_1 \) saturated \( \mathcal{E} \)-ideal \( I \) in the Borel subsets of \( \mathbb{R} \).

The model is gotten by adjoining \( \mathcal{E} \)-ideal \( I \) of subsets of \( X \) define \( k(I) \) to be the least \( k(I) \) such that there are \( x, y \in X \) where \( x \subseteq y \subseteq X \).

Theorem 4. It is consistent with ZFC that \( k(I, \mathcal{E}) = \mathcal{E} \mathcal{E} \mathcal{E} \mathcal{E} \).

This was proved with K. Kunen. The \( \mathcal{E} \) random real model is used. (Received March 8, 1979.)

Caseo.6 T.E. Harris, University of Southern California, Los Angeles, California 90007. Brownian Motions of the Homeomorphisms of \( \mathbb{R}^2 \). Preliminary report.

Statistics and Probability (60, 62)

T.E. Harris, University of Southern California, Los Angeles, California 90007. Brownian Motions on the Homeomorphisms of \( \mathbb{R}^2 \). Preliminary report.

Let \( \mathbb{N} \) be the group of homeomorphisms of \( \mathbb{R}^2 \) with itself, with the topology of compact convergence. Let \( Z = (Z_{st}, 0 \leq s \leq t) \) be an \( \mathbb{N} \)-valued random process, continuous in \( s \) and \( t \), such that \( Z_{st} \circ Z_{tu} = Z_{su} \) if \( s \leq t \leq u \), and such that \( Z_{st}, Z_{uv}, \ldots \) are independent if \( s \leq t \leq u \leq v \leq \ldots \). Assuming homogeneity in space and time, \( Z \) is called a Brownian motion on \( \mathbb{N} \). Call \( Z \) if it is incompressible (each \( Z_{st} \) preserves Lebesgue measure) and isotropic. Let \( (b_{ij}(z), z \in \mathbb{R}^2, i,j = 1,2) \) be the covariance tensor of an isotropic solenoidal \( \mathbb{R}^2 \)-valued homogeneous random field in \( \mathbb{R}^2 \). Assume \( b_{ij} \) has bounded continuous partial derivatives of order \( \leq 2 \). THEOREM. There is a unique \( \mathbb{N} \) Brownian motion \( Z \) on \( \mathbb{N} \).
such that
\[
\lim_{t \to \infty} E z_{ot}^j (o) (z_{ot}^j (z) - z^j) / t = b_{ij} (z),
\]
where \( z = (z^1, z^2) \) and \( z_{st}^j (z) \) is the \( j \)th component of the value at \( z \) of \( Z_{st}^i \). Conversely every Brownian motion on \( H \) whose \( k \)-point motions have \( C^2 \)-bounded diffusion coefficients is generated by such a covariance tensor. (For any Brownian motion on \( H \), the motion of any set of \( k \) points is Markovian, \( k = 1, 2, \ldots \).) (Received March 19, 1979.)

79T-F8  John H. Elton, The University of Texas, Austin, Texas 78712. The law of large numbers for identically distributed martingale differences.

The averages of an identically distributed martingale difference sequence converge in mean to zero, but the almost sure convergence of the averages characterizes \( L \log L \) in the following sense: if the terms of an identically distributed martingale difference sequence are in \( L \log L \), the averages converge to zero almost surely; but if \( f \) is any integrable random variable with zero expectation which is not in \( L \log L \), there is a martingale difference sequence whose terms have the same distribution as \( f \) and whose averages diverge almost surely. (Received April 5, 1979.)

79T-F9  Leonard E. Dor, Wayne State University, Detroit, MI. 48202. Lower \( L_2 \)-estimates for some martingales in \( L_1 \). Preliminary report.

**Theorem.** Fix \( 0 < \delta < 1 \). If \( (X_n) \) is a martingale difference sequence in \( L_1 (\Omega, B, P) \), satisfying
\[
\int_{\Omega} \left\| X_n \right\|_A \, dP \leq \delta \sum_{n=1}^N \left\| X_n \right\|_1
\]
for all \( n \) and all sets \( A \) with \( P(A) \leq \delta \), then
\[
\left\| \sum_{j=1}^n X_j \right\| \geq \frac{1}{2} \left( 1 - \delta \right) \frac{n}{\delta} \left( \sum_{j=1}^n \left\| X_j \right\|_1^2 \right)^{1/2}
\]
for all \( n \).

This improves a recent result of Aldous and Fremlin, who proved an analogous qualitative result under the assumption that the sequence \( \left( X_n / \left\| X_n \right\| \right) \) is uniformly integrable. (Received April 16, 1979.)

**Topology (22, 54, 55, 57, 58)**

79T-051  WITHDRAWN

79T-052  IAIN AITCHISON and HYAM RUBINSTEIN, University of Melbourne, Parkville, Vic. 3052, Australia. Fibered 2-knots and exotic involutions of \( S^4 \). Preliminary report.

Cappel and Shaneson (Annals of Math. 104 (1976), 61-72) constructed a family of smooth 4-manifolds which are simple homotopy equivalent to \( \mathbb{R}^4 \) but are not even smoothly h-cobordant to \( \mathbb{R}^4 \). Akbulut and Kirby (Topology, to appear) have shown that one of these 4-manifolds has a double cover which is diffeomorphic to \( S^4 \).

**Theorem 1.** There are at most two non-diffeomorphic 4-manifolds in the above family. Both of these 4-manifolds are a quotient of \( S^4 \) by the action of a free involution which is not PL or smoothly equivalent to the antipodal map.

An interesting class of fibered 2-knots in homotopy 4-spheres was used by Cappel and Shaneson (Annals of Math. 103 (1976), 349-353) to give examples of inequivalent 2-knots with the same complement.

**Theorem 2.** All of the homotopy 4-spheres which contain the fibered 2-knots are diffeomorphic to \( S^4 \). We also have some partial results on the problem of showing that any homotopy 4-sphere which has an open book decomposition with binding \( S^2 \) and page \( T^3 - \text{int} B^3 \) is diffeomorphic to \( S^4 \). (Received February 26, 1979.)
We have

**Theorem.** A $T_0$ space $X$ is metrizable if (and only if) it has at every point $p \in X$ a set of (weak) neighbourhoods $\{U_n(p)\}_{n \in \mathbb{N}}$ satisfying the following:

(i) given $x \in X$ and $A \subset X$ such that $x \notin \overline{A}$, there exists an $m \in \mathbb{N}$ such that $x \notin U_m(a)$ for all $a \in A$; and

(ii) given $n, m \in \mathbb{N}$ such that $n > m$, the family $\{U_n(p) : p \in X\}$, indexed by members of $X$, is cushioned in $\{U_m(p) : p \in X\}$.

In particular, the $U$'s may be stellar in origin in which case we have

**Corollary.** A $T_0$ space $X$ is metrizable if (and only if) it has a development $\{G_i\}_{i \in \mathbb{N}}$ such that the indexed family $\{\text{St}(x,G_i) : x \in X\}$ is cushioned in the family $\{\text{St}(x,G_j) : x \in X\}$ whenever $i < j$.

By generalizing Alexandroff-Urysohn. (Received February 27, 1979.)

**79T-G54** Adil G. Naoum, Department of Mathematics, College of Science, University of Baghdad, Baghdad-IRAQ. A Borsuk-Ulam type theorem for connected Lie groups.

Goldstein and Turner used intersection theory to prove a Borsuk-Ulam type theorem for even dimensional spheres with semi-free group action. In this note a similar result is proved for smooth manifolds with positive Euler characteristic and semi-free action of connected Lie group. (Received February 26, 1979.)

**79T-G55** JAN van MILL, Vrije Universiteit, De Boelelaan 1081, Amsterdam. Weak $P$-points in compact $F$-spaces.

Using a technique due to Kunen we show that each compact $F$-space $X$ of weight $2^\omega$ in which each nonempty $G_δ$ has nonempty interior contains a weak $P$-point, i.e. a point $x \in X$ such that $x \notin \overline{F}$ for each countable $F \subset X - \{x\}$. Assuming CH, we show that such points exist in each compact $F$-space in which each nonempty $G_δ$ has nonempty interior. We also discuss remote points and points which are not a limit point of any countable discrete set. (Received February 27, 1979.)

**79T-G56** ALAN DOW, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2

Absolute $C^*$-embedding of extremally disconnected spaces.

A subset $P$ of $Y$ is a $P$-set of $Y$ if any $G_δ$-set of $Y$ which contains $P$ is a neighborhood of $P$. $E(X)$ denotes the projective cover of a Tychonoff space $X$. If $Y$ is a space and $A$ a subset of $Y$, we will denote by $Y\text{mod}(A)$ the quotient space of $Y$ obtained by collapsing $A$ to a point. **Theorem:** Let $X$ be an extremally disconnected space and let $P$ be a compact $P$-set of $\beta X$ which is contained in $\beta X \setminus X$. Then for some cardinal $\lambda$ (i) there is a space $Y$ contained in $E(2^\lambda)$ which is homeomorphic to $\beta X\text{mod}(P)$ and (ii) if $q \in \beta X \setminus (X \cup P)$ then there is a space $Y$ contained in $E(2^\lambda)$ which is homeomorphic to $\beta X\text{mod}(P \cup \{q\})$.

**Corollary:** Let $X$ be an extremally disconnected space. $X$ is $C^*$-embedded in every extremally disconnected space in which it is embedded iff $X$ is weakly Lindelöf or almost compact. **Remark:** The proof of the theorem is a generalization of the method used by Balcar and Simon in *Convergent nets in the space of uniform ultrafilters*. (to appear). (Received February 27, 1979.)

**79T-G57** WITHDRAWN
The following theorem is a generalization of B.A. Pasynkov's theorem (Soviet Math. Doklady 6 (1965) 404-407): For every almost metrizable group G, \( \dim G = \text{Ind} G \).

**Theorem.** Assume that X is a normal space and that there is a quasi-perfect map f from X onto a metric space Y such that \( \dim f^{-1}(y) = 0 \) for every \( y \in Y \). Then \( \dim X = \text{Ind} X \).

This theorem follows directly from the lemma: Let f be a closed continuous map from a normal space X onto a hereditarily paracompact \( T_2 \)-space Y such that \( \dim f^{-1}(y) = 0 \) for every \( y \in Y \). Then \( \text{Ind} X \leq \text{Ind} Y \). (Received March 13, 1979.)

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**79T-059** MATTHEW G. BRIN, SUNY at Binghamton, Binghamton, NY 13901. Generalized 3-manifolds whose non-manifold set has neighborhoods bounded by tori.

Statements A and B below are equivalent by results of McMillan. We show that they are equivalent to the Poincaré conjecture.

A. Every compact, ANR, generalized 3-manifold whose non-manifold set is 0-dimensional and which has arbitrarily small neighborhoods, each component of which has connected torus boundary, is the cell-like image of a compact 3-manifold.

B. Every open 3-manifold satisfying 1, 2 and 3 below embeds in a compact 3-manifold.

1. M is an ascending union of compact 3-manifolds each of whose boundary components is a torus that separates M.
2. Every compact set \( K \) in M is contained in a compact set \( K' \) in M so that 1-cycles in \( M-K' \) bound 2-chains in \( M-K \).
3. The Freudenthal compactification of M is locally simply connected.

We show that statement B is still equivalent to the Poincaré conjecture if it is assumed that M is irreducible. Statement B is true independent of the Poincaré conjecture if M is an ascending union of solid tori. (Received March 16, 1979.)

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**79T-060** WITHDRAWN

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**Theorem 1.** If \( G \) is a collection of closed subsets of X and K is a point-finite open cover of X such that each \( K \in K \) intersects at most countably many elements of \( G \), then \( G \) has a \( \sigma \)-closure preserving refinement.

The above theorem gives the following new results concerning para-Lindelöf spaces and spaces with a \( \sigma \)-locally-countable base.

**Corollary 2.** A regular \( \theta \)-refinable space with a \( \sigma \)-locally-countable base is developable.

**Corollary 3.** A regular para-Lindelöf \( \theta \)-refinable space is subparacompact.

**Corollary 4.** If X is a regular \( \theta \)-refinable space in which every open cover has a \( \sigma \)-locally-countable refinement then X is subparacompact.

**Corollary 5.** A regular \( \theta \)-refinable space with a \( \sigma \)-locally-countable network is a \( \sigma \)-space. (Received March 19, 1979.)
William G. Fleissner, University of Pittsburgh, Pittsburgh, PA 15260. 
Point inverses under maps preserving \(\sigma\)-discrete. Preliminary report.

Theorem (Pol, Hansell) Let \(f: X \to Y, X,Y\) metrizable spaces, weight \(Y = H_1, f\) takes \(\sigma\)-discrete sets to \(\sigma\)-discrete sets. Then \((y: f^{-1}(y)\) is nonseparable\) is \(\sigma\)-discrete.

Let \(S\) be the statement of the above theorem without the hypothesis "weight \(Y = H_1\)."

Theorem: In the model constructed by collapsing a supercompact to \(\omega_2, S\) is true.

Theorem: Assuming \(\mathfrak{I} \in (k)\) (for example, in any generic extension of a model of \(V = L\), there are metrizable spaces \(Z,Y,\) weight \(Z = H_1, \) weight \(Y = k\) such that the natural map \(f: Z \times Y \to Y\) takes \(\sigma\)-discrete sets to \(\sigma\)-discrete sets. (Received April 3, 1979.)


Let \(H(F)\) and \(H(F,*)\) denote the spaces of free and basepointpreserving homotopy equivalences of a topological space \(F\). Let \(K\) be a group and \(K \to \pi_1(H(F))\) a homomorphism. Let \(G_1(F)\) be Gottlieb's subgroup of the fundamental group, and \(A\) a subgroup of \(G_1(F)\) invariant under the action of \(K\). We define an obstruction \(p\) in \(C^\infty(BK,G_1(F)/A)\) (local coefficients) to the existence of a fibration \(F \to Y \to X\) with \(\pi_1(F) \to \pi_1(Y) = A\) and \(\pi_1(X) = K\) with the given action on the fibre. In case \(p\) is 0 we construct universal fibrations with given fundamental group data. Sample application: Let \(M \to \mathbb{E} \to B\) a bundle such that \(\pi_1(B) \to \pi_1(H(M))\) is trivial. Then the induced transfer of Wall-groups \(L_1(\pi_1(B)) \to L_1(\pi_1(H(F)))\) composed with \(L_1(\pi_1(K)) \to L_1(\pi_1(M)/G_1(M)\pi_1(B))\) is equal to the map induced by product with \(M\).

In the unoriented case we obtain a similar relation to twisted products. Also we get analogous results for Whitehead torsion and finiteness obstructions. In general we prove that these transfers only depend on the fibre and the fundamental group data of the fibration (which includes information about the homomorphism \(\pi_1(E) \to \pi_1(H(F, *))\), \(E\) the total space of the fibration). (Received April 3, 1979.)


The following theorem and other extensions of our earlier results (see these Notices 25(1978), A-447 and A-609) are given. Theorem. For each integer \(n \geq 3\), there exists an uncountable family \(F\) of compact ANR's of dimension \(n\) such that each \(X\) belonging to \(F\) satisfies (a) \(X\) does not contain any proper closed subset of dimension \(\geq 2\) which is an ANR, FAR, or which has \(UV_1\), and (b) \(X \times S^1\) is homeomorphic to \(S^D \times S^I\). Furthermore, for each integer \(n \geq 3\) there exists an uncountable family of compact AR's of dimension \(n\) satisfying the assertion (a) given above. Each of these spaces is constructed as a decomposition space of \(S^D\) (or \(S^D\)) corresponding to certain null sequence of arcs. Several other related results are studied and some other generalizations of this theorem are also given. (Received April 6, 1979.)

Charles Livingston, University of California, Berkeley, California 94720. Homology cobordisms of \(3\)-manifolds.

Two \(3\)-manifolds, \(M_1\) and \(M_2\), are homology cobordant if there is a \(4\) manifold \(W\) with \(\partial W = M_1 \cup -M_2\) and with the inclusion \(H_*(M_1;Z) \to H_*(W;Z)\) an isomorphism.

A \(3\)-manifold is irreducible if every embedded 2-sphere bounds an embedded 3-ball.

Theorem. Every closed, orientable \(3\)-manifold is homology cobordant to an irreducible \(3\)-manifold. The proof of this theorem uses a construction which can be applied to give a new proof of a result of Kirby and Lickorish:

Theorem. Every knot in \(S^3\) is concordant to a prime knot. (Received April 9, 1979.)
Under MA + $2^\omega = \omega_2$ there is a (compact) strongly zero-dimensional F-space of weight $2^\omega$ which cannot be embedded in any basically disconnected space.

Dually, under MA + $2^\omega = \omega_2$ there is a weakly countably complete (or almost $\sigma$-complete, or countable separation property) Boolean algebra of cardinality $2^\omega$ which is not a homomorphic image of any countably complete Boolean algebra. The key to our construction is the observation that if $X$ is a subspace of a basically disconnected space and $\beta\omega \subseteq X$ then $\beta\omega$ is a retract of $X$. Dually, if $B$ is a homomorphic image of a countably complete Boolean algebra, and if $h$ is a homomorphism from $B$ onto $P(\omega)$, the field of subsets of $\omega$, then there is an embedding $e: P(\omega) \to B$ such that $h \circ e = \text{id}_{P(\omega)}$. (Received April 9, 1979.)
For $M$ a finitely generated module over a noetherian U.F.D. $R$, let $\sigma_k(M) \{r \in R | rM \text{ is contained in a } k\text{-generator submodule}\}$. For an ideal $I$ of $\Lambda$, let $I'$ be the smallest principal ideal containing $I$. Let $\Delta_k(M)$ generate $E_k(M)$, where $E_k(M)$ is the $k$th Alexander ideal of $M$.

**Theorem 1.** If $M$ is an $R$-torsion module, $G_k(M) = (\sigma_k(M) / \sigma_{k+1}(M))$. $G_k(M)$ is the group of a $k$-component homology boundary link in $\mathbb{S}^3$, and $M$ is the $\mathbb{Z}[G/G']$-torsion submodule of $G'/G''$ containing $\pi_1(M)$ is contained in a $k$-generator submodule.

**Theorem 2.** If $G$ is the group of a $1$-component homology boundary link in $\mathbb{S}^3$, and $M$ is the $\mathbb{Z}[G/G']$-torsion submodule of $G'/G''$, then $\sigma_0(M) (= \text{Ann } M)$ is principal, and $M$ has no $\mathbb{Z}$-torsion. If $G$ is the group of a $2$-component link with $\Delta_1 \neq 0$, then $\sigma_0(G'/G'')$ is principal.

**Remarks.** 1. This was first proven for $\mu = 1$ by Crowell. 2. $\sigma_1(M)$ is not principal for the knot $9_46$. 3. If $G$ is the group of a $2$-component homology boundary link in $\mathbb{S}^3$, then $G'/G''$ has no $\mathbb{Z}$-torsion.

**Theorem 3.** The Alexander polynomials, annihilator ideals and the Steinitz-Fox-Smythe invariant. Preliminary report. be the ideal generated by $\Delta_k(M)$. Let $\sigma_k(M)$ generate $E_k(M)$, where $E_k(M)$ is the $k$th Alexander ideal of $M$.

**Theorem 1.** If $M$ is an $R$-torsion module, $G_k(M) = (\sigma_k(M) / \sigma_{k+1}(M))$. $G_k(M)$ is the group of a $k$-component homology boundary link in $\mathbb{S}^3$, and $M$ is the $\mathbb{Z}[G/G']$-torsion submodule of $G'/G''$. Then $\sigma_0(M) (= \text{Ann } M)$ is principal, and $M$ has no $\mathbb{Z}$-torsion. If $G$ is the group of a $2$-component link with $\Delta_1 \neq 0$, then $\sigma_0(G'/G'')$ is principal.

**Remarks.** 1. This was first proven for $\mu = 1$ by Crowell. 2. $\sigma_1(M)$ is not principal for the knot $9_46$. 3. If $G$ is the group of a $2$-component homology boundary link in $\mathbb{S}^3$, then $G'/G''$ has no $\mathbb{Z}$-torsion. 4. For a general $2$-component link $G'/G''$ may have $p$-torsion for primes $p$ dividing the linking number.

**Theorem 3.** The Steinitz-Fox-Smythe column invariant of a finitely presented module $M$ of rank $r$ over a commutative domain $R$ is the isomorphism class of the rank $1$ torsion free module $\Lambda / M/torsion$. The cardinality of certain Baire spaces. Preliminary report.

All spaces considered are Hausdorff without isolated points. 

**Theorem 1.** (MA+1CH) Every separable Baire space has cardinality $\geq \mathfrak{c}$. 

**Theorem 2.** (MA+1CH) Every c.c.c. Baire space with $\pi$-weight $\leq \mathfrak{N}$ has cardinality $\geq \mathfrak{c}$. 

**Theorem 3.** CON ($\exists$ an inaccessible cardinal) $\rightarrow$ CON (MA+1CH + every Baire space with $\pi$-weight $\leq \mathfrak{N}$ has cardinality $\geq \mathfrak{c}$). (Received April 16, 1979.)

**LATE PAPERS — Presented at past meetings**

**765th MEETING, NEW YORK CITY, APRIL 17–19, 1979**


We investigate some relations between geometry and homology class for subvarieties of abelian varieties. A formula is given relating the homology classes of two subvarieties to their tangent spaces at their intersection points; this yields, as a special case, a geometric formula for the homology class of a single subvariety (of arbitrary codimension). We discuss some applications, including an intersection-theoretic solution to the Schottky problem related to, and strengthening, a solution obtained 20 years ago by Matsusaka. (Received March 16, 1979.)

**765-B-35** Carl Prather, V.P.I. and State University, Blacksburg, Virginia. Final Sets for operators on balanced entire functions. Preliminary report.

As a sequel to the recent work "Final sets for operators on finite Fourier transform" by Boas and Prather (to appear in Houston Math Journal) Final sets are determined for operators $\varphi(z)$, with $\varphi(z) = \exp(-az) f(z)$, $a \geq 0$ and $f$ a real entire function of genus $\leq 1$ with real zeros, applied to
balanced entire functions, e.g., to \( \sum C_k \exp(i \lambda_k z), \sum |C_k| < \infty \). Additional assumptions on the rate of convergence of the exponents are made (when they converge). The case \( \sum C_k \exp(\lambda_k z) \), where the \( \lambda_k \) are complex, is discussed for derivatives. We show that final set results can be obtained on non-balanced entire functions for the operator \( \varphi(D) \), where \( \varphi(z) \) has nonreal zeros. (Received February 26, 1979.)

765-P22 MARK J. DURST, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139. Chi-squared goodness-of-fit tests with data-dependent cells.

We give chi-squared goodness-of-fit tests for the composite case with great generality. In previous work the sample, parameter, and alternative spaces have been restricted to open sets in some Euclidean space, with cells formed by hyperplanes cutting the sample space. Dudley's work on the empirical process makes this restriction unnecessary, and our cells need only be among the elements of a Donsker class. Our sample space is arbitrary, and our parameters need only be in a manifold (e.g., circles, spheres, solutions of algebraic equations, etc.), in addition to the usual open set in Euclidean space, with differentiability of cell probabilities. Alternative distributions, examples, and recipes are given. (Received March 21, 1979.)

*765-G8 RALPH L. COHEN, University of Chicago, Chicago, Illinois 60637. The geometry of \( \mathbb{N}^2 S^3 \) and braid orientations. Preliminary report.

Let \( \gamma: \mathbb{N}^2 S^3 \rightarrow \mathbb{B}^0 \) be a 2 fold loop map which is nontrivial on the fundamental group. There is only one such map up to homotopy. Filter \( \mathbb{N}^2 S^3 \) via May's approximation theorem, and let \( \gamma_k: F_k(\mathbb{N}^2 S^3) \rightarrow \mathbb{B}^0 \) be the restriction of \( \gamma \). A manifold \( M \) is said to be Mahowald \( k \)-orientable (\( M_k \) orientable) if the map \( \gamma: M \rightarrow \mathbb{B}^0 \) representing the stable normal bundle of \( M \) factors through \( \gamma_k \). Our main theorem states that the spectrum \( M(M_k) \) representing \( M_k \)-oriented bordism theory is homotopy 2-equivalent to the mod 2 Brown Gitler spectrum \( B(k) \). An analogous result holds at every prime \( p \). Brown, Peterson, and myself have previously shown how the Brown Gitler spectra represent the bordism theory of manifolds with normal bundle whose structure group is reduced to Artin's braid group \( \mathbb{B}_n \). By combining these results we are able to classify both \( M_k \) and \( \mathbb{B}_k \) oriented manifolds up to cobordism through a range of dimensions. The many applications of these spectra to homotopy theory are also discussed. (Received February 5, 1979.)

MEMOIRS OF THE AMERICAN MATHEMATICAL SOCIETY

A NEW MATHEMATICAL FRAMEWORK FOR THE STUDY OF LINKAGE AND SELECTION by S. Shahshahani

A continuous multi-locus model describing the evolution of a large population of a diploid organism is studied. It is assumed that only the forces of natural selection and recombination are operating. The use of a non-Euclidean metric greatly clarifies the dynamical properties of the system of differential equations involved.

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Algebra and Theory of Numbers (05, 06, 08, 10, 12–18, 20)

767-AI Burton Fein, Oregon State University, Corvallis, Oregon 97331 and Murray Schacher, University of California at Los Angeles, Los Angeles, CA 90024. Strong crossed product division algebras.

Let $D$ be a division algebra having center $K$ and suppose $[D:K] < \infty$. We say that $D$ is a strong crossed product for the finite group $G$ if every maximal subfield of $D$ is a Galois extension of $K$ with Galois group isomorphic to $G$.

Amitsur (Israel J. Math 12 (1972), 408-420) proved that for each natural number $n$ there exists a division algebra which is a strong crossed product for the abelian group $G_n$ of order $n$ having elementary abelian Sylow subgroups; this result is one of the key steps in Amitsur's proof of the existence of non-crossed products. We prove that if $D$ is a strong crossed product for $G$, then $G \cong G_n$ and $D$ is a tensor product of cyclic division algebras of prime index. (Received March 26, 1979.)

767-A2 RAI, R.K., Dalhousie University, Halifax, N.S., B3H 4H8. Reduced rings and their orthogonal completions. Preliminary report.

A. Abian defined a partial order relation $\preceq$ on a reduced ring $R$ by $a \preceq b$ if $ab = a^2$ (Proc. Amer. Math. Soc. 52 (1975), 45-49) and called a ring $R$ orthogonally complete if every orthogonal subset (OS) $X$ ($a, b \in X$, $ab$ implies $ab = 0$) has a supremum w.r.t. $\preceq$. Burgess and Raphael (Pac. J. Math. 54-1 (1974), 55-63) defined $\hat{R}$ to be an orthogonal completion (OC) of a reduced ring $R$ if $\hat{R}$ is an orthogonally complete ring and every element of $\hat{R}$ is the supremum of an OS of $R$. This raised the question: which rings have an OC and when are OCs unique? We establish the following result.

Theorem: A reduced ring $R$ has an OC iff it has an idempotent filter $F$ of right ideals contained in the idempotent filter of dense right ideals such that (i) $\forall \, q \in \text{Qmax}(R)$ $\exists$ a maximal OS $(e_i : i \in I)$ of idempotents of $\text{Qmax}(R)$, the maximal two sided ring of quotients of $R$, such that $q$ maps (by left multiplication) the right $R$-submodule $M$ of $\text{Qmax}(R)_R$ generated $q^{-1}D$ $\cup$ $(e_i : i \in I)$ into $R$ and (ii) $\forall$ $R$-submodules $M$ of $\text{Qmax}(R)_R$ generated by a maximal OS of idempotents of $\text{Qmax}(R)$ and $\forall$ $f \in \text{Hom}_R(M, R)$ $\exists$ a $q \in \text{Qmax}(R)$ such that $f(m) = qm$ $\forall$ $m \in M$.

It can be deduced from this that many rings, including all Baer rings have OCs and that $\text{Qmax}(R)$, for $R$ reduced, is orthogonally complete. Further, OCs, when they exist, are unique. (Received March 26, 1979.)


Example: The additive group structure on an infinite field is the only algebraic group structure up to an algebraic group isomorphism.

Theorem: If an affine variety over an infinite field has an abstract group structure such that the multiplication is given by a polynomial map, then the inversion is also a polynomial map, i.e., the variety is an algebraic group. (Received March 26, 1979.)

767-A4 M. FAHY and J. ZEIDANOWITZ, University of California, Santa Barbara, California 93106. Artinian rings of quotients.

$\mathfrak{J}$ denotes a finitely based collection of left ideals of a ring $R$ and $S(\mathfrak{J}) = (\{e_1, \ldots, e_n\} \mid \sum R e_q \in \mathfrak{J})$.

Necessary and sufficient conditions for $\mathfrak{J}$ to form a Gabriel topology can be given in terms of Ore-type conditions on the set of vectors $S(\mathfrak{J})$. By taking this approach we are able to define the
HASAN A. CELIK, California State Polytechnic University, Pomona, California 91768. On the Prime and Semi-prime Antiflexible Rings, preliminary report.

Let \( R \) be an antiflexible not associative ring of characteristic not two. Let \( M, N, Z \) denote the middle nucleus, nucleus and center of \( R \) respectively. Theorem. Let \( R \) be prime, (1) If \( [R, R] \subseteq M \) then \( N = Z \). (2) If \( (x, x, x) = 0 \) or \( [R, R] \subseteq N \) then \( R^+ \) is commutative and associative. Theorem. Let \( R \) be semi-prime with \( [R, R] \subseteq M \). Then either \( N = Z \) or \( R \) is a subdirect sum of an associative ring \( R_1 \) and a semi-prime ring \( R_2 \) with \( N(R_2) = Z(R_2) \). (Received April 3, 1979.)

GEORGE M. Bergman, University of California, Berkeley, CA 94720. (Part (iii) is joint with T. Bass, D. Britten, and F. W. Lemire, University of Windsor, Windsor, Ontario N9B 3P4.) Nilpotent rings, triangular matrix rings, and graded rings. Preliminary report.

I will sketch the proofs of the following results, representing 4 papers in preparation. Let \( k \) be a commutative ring with 1, \( R \) an associative \( k \)-algebra without 1, and \( N \) a positive integer.

(i) The following three conditions are equivalent: (a) \( R \) can be embedded as a \( k \)-algebra in the ring of strictly upper-triangular \( (N+1) \times (N+1) \) matrices over an associative \( k \)-algebra \( S \). (b) Ditto, with \( S \) also assumed commutative. (c) \( R \) can be embedded as a \( k \)-algebra in a graded associative \( k \)-algebra \( T \), whose only nonzero components are \( T_1, \ldots, T_N \).

(ii) If \( k \) is a field (a)-(c) are also equivalent to: (d) \( R^n+1 = 0 \).

(iii) In general, a sufficient condition for (a)-(c) to hold is \( R^n+1 = 0 \), where \( 2^{n-1} \leq N \). This is the best possible result which remains true on going to extensions of the commutative ring \( k \).

(iv) If \( R \) is a commutative nilpotent \( k \)-algebra, we may wish an embedding as in (b) but with \( T \) also commutative. Here I have some partial results. The behavior depends strongly on the characteristic, with characteristic 0 the worst case. (E.g. if \( k = \mathbb{Q}[t] \) and \( R = \mathbb{K} / t^2 \mathbb{K} \), no such embedding is possible for any \( N \).) (Received April 18, 1979.)

CHARLES LANSKI, University of Southern California, Los Angeles, California 90007. Algebraic Elements in Rings with Involution. Preliminary Report.

Let \( R \) be a ring with involution, \( * \) over a field \( F \). Set \( K = \{ r \in R | r^* = -r \} \) and \( S = \{ r \in R | r^* = r \} \). The main results are: (i) If each element of \( K \) is algebraic over \( F \), if \( K \) contains a regular element, and if \( F \) is uncountable, then \( R \) is algebraic over \( F \); (ii) If each element of \( K \) is algebraic over \( F \) and if \( R \) is a prime \( PI \) ring, then \( R \) is algebraic over \( F \). The proofs work in greater generality when \( S \) replaces \( K \) and give the corresponding theorems for \( S \), proved by S. Montgomery. Examples are given which show that (i) is false if \( K \) does not contain a regular element, and (ii) is false for \( R \) a semi-prime \( PI \) ring. (Received April 23, 1979.)

MARK L. TEPLY, University of Florida, Gainesville, Florida 32611. Semisimple semigroup rings and some problems of J. Weissglass.

Let \( \pi \) be a property of rings that is closed under taking homomorphic images and ideals. A ring is \( \pi \)-semisimple if it has no nonzero ideals with property \( \pi \). Let \( S \) be a strong semilattice \( P \) of semigroups \( S_\alpha (\alpha \in \Pi) \). For a ring \( R \), let \( RS \) denote the semigroup ring. Theorem 1. If \( RS_\alpha \) is \( \pi \)-semisimple for each \( \alpha \in \Pi \), then \( RS \) is \( \pi \)-semisimple. Let \( \alpha, \beta \in \Pi \); then \( \beta \) is maximal.
under $\alpha$ if $\beta < \alpha$ and there is no $\gamma \in P$ such that $\beta < \gamma < \alpha$. Theorem 2. The converse to Theorem 1 holds if the following conditions are satisfied: (1) if $\alpha, \delta \in P$ with $\delta < \alpha$, then there exists $\beta$ maximal under $\alpha$ such that $\delta \leq \beta < \alpha$; (2) the set $\{\beta \in P|\beta$ is maximal under $\alpha\}$ is finite for each $\alpha \in P$. If either (1) or (2) fails, examples can be given such that some $RS_{\alpha}$ has a nilpotent ideal, but $RS$ is Jacobson semisimple. Theorem 3. Let $R$ have an identity element, and let $T$ be a commutative semigroup such that a power of each element of $T$ lies in a subgroup of $T$. Then $RT$ is semiprime if $T$ is a (strong) semilattice $P$ of groups $S_{\alpha}$, and $RS_{\alpha}$ is semiprime for each $\alpha \in P$. The results of this paper answer several questions raised by J. Weissglass. (Received April 23, 1979.)

767-A9 F. W. ANDERSON, University of Oregon, Eugene, Oregon, 97403. Square free rings.
Each square free ring $R$ determines a natural tertiary relation on its set of primitive idempotents. The resulting relational system is a "frame". In general, a given frame is the frame of many square free rings. However, special square free algebras over a field $K$ are characterized to within isomorphism by means of their frames and the cohomology of these frames. Such algebras of finite representation type are completely determined provided their frames are transitive. (Received April 24, 1979.)

767-A10 KENNETH R. GOODEARL, University of Utah, Salt Lake City, Utah 84112 and ROBERT B. WARFIELD, JR., University of Washington, Seattle WA 98195. The State Space of $K_0$ of a Noetherian Ring. Preliminary Report.
Associated to every ring $R$ with identity is a compact convex set, the state space of $K_0(R)$. This is a set of order-preserving functionals on $K_0(R)$, and in cases where $K_0$ is complicated, it can be thought of as giving a simplified picture of its structure. For fully bounded Noetherian rings of finite Krull dimension, we use a generalization of the Forster-Swan theorem to give a description of the extreme points of this convex set in terms of prime ideals of the ring. This enables us to give a complete description of the state space in some cases, but does not enable us to answer some natural questions in general, such as whether the state space is a finite complex. Several specific computations will be discussed. (Received April 24, 1979.)

Analysis (26, 28, 30–35, 39–47, 49)

#767-B1 HAROLD WILLIS MILNES, H-W Consultants, Lubbock, Texas, 79410, and S. K. HILDEBRAND, Texas Tech University, Lubbock, Texas, 79409. A topological approach to minimizing\[\int_a^b f(x,y,y') dx\] in subspaces of the plane.
In this paper a departure is made from the classical methods of the differential calculus in the theory of the calculus of variations. Techniques are applied instead which are topological and measure theoretical. This has permitted treating minimizing problems in which the minimizing arc is no longer necessarily of class $C(3)$ or even $C(1)$. It is not essential in this theory that the arc be imbedded in an open region, and the subspace of $E(2)$ over which the minimizing problem is defined can also be quite arbitrary. In addition, it has been possible to relax the requirement that the defining functional to be minimized necessarily involves a piecewise continuous derivative of the minimizing arc. Sufficient conditions for the existence of a minimizing arc have been obtained. (Received March 29, 1979.)

#767-B2 C. W. Onneweer, University of New Mexico, Albuquerque, NM 87131. Bessel potentials and Lipschitz spaces on local fields.
Let $K$ be a local field. For $\alpha > 0$ and $1 \leq r, s \leq \infty$, let $L(r, \alpha)$ denote the space of Bessel potentials of order $\alpha$ in $L_r(K)$ and let $A(\alpha, r, s)$ denote the generalized Lipschitz spaces on $K$. (See M. H. Taibleson, Fourier Analysis on Local Fields, Princeton University Press, 1975,
for a definition of these spaces). Theorem. If $\alpha > 0$ and $1 < r \leq 2$ then $A(\alpha, r, r) \subseteq L(r, \alpha)$ and these inclusions are best possible. The proof of the theorem is based on identifying the functions in $L(r, \alpha)$ with functions in $L_r(K)$ which are strongly differentiable of order $\alpha > 0$ in the (generalized) Butzer-Wagner sense. (Received April 9, 1979.)

767-B3 Buck Ware, California State University, Chico, California 95929. Normal forms for contracting diffeomorphisms. Preliminary report.

The theorem of Léopold Leau on the existence & convergence of Schröder series for contracting diffeomorphisms can be proved for Banach spaces by the majorant method. Stephen Diliberto's "accelerated convergence" procedure allows us to obtain a crude version in infinite dimensions of the polynomial normal forms first investigated by Samuel Lattès. Specifically, if $f$ is a local contraction at the origin of a complex Banach space and is analytic, then $f$ is analytically conjugate to a polynomial. (Received April 23, 1979.)

767-B4 OSCAR E. LANFORD III, Department of Mathematics, University of California, Berkeley, California 94720. One-dimensional transformations.

This address will survey recent (and some not-so-recent) discoveries about one-parameter families of mappings of the unit interval into itself, concentrating on the unimodal case. Topics include Sarkovskii's Theorem on the order in which periodic points appear, the universal bifurcation sequence, the results of Ruelle-Sinai-Jakobson on chaotic behavior, and the phenomenon of "quantitative universality" discovered by Feigenbaum. (Received April 24, 1979.)

Applied Mathematics (65, 68, 70, 73, 76, 78, 80-83, 85, 86, 90, 92-94)

*767-C1 S. GUDDER, University of Denver, Denver, Colorado 80208 and J. MICHEL, Marietta College, Marietta, Ohio 45750. Embedding Quantum Logics in Hilbert Space.

Let $L$ be an orthomodular lattice and let $S$ be a coordinatizing Baer *-semigroup for $L$. We first prove the existence of an enveloping Banach *-algebra $B$ for $S$. A state $\omega$ on $B$ is consistent if $\omega(s^*s) = 0$ implies $\omega(s') = 1$ for any $s$ in $S$. A state $\omega$ is strongly consistent if the limits of conditional expectations with respect to $\omega$ are consistent. We show that $L$ is embeddable in a Hilbert space if and only if there are sufficiently many strongly consistent states. A physical motivation for the existence of such states is given and a connection is provided between the quantum logic, algebraic and operational approaches to quantum mechanics. (Received March 19, 1979.)


An existence theorem is proved for a probability measure on continuous paths in $\mathbb{R}^3$, proposed by Edwards as a stochastic model for the geometric properties of long polymer chains. (Received April 10, 1979.)

A-402
A statistical ensemble point of view provides a consistent interpretation of the standard formalism of quantum mechanics. The so-called "reduction of the wave packet" can be deduced from a natural property of conditional probabilities. It is neither necessary nor desirable to introduce the consciousness of the observer into the Schrödinger equation. The usual "paradoxes" cause no difficulty. What has to be given up is any representation of the state of an individual system. On the other hand, some simple facts about extensions of states on $\mathbb{C}^n$ algebras establish that "subjective" information is often objective in a reasonable sense. (Received April 13, 1979.)


Cooperative phenomena of physical interest are frequently studied with the aid of lattice models. Phase transitions are related to non uniqueness of Gibbs measures on the space of configurations of infinite systems. While in three or more dimensions there are known Gibbs states which in different regions resemble different phases, it has now been shown that for various two dimensional systems, including the Ising model, there is no stable phase coexistence. This is done by proving that the only Gibbs measures are convex combinations of the "pure phases." In the proof use is made of the stochastic aspects of the geometry of the infinite contours, which serve as interfaces. (Received April 23, 1979.)

W. L. PERRY, Texas A&M University, College Station, Texas 77843 and C. D. LUNING, Sam Houston State University, Huntsville, Texas 77840. Implementation of new iterative techniques for Thomas-Fermi and generalized Emden-Fowler equations.

New iterative techniques for Thomas-Fermi and generalized Emden-Fowler equations have been recently developed by the authors. Results of computational trials of these techniques are presented. (Received April 23, 1979.)

GUY A. BATTLE and LON ROSEN, University of British Columbia, Vancouver, B.C., Canada V6T 1W5. The FKG Inequality for the Yukawa Quantum Field Model.

We establish the FKG correlation inequality for the scalar Yukawa quantum field model. The proof reduces to a positivity condition on the fundamental solution of the elliptic Dirac equation with an external field. In two dimensions the analysis relies on the Bers-Vekua theory of generalized analytic functions. (Received April 24, 1979.)

Geometry (50, 52, 53)

THEODORE FRANKEL, University of California, San Diego, California 92093. Some geometrical aspects of general relativity.

Many striking applications in relativity (e.g. compactness of spatial cosmologies, maximum size of static spherical bodies) result from explicit solutions that are possible only because of the large number of simplifying assumptions of symmetry that are imposed. However, the real universe is not of constant sectional curvature in the neighborhood of a galaxy, and real bodies are neither static nor spherically symmetric. We shall indicate how these more realistic situations can be studied via differential-geometric methods. (Received April 23, 1979.)
ROBERT S. WOLF, Department of Mathematics, California Polytechnic State University, San Luis Obispo, California 93407. Determinateness of certain almost-Borel games. Preliminary report.

We prove (in ZFC Set Theory) that all infinite games whose winning sets are of the following forms are determined: (1) \((A \setminus S) \cup B\), where \(A\) is \(\aleph_2^n, S < 2^{\aleph_0}\), and the game whose winning set is \(B\) is "strongly determined" (meaning that all of its subgames are determined), (2) a Boolean combination of \(\sum_0^n\) sets and sets smaller than the continuum. This also enables us to show that strong determinateness is not preserved under complementation, improving a result of Morton Davis which required the Continuum Hypothesis to prove this fact. Various open questions related to the above results are discussed. Our main conjecture is that (2) above remains true when \(\sum_0^n\) is replaced by "Borel". (Received April 23, 1979.)


Let \(X^0\) be a Hunt process taking values in \(\mathbb{R}^n\) whose very trajectory is of locally bounded variation. Then, there exist three deterministic Borel functions \(a: \mathbb{R}^n \rightarrow \mathbb{R}^n\), \(b: \mathbb{R}^n \rightarrow \mathbb{R}_+ \cup \{0\}\), \(c: \mathbb{R}^n \times \mathbb{R} \rightarrow \mathbb{R}^n\) such that \(X^0\) is related to a Hunt process \(X\) satisfying

\[ X_t = X_0 + \int_0^t a(X_u)du + \int_0^t \int_{-\infty}^\infty N(du,dz)c(X_u,z) \]

through a time change \(X^0_t = X_{A_t}\) where \(A\) is the functional inverse of \(B_t = \int_0^t b(X_u)du\).

Here \(N\) is a Poisson random measure on \(\mathbb{R}_+ \times \mathbb{R}\) whose mean measure element at \((t,z)\) is \(dt \cdot dz/z^2\). In particular, if \(a\) and \(c\) are such that the equation for \(X\) has only one solution, then the probability law of \(X^0\) is determined by the three functions \(a, b, c\). (Received March 23, 1979.)

MURRAY D. BURKE, University of Calgary, Calgary, Alberta T2N 1N4. Approximations of the Product Limit Estimate Under Random Censorship.

The empirical distribution function has been widely used as an estimator for the distribution function of a random sample. It is not, however, appropriate when the observations have been randomly censored on the right. In its place, the so-called product limit estimate has been generally accepted as a substitute. Asymptotic approximations of the product limit estimate by Gaussian processes are obtained. These approximation results are then used to produce Gaussian approximations in the case when parameters of the underlying distribution function are estimated. (Received April 6, 1979.) (Author introduced by Professor Priscilla E. Greenwood).

SIDNEY RESNICK, Colorado State University, Fort Collins, Colorado 80523. Regularly Varying Tail Probabilities and Point Processes.

Certain regularly varying tail probabilities are equivalent to the weak convergence of associated point processes to a Poisson limit. This provides a unified way to look at weak convergence to stable and extremal processes. Generalization to multiparameter or multidimensional processes is straightforward. The tail behavior of randomly stopped sums can be studied by similar techniques. (Received April 6, 1979.) (Author introduced by Professor Priscilla E. Greenwood).
Let $U: \mathbb{R}^+ \to \mathbb{R}^+$ be non-decreasing and $U(0)=0$. Suppose that its Laplace-Stieltjes transform is finite.

Two types of Tauberian theorems can be applied to Laplace transforms of infinitely divisible probability distributions, namely Karamata's Tauberian theorem (e.g. [2]) and Kohlbecker's Tauberian theorem [3]. The latter relates the logarithm of the Laplace-Stieltjes transform of exp $g$ to the Legendre transform of $g$ (this is a simpler transform originating from complementary convex functions).

For the application of Kohlbecker's theorem to infinitely divisible Laplace transforms see [1]. We present refinements of both Tauberian theorems in special cases and their applications to infinitely divisible Laplace transforms.


Let $(X_k)_{k=1}^\infty$ be a sequence of dependent integer valued random variables. Let $S_n = \sum_{k=1}^n X_k$.

We describe the following decomposition: $S_n \approx Z_n + \sum_{k=1}^n L_k$. ($\approx$ indicates equivalence in law) where (a) $(L_k)_{k=1}^\infty$ is i.i.d., (b) $P(L_k = 0) = P(L_k = 1) = 1/2$, (c) $(L_k)_{k=1}^\infty$ is independent of $(Z_n, N_n)$. $\sum_{k=1}^n L_k$ is called the Bernoulli part of $S_n$. We apply this decomposition to give renewal theorems for simple integer valued point processes. (Received April 10, 1979.)

(Author introduced by Professor Priscilla E. Greenwood.)

A random time $R$ is called a regular birth time for a Markov Process if (i) the $R$-past and $R$-future are conditionally independent with respect to $X(R)$ and (ii) the post-$R$ process evolves as a Markov process, perhaps with different probability laws. In this paper we characterize each regular birth time in terms of an earlier, coterminal time $L$. It is shown (Thm 4.6) that to the post-$L$ process $R$ appears as an optional time, perhaps with dependency on pre-$L$ information. (Received April 16, 1979.)

A Markovian evolution of a spin system gives a model of the approach to equilibrium of a magnet at fixed temperature. In the infinite volume limit the generator for a continuous spin system is a linear partial differential operator in infinitely many dimensions. The proof that this is in fact a generator depends on estimates involving the Laplacian on the Riemannian manifold of possible spin values. The number of equilibrium measures for this generator depends on the temperature. (Received April 16, 1979.)
We prove that an infinite full simplicial complex with the weak topology cannot be densely imbedded in a Baire stratifiable space, not even in a Baire σ-space. This leads to a variety of other results which expand and improve recent results of van Douwen. (Received January 24, 1979.)

MARY ANDERSON, University of California, Berkeley, California 94720

A complex version of Bruhat's lemma for SO(l,n)

Let G be a noncompact real form of a complex Lie group Gc, and let \( U(g; \lambda, m) \) be the representation of G induced by the representation \( m \to \pi(m) \lambda(a) \) of the maximal parabolic subgroup MAN of G. Let \( W_c \), the "complex Weyl group" be the Weyl group in Gc for a Cartan subalgebra of the complexification \( M_{\text{c}}A_{\text{c}} \) of MA. Then, if \( U(g; \lambda, m) \) is a meromorphic representation, and \( (\lambda, m', \lambda') = w_c (\lambda, m) \) for some \( w_c e W_c \), subquotients of the two representations are isomorphic. This equivalence is proved by constructing an intertwining operator which is a natural generalisation of that of Knapp and Stein for the action of the "little" Weyl group on the principal series. The same method gives an interesting intertwining of certain of the meromorphic series with representations induced by the compact Cartan subalgebra of SO(1,2n), thus giving a model of the discrete series on spaces of functions on K whose Fourier coefficients satisfy a certain symmetry. (Received April 24, 1979.)

Erratum – Volume 25


Re: the formula for sphere-packed polyhedral shells, independently derived in slightly different terms by the undersigned, Professor H.S.M. Coxeter noted to me that it had been previously published by him in Vol. XV of the Boston Studies on the Philosophy of Science (Reidel, Dordrecht, Holland, 1974, p. 33) and I am glad to record his priority. The independent derivation, however, is valid for all sphere-packed shells, and not only close cubic packings. It was also differently proved, and showed up the new theorem that, under certain quite general circumstances, Coxeter's (p. 35) \( A + C = B + D \).

C. Musès

Erratum – Volume 26


In line 3, the author said that Kosnowski's result was not true for \( p \neq 5 \). However, after reading my preprints, Professor Kosnowski showed me that his result was correct and the generators I found were redundant. I am very sorry that I did not examine his result more carefully beforehand. But the other results I obtained are still worth publishing for reference, so I will renew the content and publish it with the title: "Some special elements in \( U_*(Z_5) \)."
SUGGESTED USES for classified advertising are books or lecture notes for sale, books being sought, positions available, summer or semester exchange or rental of houses, mathematical typing services and special announcements of meetings. The rate is $3.00 per line. The ad must run in seven consecutive issues is $22.00 per line. Ads will be typed in the AMS office and will be typed solid. If centering and spacing of lines is requested, the charge will be per line with the same rate for open space as for solid type.

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