Notices

OF THE

AMERICAN MATHEMATICAL SOCIETY

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THE CALENDAR BELOW lists all of the meetings which have been approved by the Council up 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.

ABSTRACTS 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 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.

CALENDAR OF MEETINGS

MEETING NUMBER	DATE	PLACE	DEADLINE for ABSTRACTS * and NEWS ITEMS
747	August 14-18, 1977 (81st Summer Meeting)	Seattle, Washington	JUNE 7
748	October 22, 1977	Wellesley, Massachusetts	AUGUST 30
749	October 29, 1977	West Lafayette, Indiana	AUGUST 30
750	November 11-12, 1977	Memphis, Tennessee	SEPTEMBER 20
751	November 11-12, 1977	San Luis Obispo, California	SEPTEMBER 20
752	January 4-8, 1978 (84th Annual Meeting)	Atlanta, Georgia	OCTOBER 18
	March 18-23, 1978	Columbus, Ohio	
	April 7-8, 1978	Houston, Texas	
	April 14-15, 1978	San Francisco, California	
	August 8-12, 1978 (82nd Summer Meeting)	Providence, Rhode Island	
	January 11-15, 1979 (85th Annual Meeting)	Milwaukee, Wisconsin	
	April 6-8, 1979	Honolulu, Hawaii	
	August 21-25, 1979 (83rd Summer Meeting)	Blacksburg, Virginia	
	January 3-7, 1980 (86th Annual Meeting)	San Antonio, Texas	
	January 8-12, 1981 (87th Annual Meeting)	San Francisco, California	

*Deadline for abstracts NOT presented at a meeting (by title)

August 1977 issue:	MAY 31
October 1977 issue:	AUGUST 23
November 1977 issue:	SEPTEMBER 13

OTHER EVENTS

July 11-August 5, 1977	Summer Research Institute on Automorphic Forms, Representations, and L-Functions Oregon State University, Corvallis, Oregon	
August 12-13, 1977	Fundamentals of Applied Combinatorics (AMS Short Course) University of Washington, Seattle, Washington	
February 1978	Symposium on Some Mathematical Questions in Biology Washington, D. C.	OCTOBER 18
August 15-23, 1978	International Congress of Mathematicians Helsinki, Finland	

PLEASE AFFIX THE PEEL-OFF LABEL on these *Notices* to correspondence with the Society concerning fiscal matters, changes of address, promotions, or when placing orders for books and journals.

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Notices

OF THE AMERICAN MATHEMATICAL SOCIETY

CONTENTS

June, 1977

PRELIMINARY ANNOUNCEMENTS OF MEETINGS

81ST SUMMER MEETING

University of Washington
Seattle, Washington
August 15–18, 1977

The eighty-first summer meeting of the American Mathematical Society will be held at the University of Washington, Seattle, Washington, from Monday, August 15, through Thursday, August 18. All sessions of the meeting will take place on the campus of the university.

A set of Colloquium Lectures, consisting of four one-hour talks, will be presented by HERBERT FEDERER of Brown University in Meany Hall. The title of the series is "Geometric measure theory." The first lecture will be given at 1:00 p.m. on Monday; the second lecture will be given at 11:00 a.m. on Tuesday; the third and fourth lectures will be given at 1:00 p.m. on Wednesday and Thursday.

By invitation of the Society's Program Committee, there will be five invited one-hour addresses. JAMES W. CANNON of the University of Wisconsin, Madison, will lecture at 9:45 a.m. on Thursday; the title of his address is "What is a topological manifold? (the characterization problem)." JAMES M. GREENBERG of the State University of New York at Buffalo will lecture at 8:30 a.m., Tuesday, on "Pattern formation and periodic structures in systems modeled by reaction-diffusion equations." WILLIAM B. JOHNSON of Hebrew University, Jerusalem, and Ohio State University, Columbus, is scheduled to speak at 9:45 a.m. on Tuesday. He will lecture on "Symmetric structures in Banach spaces." KENNETH A. RIBET of Princeton University is giving an address at 8:30 a.m. on Thursday; the title is "Interplay between classical modular forms and associated Galois representations." SHING-TUNG YAU of Stanford University will lecture at 11:00 a.m., Thursday, on "Some aspects of the theory of elliptic equations in differential geometry." All hour lectures will be in Meany Hall.

There will be sessions for contributed ten-minute papers on Monday afternoon, Wednesday afternoon, and Thursday afternoon. If necessary, sessions will also be scheduled Tuesday morning, Wednesday morning, and Thursday morning. If there is a demand, a late-paper session will be scheduled on Thursday afternoon. Overhead projectors and screens will be provided; each room will also contain a blackboard. Abstracts should be prepared on the standard AMS form available in most departments of mathematics and from the AMS office in Providence, and should be sent to the American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02940, so as to arrive prior to the deadline of June 7. (Recall that a typing charge of $7 is imposed on abstracts that are not in camera-ready form.)

The Data Subcommittee of the Society's Committee on Employment and Educational Policy (CEEP) has scheduled an open meeting and panel discussion at 3:30 p.m. on Monday, August 15, in Meany Hall. The meeting will be devoted to data recently collected by the committee. Lida K. Barrett and Wendell H. Fleming are members of the panel.

On Monday, Tuesday, and Wednesday, from 4:30 p.m. to 5:30 p.m. in Walker-Ames Room in Kane Hall, members of the Committee on Employment and Educational Policy plan to be available for discussion and exchange of ideas with participants who are concerned about problems of the labor market for mathematicians, and related questions.

This meeting of the Society will be held in conjunction with the annual summer meetings of the Mathematical Association of America (August 14–16), the Institute of Mathematical Statistics (August 15–18), and Pi Mu Epsilon. The Pacific Northwest Section of the MAA will also meet in conjunction with the Association and will hold its Business Meeting at 4:30 p.m. on Tuesday.

The twenty-fifth series of the Association's Earle Raymond Hedrick Lectures will be given by JOSEPH B. KELLER of the Courant Institute of Mathematical Sciences, New York University. The title of his lecture series is "Mathematical aspects of athletics and of vision." The Carl B. Allendoerfer, Lester R. Ford, and George Pólya Awards will be presented at the Business Meeting of the Association at 10:00 a.m. on Monday, and the receipt of a bequest to the Association will be announced.

The Association has scheduled a poster session for noon on Tuesday in the first floor foyer of Kane Hall. This session is for contributed papers in the area of mathematics education at the collegiate level. Each contributor is to prepare a visual presentation which will be on display beginning at 9:00 a.m. on Monday. Additional information about the poster session and abstract forms for contributed papers are available upon request from David P. Roselle, Secretary, Mathematical Association of America, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061. The deadline for completed abstracts is July 10, 1977. The poster session is an experiment. If response is not great, the session will be canceled; and, if response is great, it will be necessary to limit the number of displays.

There will be a dinner at 6:30 p.m. on Monday in the Ballroom of the University Tower Hotel for those who have been members of the Association for thirty years or more. The dinner will be followed by a short program with Raymond L. Wilder as emcee and MAA President Henry L. Alder, Edwin F. Beckenbach, Victor L. Klee, and George Pólya as speakers. A similar dinner was held at the August 1976 meeting in Toronto, and it proved to be a pleasant occasion to recall the services of the MAA's senior members and spouses and to inform them of current activities and future plans. The dinner was

American Mathematical Society Short Course Series

Fundamentals of Applied Combinatorics
August 12–13, 1977

The American Mathematical Society will present a one and one-half day course on Fundamentals of Applied Combinatorics on Friday and Saturday, August 12 and 13, in Room 120 in Kane Hall on the campus of the University of Washington, Seattle.

The course is designed to provide substantial introductions to three important areas of application of combinatorial mathematics for mathematicians whose specializations are in other areas. It is intended to illustrate both the variety of mathematically challenging questions which can arise in connection with problems encountered in modern applications as well as some of the new approaches now being taken for treating those problems which are inherently too difficult to solve. Although some mathematical maturity will be assumed on the part of the participant, no prior specialized knowledge of combinatorics, graph theory or coding theory will be required.

The program is under the direction of Ronald L. Graham of Bell Laboratories, Murray Hill, New Jersey. The course was recommended by the Society's Committee on Employment and Educational Policy (CEEP), whose members are Lida K. Barrett, David Blackwell, Wendell H. Fleming (chairman), Hugo Rossi, Martha K. Smith, and Robert J. Thompson.

There will be three lecturers, each of whom will give two seventy-five minute lectures. RONALD L. GRAHAM will speak on combinatorial scheduling theory; DANIEL J. KLEITMAN of Massachusetts Institute of Technology will speak on graphs and algorithms; and ROBERT J. McELIECE of California Institute of Technology, Jet Propulsion Laboratory will speak on coding theory.

Summaries of these talks and accompanying lists appeared on pages A-355 and A-356 of the April issue of these *Notices*.

This course is open to all who wish to participate upon payment of the registration fee. This fee is reduced for students and unemployed individuals. Please refer to the section entitled MEETING PREREGISTRATION AND REGISTRATION for details.

also an excellent opportunity for renewing friendships, and it was recommended by many who attended that a second such dinner be scheduled. Thirty-year members of the Association who have reserved tickets for this dinner may purchase them at the registration desk, and should do so prior to 5:00 p.m. on Sunday. Others who have been MAA members for thirty years or more and would like to attend this dinner will find tickets on sale at the desk until 5:00 p.m. on Sunday. Tickets for the dinner are $10 per person, and spouses are invited. The ticket price includes sales tax and gratuity.

The Institute of Mathematical Statistics' (IMS) 1977 Wald Lectures will be given by J. F. C. KINGMAN. The title of this lecture series will be announced in the August issue of these *Notices*. BRADLEY EFRON will present the IMS Rietz Lecture at 11:00 a.m. on Monday. Professor Efron's title is "Another look at the jackknife." The IMS Business Meeting will take place on Tuesday at 5:00 p.m.

The Pi Mu Epsilon J. Sutherland Frame Lecture will be presented by IVAN NIVEN of the University of Oregon at 8:00 p.m. on Monday. The title of his lecture is "Techniques for solving extremal problems."

The Association for Women in Mathematics (AWM) will hold a panel discussion on "Alternatives to academic employment for mathematicians" at 7:30 p.m. on Monday. Lenore Blum will serve as moderator. There will be an open meeting of the AWM Executive Committee at 5:00 p.m. on the same day.

The Council of the Conference Board of the Mathematical Sciences will meet on Wednesday at 2:15 p.m.

The Mathematicians Action Group will hold an open meeting of its Steering Committee at 7:30 p.m. on Sunday, its Business Meeting at 3:15 p.m. on Monday, and a panel discussion at 9:30 a.m. on Tuesday.

There will be a conference on Discrete Optimization just prior to the mathematics meetings, from August 8–12, at the University of British Columbia in Vancouver, Canada (145 miles north of Seattle). The program will consist of survey lectures on the state of the art of integer programming. Information about the program is available from the directors: P. L. Hammer (University of Waterloo), E. L. Johnson (IBM-Yorktown Heights), and B. Korte (University of Bonn). A preliminary list of speakers includes E. Balas, E. M. L. Beale, C. Berge, R. Burkard, J. Edmonds, R. Graham, P. L. Hammer, A. Hoffman, R. Jeroslow, E. Johnson, V. Klee, B. Korte, J. Krarup, A. Land, G. Lawler, J. K. Lenstra and A. Rinnooy Kan, L. Lovász, M. Padberg, J. Shapiro, K. Spielberg, and J. Tind. Participation in this conference is open to mathematicians and practitioners of operations research interested in this area. Full texts of surveys will be distributed to all participants in advance of the meeting. The final form of these texts, including discussions and comments by participants, will be published. For further information, including information about accommodations and registration fees, contact Brian Alspach, DO77, Department of Mathematics, Simon Fraser University, Burnaby, B.C., Canada V5A 1S6.

SPECIAL SESSIONS

MIROSLAV BENDA and ANNE C. MOREL of the University of Washington are organizing a special session on Boolean algebras, algebraic

and metamathematical aspects. AFTON H. CAYFORD of the University of British Columbia is organizing a special session on Banach spaces of analytic functions. A tentative list of speakers includes Frank Forelli, Theodore W. Gamelin, John B. Garnett, Walter Rudin, Donald E. Sarason, and Stephen Scheinberg. COLIN W. CLARK of the University of British Columbia will organize a special session on Mathematical models in natural resource management. So far the speakers are John R. Beddington, Colin W. Clark, Frank H. Clarke, Paul H. Cootner, Glenn C. Loury, Donald A. Ludwig, William J. Reed, David A. Sánchez, Jon Schnute, William R. Smith, and Frederic Y. M. Wan. MICHEAL N. DYER and ALLAN J. SIERADSKI of the University of Oregon are organizing a special session on Algebraic topology; the list of speakers includes M. Bendersky, Robert F. Brown, Roy R. Douglas, Ross Geoghegan, David Handel, Alex Heller, Peter J. Hilton, Cheong Seng Hoo, G. Kozlowski, George E. Lang, Jr., Douglas C. Ravenal, Jack Segal, Denis Sjerve, and Kalathoor Varadarajan. CARL FAITH of Rutgers University is organizing a special session on Module theory. BRANKO GRÜNBAUM of the University of Washington is organizing a special session on Tilings, patterns and symmetries. Among the speakers will be H. S. MacDonald Coxeter, Branko Grünbaum, William P. Hanf, R. B. Kershner, Dale W. Myers, Raphael M. Robinson, Doris W. Schattschneider, Sherman K. Stein, and Thomas W. Wieting. HENRY L. LOEB of the University of Oregon is organizing a special session on Approximation theory; the tentative list of speakers includes Richard B. Barrar, David L. Barrow, R. Creighton Buck, Hermann G. Burchard, Bruce L. Chalmers, Joel Davis, Gary A. Gislason, Allen A. Goldstein, Seymour Haber, Karl Heinz Hoffman, John M. Karon, John W. Lee, Lois E. Mansfield, Larry Lee Schumaker, Ambikeshwar Sharma, David A. Sprecher, Frank Stenger, Gerald D. Taylor, Jerry Wolfe, and Daniel Wulbert. CALVIN T. LONG of Washington State University will organize a special session on Combinatorial number theory. The list of speakers includes George E. Andrews, Paul T. Bateman, John D. Brillhart, Richard T. Bumby, Leonard Carlitz, Solomon W. Golomb, Ronald L. Graham, Verner E. Hoggatt, Jr., James H. Jordan, Derrick H. Lehmer, Melvyn B. Nathanson, Harold G. Niederreiter, Ivan Niven, Gordon Pall, John L. Selfridge, E. G. Straus, and William A. Webb. A problem session will be scheduled for Thursday afternoon. EDGAR LEE STOUT of the University of Washington is organizing a special session on Several complex variables; a tentative list of speakers includes Herbert J. Alexander, John Erik Fornaess, James R. King, James A. Morrow, Alexander J. Nagel, Hugo Rossi, Andrew J. Sommese and Wilhelm F. Stoll.

ROBERT T. MOORE of the University of Washington is organizing an informal session on Calculators and computers.

COUNCIL AND BUSINESS MEETING

The Council of the Society will meet at 5:00 p.m. on Monday, August 15, in the Condon Room of the University Tower Hotel. The Business Meeting of the Society will be held in Meany Hall at 11:00 a.m. on Wednesday, August 17. 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."

MEETING PREREGISTRATION AND REGISTRATION

Participants who wish to preregister for the meetings should complete the Meeting Preregistration Form on the last page of these *Notices*. Please note that one may preregister for the meetings until July 27, although the deadline for confirmed residence hall reservations through the Housing Bureau is July 10. Those who preregister will pay lower registration fees than those who register at the meeting, as indicated in the schedule below. Preregistrants will be able to pick up their badges and programs when they arrive at the meeting after 2:00 p.m. on Saturday, August 13, at the Joint Mathematics Meetings registration desk. Complete instructions on procedures for making hotel or residence hall reservations are given in the sections entitled RESIDENCE HALL HOUSING and HOTELS.

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 registration fees are required for the short course and the Joint Meetings. These fees are as follows:

Fundamentals of Applied Combinatorics

Short Course

	Preregistration	At Meeting
Student or unemployed	$ 3	$ 5
All other participants	18	20
One day fee for second day	-	10

Joint Mathematics Meetings

	Preregistration	At Meeting
Members of AMS, MAA, or IME, who are not members of IMS	$15	$20
Members of IMS	18	23
Nonmember	25	30
Student or unemployed	2	3

An extra $3 is being charged IMS members to be assigned to IMS, to cover some of that organization's expenses beyond those required for the Joint Mathematics Meetings.

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.

The unemployed status refers to any participants currently unemployed and actively seeking employment. It is not intended to include participants who have voluntarily resigned or retired from their latest position. Students are considered to be only those currently working toward a degree who do not receive an annual compensation totaling

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. Sánchez, Michael Taylor, and Guido L. Weiss, with the secretary initially as chairman.

In order that a motion for the Business Meeting of August 17, 1977, receive the service to be offered by the committee, it should be in the hands of the secretary by July 13, 1977.

Everett Pitcher, Secretary

more than $7,000 from employment, fellowships, and scholarships.

Checks for the preregistration fee(s) should be mailed to arrive in Providence not later than July 27. Participants should make their own reservations directly with hotels in the area (cf. section titled HOTELS). It is essential, however, to submit the Meeting Preregistration Form on the last page of these *Notices* by July 10 to obtain confirmed residence hall accommodations.

A fifty percent refund of preregistration fees will be made for all cancellations received in Providence prior to August 10. There will be no refunds granted for cancellations received after that date, or to persons who do not attend the meetings.

Registration for the short course only will begin on Thursday, August 11, in the first floor foyer of Kane Hall. Lecture notes and other short course material will be distributed before the first session at the short course registration desk. Those individuals who do not preregister for the short course are strongly urged to register and pick up their material on Thursday evening so as not to miss the start of the lecture on Friday morning.

Joint Meeting registration will commence on Saturday, August 13, at 2:00 p.m. in the basement of the Odegaard Undergraduate Library. Participants who are not attending the short course are advised that no general meeting information material will be available prior to the opening of Joint Meeting registration on Saturday. Upon arrival at the University of Washington campus, participants should proceed directly to the check-in desk in Haggett Hall in order to check into their accommocations before registering for the meetings. The hours the registration desks will be open are as follows:

Fundamentals of Applied Combinatorics
Short Course Registration
Location: First Floor Foyer, Kane Hall

Date and Time	
Thursday, August 11	4:30 p. m. - 7:30 p. m.
Friday, August 12	8:00 a. m. - 5:00 p. m.
Saturday, August 13	noon - 2:00 p. m.

Joint Mathematics Meetings Registration
Location: Basement Registration Area
Odegaard Undergraduate Library

Date and Time	
Saturday, August 13	2:00 p. m. - 8:00 p. m.
Sunday, August 14	8:00 a. m. - 5:00 p. m.
Monday, August 15 through Wednesday, August 17	8:30 a. m. - 4:30 p. m.
Thursday, August 18	8:30 a. m. - 1:30 p. m.

MATHEMATICAL SCIENCES EMPLOYMENT REGISTER

It is planned to operate an informal Employment Register at Seattle. No interviews will be scheduled by the staff. Instead, facilities will be provided for applicants and employers to display resumes and job listings. Message boxes will be set up for individuals to leave messages for one another requesting interviews. Tables and chairs will be provided in the room for interviews. Applicants and employers are reminded that registration for the Joint Mathematics Meetings is required for participation in the Employment Register.

Employers are encouraged to attend the meetings and participate, if possible. Applicants should recognize that the Mathematical Sciences Employment Register (MSER) cannot guarantee that any employers will, in fact, attend the meeting or participate in the Employment Register.

The AMS-MAA-SIAM Committee on Employment Opportunities will, however, request employers listing in the July and August 1977 issues of Employment Information for Mathematicians to signify in their listing their intention to participate in the Employment Register at the summer meeting.

Employers and applicants are referred to the announcement on page 228 of this issue regarding the 1977 Summer List of Applicants. Applicants who plan to participate in the Seattle Employment Register are urged to consider listing themselves in the 1977 Summer List of Applicants, which will be sold at cost not only to employers interviewing in Seattle, but to all interested employers upon request. Please note that applicants' forms must be received in the Providence office by June 30 in order to be included in the 1977 Summer List of Applicants.

EXHIBITS AND BOOK SALE

The book and educational media exhibits will be displayed in the Basement Registration Area of the Odegaard Undergraduate Library at the following times: Sunday, August 14, 1:00 p.m. to 5:00 p.m.; and Monday and Tuesday, August 15–16, 8:30 a.m. to 4:30 p.m. All participants are encouraged to visit the exhibits some time during the meeting. The AMS and at least one other publisher will be having book sales.

RESIDENCE HALL HOUSING

Participants desiring to obtain confirmed reservations for residence hall accommodations must preregister prior to the deadline of July 10. Residence hall reservations will not require a deposit in advance. Full payment for rooms at the residence halls must be made at check-in time. Requests for residence hall housing will be acknowledged. Participants who fail to preregister before July 10 may still be able to obtain residence hall accommodations by writing or calling the University of Washington Housing and Food Services Conference Office, Lander Hall, 1201 N.E. Campus Parkway, University of Washington, Seattle, Washington 98195 (telephone 206-543-7634) in order to determine whether residence hall space is still available; however, the Mathematics Meetings Housing Bureau cannot guarantee that space will be available or that it will be possible to obtain confirmed reservations. No requests for rooms will be honored after July 29. Please use the preregistration and housing request form provided on the last page of these *Notices* and return it to the Housing Bureau, being as explicit as possible in order that your residence hall assignment can be made correctly.

Three residence halls have been reserved for the use of participants in the Joint Mathematics Meetings and the Fundamentals of Applied Combinatorics Short Course: Haggett Hall, Hansee Hall, and McCarty Hall (see map on page 201). The residence halls are not air conditioned, but it is seldom uncomfortably warm in Seattle in August. All of these residence halls are within a five minute walk of the HUB (Student Union Building), and the central square on campus where Meany and Kane Halls are located, as well as the Odegaard Undergraduate Library. Participants must go to the check-in desk at Haggett Hall in order to determine their residence hall assignment, and to obtain keys to the room and mail/message box. Payment in full for lodgings will be required at that time. The desk in Haggett Hall will be open during the following hours:

Thursday, August 11 and Friday, August 12	7:30 a.m. to 10:00 p.m.
Saturday, August 13 and Sunday, August 14	7:30 a.m. to midnight
Monday, August 15 through Thursday, August 18	7:30 a.m. to 10:00 p.m.

Those participants arriving after the check-in desk in Haggett Hall is closed will be assisted by the night watch personnel. Signs will be posted near the telephones in Haggett Hall lobby giving instructions on how to locate the watchman by telephone. It will not be possible for participants to occupy residence hall rooms before Thursday, August 11, or after the night of Thursday, August 18. All participants must be checked out of their rooms no later than 10:00 a.m. on Friday, August 19. If housing requests are received for dates before August 11 or after August 18, they will be honored for the period August 11–18 only.

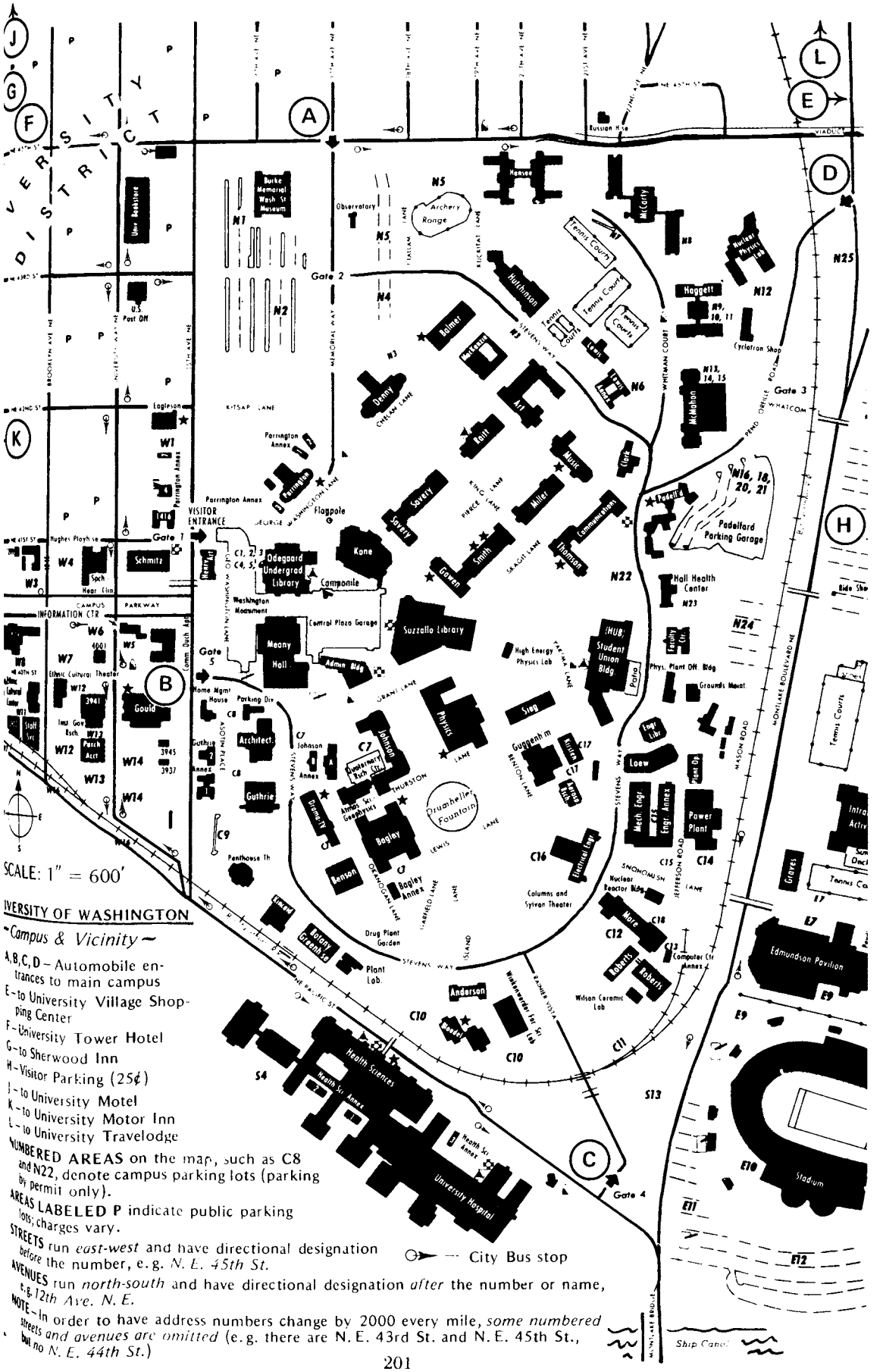
The rates quoted below include the maximum per night cost of the room, plus breakfast which will be served at Haggett Hall August 14 through August 18. Those short course participants staying in a residence hall room on campus the nights of Thursday, August 11, and Friday, August 12 should refer to the chart of available meal facilities included in the section titled FOOD SERVICES.

Single Room	$10/night
Double Room	$ 8/night per person

Rooms occupied nights prior to August 13 will be charged at a slightly lower rate.

There will be no room charge for children under nine years of age occupying a sleeping bag, air mattress, or crib provided by the parents, but breakfast will be charged, except for infants. Children nine years of age or over are required to occupy a bed, and will be charged the same rate as an adult. Any child under nine years of age occupying a bed will, of course, be charged the same rate as an adult. (Please see the sections titled CHILD CARE and CRIB RENTAL on page 203 of these *Notices*.) Participants accompanied by small children should be aware that some hazards to them exist in the residence halls which are highrise structures designed for adult use. There are automatic elevators and open railings in the stairwells and on balconies, and in some lounge areas there are portions of the windows at floor level which may be open and without screens.

Most rooms contain two single beds (double beds are not available), and there are community bathroom facilities on each floor. Because each bathroom will be used by only one sex, in a few instances a participant may have to use a bathroom on another floor or on the same floor but in the opposite wing from where he or she is housed.


SCALE: 1" = 600'
IVERSITY OF WASHINGTON
~Campus & Vicinity~
A, B, C, D – Automobile entrances to main campus
E – to University Village Shopping Center
F – University Tower Hotel
G – to Sherwood Inn
H – Visitor Parking (25¢)
J – to University Motel
K – to University Motor Inn
L – to University Travelodge
NUMBERED AREAS on the map, such as C8 and N22, denote campus parking lots (parking by permit only).
AREAS LABELED P indicate public parking lots; charges vary.
STREETS run east-west and have directional designation before the number, e.g. N. E. 45th St.
AVENUES run north-south and have directional designation after the number or name, e.g. 12th Ave. N. E.
NOTE – In order to have address numbers change by 2000 every mile, some numbered streets and avenues are omitted (e.g. there are N. E. 43rd St. and N. E. 45th St., but no N. E. 44th St.)
City Bus stop
Gate 1
Gate 2
Gate 3
Gate 4
Gate 5
VISITOR ENTRANCE
CAMPUS INFORMATION CTR
Padelford Parking Garage
Suzzallo Library
Odegaard Undergrad Library
Health Sciences
University Hospital
Edmundson Pavilion
Stadium
Ship Canal

There are several large and comfortable public lounges in each residence hall. Coin-metered automatic washers are available (20¢); use of automatic dryers is free. Participants are required to supply their own detergent and laundry materials. There are several ironing boards in each hall, and irons may be checked out at the desk on the main floor.

Beds will be made up with linen and blankets when participants arrive. Two bath towels will be provided each guest and replaced every third day. Wastebaskets will be emptied every third day; otherwise, no further daily maid service will be provided. Soap and plastic cups will be in each room; toilet paper will be supplied in the bathrooms.

Light kitchen facilities are available on some floors; participants are advised to bring their own cooking utensils. Vending machines dispensing soft drinks and snacks are also located in convenient areas in each building. Consumption of alcoholic beverages in one's room is permitted, but is not allowed in public areas such as hallways or lounges. No pets are allowed in the residence halls.

There is a telephone in each room which is restricted to local use; however, there are pay phones located on some floors.

HOTELS

Blocks of rooms have been set aside for use by participants at the University Tower Hotel and the Sherwood Inn. Also listed below are other hotels within walking distance of the campus. Rates are subject to change without notice, and to a 5.4 percent sales tax. Participants should make their own reservations early directly with these hotels, and should identify themselves as participants in either the Fundamentals of Applied Combinatorics Short Course or the Joint Mathematics Meetings. All addresses use zip code 98105.

The following codes apply: FP-Free Parking; 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) 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 letter in parentheses following the name of the hotel corresponds to the map on page 201, and is followed by the average walking time from the hotel to the registration area on campus.

UNIVERSITY TOWER HOTEL (F - 11 minutes)
4507 Brooklyn Avenue N.E.
Single $24; Double $26; Twin $30
Extra person in room $4 (16 years)
Code: FP, TV, CL, RT
Telephone: 800-547-4262 or 206-634-2000
(Within Oregon, call collect 503-221-1611)
(The tenth floor is reserved for nonsmokers. There is direct courtesy car service for registered guests to and from the downtown airport terminal daily between 6:00 a.m. and 9:00 p.m.)

SHERWOOD INN (G - 22 minutes)
400 N.E. 45th Street
Single $20; Double $25; Twin $25
Extra person in room $4 (12 years)
Code: FP, SP, AC, TV, CL, RT
Telephone: 206-634-0100

UNIVERSITY MOTEL (J - 16 minutes)
4731 12th Avenue N.E.
Single $16.50 Double $18.50
Extra person in room $3
Code: FP, TV, RT (across street)
Telephone: 206-522-4724

UNIVERSITY MOTOR INN (K - 16 minutes)
4140 Roosevelt Way N.E.
Single $16.50 Double $18.50
Twin 19.50
Twin Double $21.50 (for two persons)
Extra person in room $2
Code: FP, SP, TV, CL (across street), RT (coffee shop)
Telephone: 206-632-5055

UNIVERSITY TRAVELODGE (L - 19 minutes)
4725 25th Avenue N.E.
Single $16 Double $19 Twin $21
Extra person in room $3 (17 years)
Code: FP, SP, AC, TV, CL, RT (next door)
Telephone: 206-525-4612

CAMPING

There are several National Forest campgrounds about two hours' drive from Seattle, and Saltwater State Park is 25 kilometers south of Seattle near Kent (space for 56 tents only). In addition, there are some private campgrounds and recreational vehicle facilities within a radius of 30 kilometers. Information concerning these facilities will be available at the Local Information section of the Joint Meetings registration desk.

FOOD SERVICES

The following food service facilities will be available on campus to participants in the Applied Combinatorics Short Course and/or Joint Mathematics Meetings:

Evergreen in HUB

Saturday, August 13	10:30 a.m. to 2:30 p.m.

Husky Den in HUB

Thursday and Friday (August 11–12)	7:00 a.m. to 4:00 p.m.
Monday through Friday (August 15–19)	7:00 a.m. to 4:00 p.m.

Haggett Hall Cafeteria

Sunday through Thursday (August 14–18)	(Breakfast only) 7:00 a.m. to 9:00 a.m.

Odegaard Undergraduate Library Cafeteria

Thursday and Friday (August 11–12)	Lunch only
Monday through Friday (August 15–19)	Lunch only

There are many good restaurants in the "University District" bordering the campus which are within walking distance. A list of these will be supplied to participants in their registration packets at the meeting.

ENTERTAINMENT

At 6:00 p.m. on Tuesday, August 16, an Indian-style salmon barbecue will be served on the campus. Fresh Pacific Ocean King salmon will be prepared in the ancient Makah manner on cedar stakes over an open alderwood fire and, in addition to the salmon, dinner will include tossed green salad with choice of dressings, potato, vegetable, dessert, and beverage. The cost per person, including tax, will be $8.75 for adults and $5 for children aged 12 and under. Tickets may be purchased at the meeting until 4:30 p.m. on Monday, August 15; however, to be assured of a reservation, participants are urged to use the section of the preregistration form on page A-408 of these *Notices* to reserve and pay for their tickets in advance; these would be picked up at the Joint Meetings registration desk.

The barbeque will be followed at 8:00 p.m. that same evening by a beer party in the Ballroom of the Student Union Building (HUB). The estimated cost is $3 per person. Tickets will be on sale at the Local Information section of the Joint Meetings registration desk.

ATHLETIC FACILITIES

The campus golf driving range and the game room in the HUB (Student Union Building) will be available to participants upon presentation of a Joint Mathematics Meetings badge and payment of nominal fees. The game room has facilities for bowling, billiards, table tennis, etc. Robert R. Phelps, University of Washington mathematics faculty member, will lead a daily run/jog each weekday starting at noon. This event will originate at the entrance to Haggett Hall; pace and distance will be adjusted to suit the participants.

BOOKSTORES

The main branch of the University Bookstore is located at 4326 University Way N.E., one block west of the campus. It is open from 8:45 a.m. to 5:30 p.m., Monday through Saturday, and to 9:00 p.m. on Thursday. It carries stationery, clothing, cameras, records, gifts, etc., as well as books. Several other bookstores are also located on University Way within two blocks of the University Bookstore. The campus branch of the University Bookstore is located in the HUB (Student Union Building), and is open from 9:00 a.m. to 1:00 p.m. It carries only paperback books, plus stationery and sundries.

CHILD CARE

The University Methodist Temple day care center at 1415 N.E. 43rd Street may have space for a limited number of three- to five-year olds. Lists of students willing to babysit are posted on a notice board in the HUB (Student Union Building). In addition, information concerning commercial babysitting firms will be included in the registration packets distributed at the meeting.

CRIB RENTAL

Cribs for smaller children staying with their parent(s) in the residence halls may be rented from Aannex Rents, 12554 Lake City Way N.E. ($7/week), and from Abbey Rentals, 4111 Aurora Avenue N. Participants are advised to make reservations by mail with either of these two firms in advance of the meeting in order to be assured the crib will be avilable. Each firm has requested that participants pick the cribs up at the store, and return them when no longer needed.

LIBRARIES

All mathematics books beyond calculus level and all mathematical journals on the campus are located in the Mathematics Research Library on the third floor of Padelford Hall. It is open on weekdays only, from 8:30 a.m. to 5:00 p.m. The main collections of books and journals in other fields are in Suzallo Library (the main university library), and in the Odegaard Undergraduate Library. Suzallo is open from 7:00 a.m. to 10:00 p.m., Monday through Thursday; 7:00 a.m. to 5:00 p.m. on Friday; and from noon to midnight on Sunday. Odegaard is open from 7:30 a.m. to midnight Monday through Thursday; until 10:00 p.m. on Friday and Saturday; and from noon to midnight on Sunday.

MEDICAL SERVICES

Around the clock emergency service is available at the University Hospital and many other area hospitals. The King County Medical Society can make referrals Monday through Friday, from 9:00 a.m. to 5:00 p.m. (telephone 285-0221). Referrals to dentists can be obtained by calling 624-4912 at any time. For temporary emergency service call for an appointment at 543-5850.

The Hall Health Center on campus provides one-time emergency service only.

TRAVEL AND LOCAL INFORMATION

Seattle operates on Pacific daylight time during the summer. Airlines offering regular service to the Seattle-Tacoma International Airport are Alaska, Air Canada, Braniff, Continental, Eastern, Hughes Airwest, Northwest Orient, Pacific Western, United, and Western. The airport bus to downtown Seattle costs $3 and takes about twenty minutes. Taxi fare from downtown to the university runs about $4 and the fare from the airport to the university is approximately $14. There are a number of car rental agencies at the airport, including Airway, Avis, Budget, Hertz, and National. If you plan to drive from the airport to the university, follow the signs to northbound I-5, and then the following directions.

The main highways into Seattle are I-90 from the east and I-5 from the north and south. To reach the university from I-90, follow the signs from I-90 to northbound I-5. When approaching Seattle on I-5 (from north or south), exit at N.E. 45th Street and proceed approximately ten blocks east to the main entrance of the university at the corner of N.E. 45th Street and 17th Avenue N.E. Once on campus, participants may wish to stop at the Visitors' Information Center at 4014 University Way N.E., where visitors are provided with campus maps and information brochures; directions to parking areas, university buildings and other locations; and information about the community and the city. Center hours are 8:00 a.m. to 5:00 p.m., Monday through Friday.

Two Amtrak trains arrive daily in Seattle

from the east and midwest; one from California and one from Vancouver, Canada. The railroad station is in downtown Seattle, approximately a $4 cab ride from the University.

PARKING

Parking permits will be required for parking in all areas of the campus, with the exception of a metered lot (Montlake lot, 25¢ out). Parking fees are $1.25 per day, $1.50 per week on campus; $2.25 per week in a garage. For persons residing in the dormitories, permits are issued at check-in time when housing accommodations are paid for. Others may obtain their permits at the Parking Division Building, Monday through Friday, from 8:00 a.m. to 5:00 p.m.

WEATHER

The normal daytime high is 23°C. Normal nightime low is 12°C. Rainfall in August averages only 2.74 cm (although the last two summers have considerably exceeded this with 11.7 cm in 1975). Humidity ranges from an early morning high of 90% to an evening low below 50%. The record high and low temperatures for August are 37°C and 7°C, respectively. Light sweaters and jackets are advisable for evening wear.

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, Department of Mathematics (GN-50), University of Washington, Seattle, Washington 98195. Mail and telegrams so addressed may be picked up at the Joint Meetings registration desk located in the basement registration area of the Odegaard Undergraduate Library.

A telephone message center will be located in the same area to receive incoming calls for registrants during the hours the desk is open, cf. section titled MEETING PREREGISTRATION AND REGISTRATION, on a previous page. Messages will be written down, and the name of any participant for whom a message has been received will be posted until the message is picked up at the message center. The telephone number of the center will be published in the August issue of these *Notices*.

LOCAL ARRANGEMENTS COMMITTEE

Kathleen Baxter, Ross A. Beaumont, Roy Dubisch (chairman), Samuel L. Dunn, Thomas W. Hungerford, J. Maurice Kingston, Lloyd J. Montzingo, Jr., Norman G. Myer, Jr., David P. Roselle (ex officio), Kenneth A. Ross (ex officio), Friedrich W. Scholz, and Gordon L. Walker (ex officio).

SUMMARY OF ACTIVITIES

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

	FUNDAMENTALS OF APPLIED COMBINATORICS
THURSDAY, August 11	
4:30 p.m. - 7:30 p.m.	REGISTRATION (Short Course Only)
FRIDAY, August 12	
8:00 a.m. - 5:00 p.m.	REGISTRATION (Short Course Only)
9:00 a.m. - 10:15 a.m.	Introductory remarks Combinatorial scheduling theory I Ronald L. Graham
10:45 a.m. - noon	Combinatorial analysis of convolutional codes I Robert J. McEliece
2:00 p.m. - 3:15 p.m.	Fast but imperfect algorithms I Daniel J. Kleitman
3:45 p.m. - 5:00 p.m.	Combinatorial scheduling theory II Ronald L. Graham
SATURDAY, August 13	
noon - 2:00 p.m.	REGISTRATION (Short Course Only)
2:00 p.m. - 3:15 p.m.	Combinatorial analysis of convolutional codes II Robert J. McEliece
3:45 p.m. - 5:00 p.m.	Fast but imperfect algorithms II Daniel J. Kleitman

AMS - MAA SUMMER MEETINGS

	American Mathematical Society	Mathematical Association of America
SATURDAY, August 13		
9:00 a.m. - 4:00 p.m.		Board of Governors Meeting
2:00 p.m. - 8:00 p.m.	REGISTRATION	
SUNDAY, August 14	**AMS**	**Other Organizations**
8:00 a.m. - 5:00 p.m.	REGISTRATION	
9:00 a.m. - 9:10 a.m.		WELCOME ADDRESS John Hogness, President University of Washington
9:10 a.m. - 10:00 a.m.		MAA - THE EARLE RAYMOND HEDRICK LECTURES I: Mathematical aspects of athletics and of vision: Athletics Joseph B. Keller
10:00 a.m. - 11:00 a.m.		MAA - PANEL DISCUSSION: How to teach mathematics Jean J. Pederson (moderator) What not to do (a demonstration) Peter J. Hilton What to do (some rules of thumb) George Polya
1:00 p.m. - 5:00 p.m.	EXHIBITS	
1:30 p.m. - 2:30 p.m.		MAA - THE EARLE RAYMOND HEDRICK LECTURES II: Mathematical aspects of athletics and of vision: Color vision Joseph B. Keller
2:30 p.m. - 3:20 p.m.		MAA - SESSION: The WAM program: Women and mathematics Jean J. Pedersen Eileen L. Poiani
3:30 p.m. - 4:20 p.m.		MAA - INVITED ADDRESS Mathematics and mathematicians in industry Brockway McMillan

SUNDAY, August 14	American Mathematical Society	Other Organizations
7:00 p.m. - 9:25 p.m.		MAA - FILM PROGRAM Unless noted otherwise, all films are in color
7:00 p.m.		Dot and the line
7:10 p.m.		Curves of constant width (with J. D. E. Konhauser)
7:30 p.m.		Time for change—the calculus (a BBC broadcast as part of the Open University's History of Mathematics)
8:00 p.m.		Mathematics peep show
8:15 p.m.		Similar triangles
8:25 p.m.		Flatlands
8:40 p.m.		The theorem of the mean
8:52 p.m.		Newton's equal areas
9:03 p.m.		Cycloidal curves or Tales from the Wanklenberg Woods
7:00 p.m. - 10:00 p.m.		MAA - Section Officers Meeting
7:30 p.m. - 10:30 p.m.		Mathematicians Action Group Steering Committee - Open Meeting

MONDAY, August 15	AMS	Other Organizations
8:30 a.m. - 10:00 a.m.		Institute of Mathematical Statistics INVITED PAPER SESSION Representing densities of maximal invariants in multivariate analysis A survey of densities of maximal invariants Robert Wijsman Densities of maximal invariants under a special group structure Thomas Woteki
8:30 a.m. - 4:30 p.m.	REGISTRATION	
8:30 a.m. - 4:30 p.m.	EXHIBITS	
8:30 a.m. - 4:30 p.m.	EMPLOYMENT REGISTER	
9:00 a.m. - 9:50 a.m.		MAA - THE EARLE RAYMOND HEDRICK LECTURES III: Mathematical aspects of athletics and vision: Binocular vision and mach bands Joseph B. Keller
10:00 a.m. - 10:50 a.m.		MAA - Business Meeting
11:00 a.m. - 11:50 a.m.		MAA - INVITED ADDRESS On the Landau problem of bounds for derivatives Isaac J. Schoenberg
11:00 a.m. - noon		IMS - RIETZ LECTURE Title to be announced Bradley Efron
noon - 1:00 p.m.		Pi Mu Epsilon - Council Luncheon
1:00 p.m. - 2:00 p.m.	COLLOQUIUM LECTURE I Geometric measure theory Herbert Federer	
afternoon	Sessions for Contributed Papers Special Sessions	
2:15 p.m. - 3:15 p.m.		IMS - WALD LECTURE I Title to be announced J. F. C. Kingman
3:00 p.m. - 5:30 p.m.		IIME - Contributed Papers
3:15 p.m. - 5:00 p.m.		MAG - Business Meeting
3:30 p.m. - 4:30 p.m.	Committee on Employment and Educational Policy Open Meeting and Panel Discussion Lida K. Barrett Wendell H. Fleming	

MONDAY, August 15	American Mathematical Society	Other Organizations
3:30 p.m. - 6:00 p.m.		IMS - INVITED PAPER SESSION Advances in probability: 1977 Ergodic theory and randomness Don Ornstein Infinite particle systems and set valued Markov processes Ted Harris
4:00 p.m. - 5:00 p.m.		Association for Women in Mathematics Open Executive Committee Meeting
5:00 p.m.	Council Meeting	
5:30 p.m. - 7:30 p.m.		MAA Pacific Northwest Section Informal Meeting
6:00 p.m. - 7:00 p.m.		ΠME - Banquet
6:30 p.m.		MAA - Banquet for 30 year members
7:00 p.m.		IMS - Council Meeting
7:00 p.m. - 9:20 p.m.		MAA - FILM PROGRAM Unless noted otherwise, all films are in color
7:00 p.m. - 7:34 p.m.		Films of the Topology Films Project
7:00 p.m.		Regular homotopies in the plane: Part I
7:15 p.m.		Regular homotopies in the plane: Part II
7:35 p.m.		The marriage theorem: Applications, Part II (b & w)
8:25 p.m.		Dihedral kaleidoscopes (with H.S.M. Coxeter)
8:40 p.m. - 8:57 p.m.		Films produced by Thomas F. Banchoff and Charles Strauss
8:40 p.m.		The hypercube—projections and slicing (b & w)
8:50 p.m.		Complex functions graphed in 4-space (b & w)
9:00 p.m.		Newton's method (MAA Calculus Film Series)
9:12 p.m.		Accidental nuclear war (produced by David S. Gillman)
7:30 p.m. - 9:30 p.m.		AWM - Panel Discussion
8:00 p.m. - 9:00 p.m.		ΠME - J. Sutherland Frame Lecture Techniques for solving extremal problems Ivan Niven

TUESDAY, August 16	AMS	Other Organizations
8:00 a.m. - 9:00 a.m.		ΠME - Dutch Treat Breakfast
8:30 a.m. - 11:00 a.m.		IMS - INVITED PAPER SESSION Advances in statistics: 1977 Estimation and prediction for the compound Poisson distribution Herbert Robbins On resolving the controversy in statistical inference Graham Wilkinson Correlation and regression with orientation data Richard Johnson and Tom Wehrly
8:30 a.m. - 4:30 p.m.	REGISTRATION	
8:30 a.m. - 4:30 p.m.	EXHIBITS	
8:30 a.m. - 4:30 p.m.	EMPLOYMENT REGISTER	
8:30 a.m. - 9:30 a.m.	INVITED ADDRESS Pattern formation and periodic structures in systems modeled by reaction-diffusion equations James M. Greenberg	

TUESDAY, August 16	American Mathematical Society	Other Organizations
9:30 a.m. - 11:00 a.m.		MAG - Panel Discussion
9:45 a.m. - 10:45 a.m.	INVITED ADDRESS Symmetric structures in Banach spaces William B. Johnson	
11:00 a.m. - noon	COLLOQUIUM LECTURE II Geometric measure theory Herbert Federer	
noon - 1:30 p.m.		MAA - Poster Session
1:30 p.m. - 2:20 p.m.		MAA - INVITED ADDRESS Measure algebras and their uses Dorothy Maharam Stone
1:30 p.m. - 2:20 p.m.		MAA - INVITED ADDRESS One step beyond: Some well-known results we seldom see Bill Leonard
1:30 p.m. - 2:30 p.m.		IMS - WALD LECTURE II Title to be announced J. F. C. Kingman
2:30 p.m. - 3:20 p.m.		MAA - INVITED ADDRESS Some recent results on the geometry of N-space David G. Larman
2:30 p.m. - 3:20 p.m.		MAA - INVITED ADDRESS MAA-NCTM sourcebook of applications of secondary mathematics Donald W. Bushaw
2:45 p.m. - 4:45 p.m.		IMS - INVITED PAPER SESSION Categorical data analysis Consistent estimates for models of mental tests Michael Levine Data analysis for tables of counts Persi-Diaconis
2:45 p.m. - 4:45 p.m.		IMS - INVITED PAPER SESSION Martingales and related topics Application of martingales to infinite interacting systems Richard Holley Representing n-dimensional martingales as stochastic integrals of n-dimensional Brownian motion Itrel Monroe On the Andersen-Jessen theorem Joseph Horowitz
3:00 p.m. - 5:30 p.m.		IIME - Contributed Papers
3:30 p.m. - 4:20 p.m.		MAA - INVITED ADDRESS A lost notebook of Ramanujan George E. Andrews
3:30 p.m. - 4:20 p.m.		MAA - INVITED ADDRESS Creative gems from the classroom Robert J. Bitts
		MAA - INVITED ADDRESS The place of unsolved problems in the classroom Ben J. Jones
4:30 p.m. - 5:30 p.m.		MAA Pacific Northwest Section Business Meeting
5:00 p.m. - 6:00 p.m.		IMS - Business Meeting
6:00 p.m.	SALMON BARBECUE	
8:00 p.m.	BEER PARTY	

WEDNESDAY, August 17	American Mathematical Society	Other Organizations
8:30 a.m. - 10:00 a.m.		IMS - Contributed Paper Sessions
8:30 a.m. - 4:30 p.m.	REGISTRATION	
8:30 a.m. - 4:30 p.m.	EMPLOYMENT REGISTER	
10:00 a.m. - 11:00 a.m.	Prize Session	
11:00 a.m. - noon	Business Meeting	
1:00 p.m. - 2:00 p.m.	COLLOQUIUM LECTURE III Geometric measure theory Herbert Federer	
1:00 p.m. - 2:00 p.m.		IMS - SPECIAL INVITED PAPER Title to be announced William C. Davidon
afternoon	Sessions for Contributed Papers Special Sessions	
2:15 p.m. - 3:15 p.m.		IMS - WALD LECTURE III Title to be announced J. F. C. Kingman
2:15 p.m. - 6:00 p.m.		Conference Board of the Mathematical Sciences - Council Meeting
3:30 p.m. - 5:30 p.m.		IMS - INVITED PAPER SESSION Gaussian processes Strong approximations of empirical processes when parameters are estimated M. D. Burke How big are the increments of a Weiner process? M. Csorgo Weak convergence and embeddings J. Komtos
3:30 p.m. - 5:30 p.m.		IMS - INVITED PAPER SESSION Recent advances in the analysis of censored survival data Using Gehan's test with unequal censoring J. E. Hyde Nonparametric Bayesian inference with censored survival data V. Susarla and J. Van Ryzin Nearly robust estimation of survival functions J. S. Williams and S. W. Lagokos
7:00 p.m.		IMS - Council Meeting
8:00 p.m. - 10:15 p.m.		CBMS - Council Meeting

THURSDAY, August 18	AMS	Other Organizations
8:30 a.m. - 9:30 a.m.	INVITED ADDRESS Interplay between classical modular forms and associated Galois representations Kenneth A. Ribet	
8:30 a.m. - 10:30 a.m.		IMS - INVITED PAPER SESSION Methods in inference Necessary analysis: Robustness and resistance B. Fick Estimating equations V. P. Godambe Model factorization and form identification D. Brenner and D. A. S. Fraser
8:30 a.m. - 1:30 p.m.	REGISTRATION	
9:45 a.m. - 10:45 a.m.	INVITED ADDRESS What is a topological manifold? (The characterization problem) James W. Cannon	

THURSDAY, August 18	American Mathematical Society	Other Organizations
10:45 a.m. - 12:15 p.m.		IMS - Contributed Paper Sessions
11:00 a.m. - noon	INVITED ADDRESS Some aspects of the theory of elliptic equations in differential geometry Shing-Tung Yau	
1:00 p.m. - 2:00 p.m.	COLLOQUIUM LECTURE IV Geometric measure theory Herbert Federer	
afternoon	Sessions for Contributed Papers Special Sessions	

Kenneth A. Ross
Associate Secretary

Eugene, Oregon

ORGANIZERS AND TOPICS OF SPECIAL SESSIONS

Abstracts of contributed papers to be considered for possible inclusion in special sessions should be submitted to the Providence office by the deadlines given below. The latest abstract form has a section for indicating special sessions. Lacking this, be sure your abstract form is clearly marked "For consideration for special session (title of special session)." Those papers not selected for special sessions will automatically be considered for regular sessions unless the author gives specific instructions to the contrary.

Deadline

Seattle, Washington, August 1977 — May 24

Miroslav Benda and Anne C. Morel, Boolean algebras, algebraic and metamathematical aspects
Afton H. Cayford, Banach spaces of analytic functions
Colin W. Clark, Mathematical models in natural resource management
Michael N. Dyer and Allan J. Sieradski, Algebraic topology
Carl Faith, Module theory
Branko Grünbaum, Tilings, patterns and symmetries
Henry L. Loeb, Approximation theory
Calvin T. Long, Combinatorial number theory
Edgar Lee Stout, Several complex variables

West Lafayette, Indiana, October 1977 — August 9

Georgia M. Benkart, Nonassociative algebras and their connections with physics
John D. Conway, Subnormal operators
Joseph B. Miles, Functions of one complex variable
Johannes C. C. Nitsche, Methods of the calculus of variations and partial differential equations applied to geometrical or physical problems

749TH MEETING

Purdue University
West Lafayette, Indiana
October 29, 1977

The seven hundred forty-ninth meeting of the American Mathematical Society will be held at Purdue University, West Lafayette, Indiana on Saturday, October 29, 1977.

By invitation of the Committee to Select Hour Speakers for Western Sectional Meetings, there will be two invited one-hour addresses by ALBERT BAERNSTEIN II of Washington University and KAREN K. UHLENBECK of the University of Illinois at Chicago Circle. The titles of the addresses will be announced in later issues of these *Notices*.

By invitation of the same committee there will be four special sessions of selected twenty-minute papers. The organizers and titles of these special sessions follow. GEORGIA M. BENKART of the University of Wisconsin is arranging a special session on Nonassociative algebras and their connections with physics; JOHN B. CONWAY of Indiana University is arranging a special session on Subnormal operators; JOSEPH B. MILES of the University of Illinois at Urbana-Champaign is arranging a special session on Functions of one complex variable; and JOHANNES C. C. NITSCHE of the University of Minnesota is arranging a special session on Methods of the calculus of variations and partial differential equations applied to geometrical or physical problems. Most of these special sessions will be by invitation. However, anyone contributing an abstract for the meeting who feels that his or her paper is particularly appropriate for one of these special sessions should indicate this clearly on the abstract and submit it by August 9 (three weeks before the normal deadline for contributed papers), in order that it may be considered for inclusion.

There will be sessions of contributed ten-minute papers. The abstract deadline is August 30.

Information on accommodations and travel will be given in the August and October issues of these *Notices*.

On Friday, October 28, the day before the meeting itself, Purdue University will sponsor a conference on Homomorphisms of Polynomial Rings.

Urbana, Illinois

Paul T. Bateman
Associate Secretary

INVITED SPEAKERS AT AMS MEETINGS

This section of these *Notices* lists regularly the individuals who have agreed to address the Society at the times and places listed below. For some future meetings, the lists of speakers are incomplete.

Seattle, Washington, August 1977

James W. Cannon
James M. Greenberg
William B. Johnson
Kenneth A. Ribet
Shing-Tung Yau

West Lafayette, Indiana, October 1977

Albert Baernstein II
Karen K. Uhlenbeck

NOMINATIONS FOR VICE-PRESIDENT OR MEMBER-AT-LARGE

Two positions of vice-president of the Society and member of the Council *ex officio* for a term of two years are to be filled in the election of October 1977. The Council has nominated four candidates for the two positions, namely

Julia B. Robinson
Hans F. Weinberger
John Wermer
[First candidate withdrew. E. P.]

Additional nominations by petition in the manner described below are acceptable.

Five positions of member-at-large of the Council for a term of three years are to be filled in the same election. The Council has nominated seven candidates for these positions, namely

Joan S. Birman
James A. Donaldson
Richard M. Dudley
Clifford J. Earle, Jr.
Daniel Gorenstein
Ronald L. Graham
H. Blaine Lawson

Additional nominations by petition in the manner described below are acceptable. The Council intends that there shall be at least ten candidates for the five positions and will bring the number up to ten if the number of nominations by petition does not do so.

Names of these candidates are published to assist those who may wish to make nominations by petition.

The name of a candidate for the position of vice-president or of member-at-large of the Council may be placed on the ballot by a petition that conforms to several rules and operational considerations, as follows:

1. To be considered, petitions must be addressed to Everett Pitcher, Secretary, Box 6248, Providence, Rhode Island 02940, and must arrive by August 1, 1977.

2. The name of the candidate must be given as it appears in the *Combined Membership List*. If the name does not appear in the list, as in the case of a new member or by error, it must be as it appears in the mailing lists, for example on the mailing label of these *Notices*. If the name does not identify the candidate uniquely, append the member code, which may be obtained from the candidate's mailing label or the Providence office.

3. The petition for a single candidate may consist of several sheets each bearing the statement of the petition, including the name of the position, and signatures. The name of the candidate must be exactly the same on all sheets.

4. On the facing page is a sample form for petitions. Copies may be obtained from the Secretary; however, petitioners may make and use photocopies or reasonable facsimiles.

5. A signature is valid when it is clearly that of the member whose name and address is given in the left-hand column. At least fifty valid signatures are required for a petition to be considered further.

6. The signature may be in the style chosen by the signer. However, the printed name and address will be checked against the *Combined Membership List* and the mailing lists. No attempt will be made to match variants of names with the form of name in the CML. A name not in the CML or on the mailing lists is not that of a member. (Example: The name Everett Pitcher is that of a member. The name E. Pitcher appears not to be. Note that the current mailing label of these *Notices* can be peeled off and affixed to the petition as a convenient way of presenting the printed name correctly.)

7. When a petition meeting these various requirements appears, the Secretary will ask the candidate whether he is willing to have his name on the ballot. His assent is the only other condition of placing it there. Petitioners can facilitate the procedure by accompanying the petitions with a signed statement from the candidate giving his consent.

NOMINATION PETITION FOR 1977 ELECTION

The undersigned members of the American Mathematical Society propose the name of

.....

as a candidate for the position of*

.....

of the American Mathematical Society for a term beginning January 1, 1978.

Name and Address (Printed or typed, or *Notices* mailing label)	Signature

*Specify "vice-president" or "member-at-large of the Council".

THE NOMINATING COMMITTEE FOR 1978

The Council has approved the continuation of the procedure of filling places on the Nominating Committee by election. There will be four continuing members of the Nominating Committee, namely

Hyman Bass
Irving Kaplansky
Seymour V. Parter
Jean E. Taylor

There will be four places filled by election in a preferential ballot. The President has named six candidates for these four places, namely

R. Creighton Buck
E. W. Cheney
Robert Gilmer
Calvin C. Moore
Cathleen S. Morawetz
Hugo Rossi

Nominations by petition, in the manner described below will be accepted. Should the final number of candidates be less than eight, the President will bring it up to eight.

The name of a candidate for member of the Nominating Committee may be placed on the ballot by a petition that conforms to several rules and operational considerations, as follows:

1. To be considered, petitions must be addressed to Everett Pitcher, Secretary, Box 6248, Providence, Rhode Island 02940, and must arrive by August 1,1977.

2. The name of the candidate must be given as it appears in the *Combined Membership List*. If the name does not appear in the list, as in the case of a new member or by error, it must be as it appears in the mailing lists, for example on the mailing label of these *Notices*. If the name does not identify the candidate uniquely, append the member code, which may be obtained from the candidate's mailing label or the Providence office.

3. The petition for a single candidate may consist of several sheets each bearing the statement of the petition, including the name of the position, and signatures. The name of the candidate must be exactly the same on all sheets.

4. On the facing page is a sample form for petitions. Copies may be obtained from the Secretary; however, petitioners may make and use photocopies or reasonable facsimiles.

5. A signature is valid when it is clearly that of the member whose name and address is given in the left-hand column. At least 100 valid signatures are required for a petition to be considered further.

6. The signature may be in the style chosen by the signer. However, the printed name and address will be checked against the *Combined Membership List* and the mailing lists. No attempt will be made to match variants of names with the form of name in the CML. A name not in the CML or on the mailing lists is not that of a member. (Example: The name Everett Pitcher is that of a member. The name E. Pitcher appears not to be. Note that the mailing label of these *Notices* can be peeled off and affixed to be petition as a convenient way of presenting the printed name correctly.)

7. When a petition meeting these various requirements appears, the Secretary will ask the candidate whether he is willing to have his name on the ballot. His assent is the only other condition of placing it there. Petitioners can facilitate the procedure by accompanying the petitions with a signed statement from the candidate giving his consent.

NOMINATION PETITION FOR 1977 ELECTION

(Nominating Committees of 1978–1979)

The undersigned members of the American Mathematical Society propose the name of

.....

as a candidate for the position of Member of the Nominating Committee of the American Mathematical Society for the years 1978 and 1979.

Name and Address (Printed or typed, or *Notices* mailing label)	Signature

NEW AMS PUBLICATIONS

CBMS REGIONAL CONFERENCE SERIES IN MATHEMATICS

LECTURES ON SYMPLECTIC MANIFOLDS
by Alan Weinstein

Number 29
50 pages
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Publication date: 5 31 77
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The first six sections of these notes contain a description of some of the basic constructions and results on symplectic manifolds and lagrangian submanifolds. §7, on intersections of lagrangian submanifolds, is still mostly internal to symplectic geometry, but it contains some applications to mechanics and dynamical systems. §§8, 9, and 10 are devoted to various aspects of the quantization problem. In §10 there is a feedback of ideas from quantization theory into symplectic geometry itself.

In addition to an introduction and references, the following lectures are included in these notes: Sympletic manifolds and lagrangian submanifolds, examples; Lagrangian splittings, real and complex polarization, Kähler manifolds; Reduction, the calculus of canonical relations, intermediate polarizations; Hamiltonian systems and group actions on symplectic manifolds; Normal forms; Lagrangian submanifolds and families of functions; Intersection Theory of lagrangian submanifolds; Quantization on cotangent bundles; Quantization and polarizations; Quantizing lagrangian submanifolds and subspaces, construction of the Maslov bundle.

AMERICAN MATHEMATICAL SOCIETY TRANSLATIONS—SERIES 2

TWO PAPERS ON SPECIAL FUNCTIONS
by Ja. L. Geronimus and Gábor Szegö

Volume 108
130 pages
List price $19.60; member price $14.70
ISBN 0-8218-3058-9; LC 76-30843
Publication date: 3 31 77
To order, please specify TRANS2 108

This volume contains two papers on special functions. The first paper, by Gábor Szegö, titled "Hankel forms", has ten sections and a Bibliography. The section titles are as follows.

1. A system of orthogonal functions
2. Certain quadratic forms
3. A theorem on (K)-forms
4. Application
5. On Hankel forms
6. Auxiliary theorems from the theory of quadratic forms
7. Continuation of the study of Hankel forms
8. On certain polynomials
9. A connection with Stieltjes' theory of continued fraction
10. On the denominators of the continued fractions

The paper by Ja. L. Geronimus, titled "Orthogonal polynomials", contains the following sixteen chapters and a Bibliography.

I. Preliminaries
II. Definition of orthogonal polynomials; principal examples
III. General properties of orthogonal polynomials
IV. Jacobi polynomials
V. Laguerre and Hermite polynomials
VI. Zeros of orthogonal polynomials
VII. Inequalities
VIII. Asymptotic properties of the classical polynomials
IX. Expansion problems associated with the classical polynomials
X. Representation of positive functions
XI. Polynomials orthogonal on the unit circle
XII. Asymptotic properties of general orthogonal polynomials
XIII. Expansion problems associated with general orthogonal polynomials
XIV. Interpolation
XV. Mechanical quadrature
XVI. Polynomials orthogonal on an arbitrary curve

MEMOIRS OF THE AMERICAN MATHEMATICAL SOCIETY

THE THEORY OF ULTRASPHERICAL MULTIPLIERS
by W. C. Connett and H. L. Schwartz

Number 183
92 pages
List price $7.20; member price $5.40
ISBN 0-8218-2183-0; LC 76-58958
Publication date: 4 15 77
To order, please specify MEMO/183

Many multiplier theorems of Fourier analysis have analogs for ultraspherical expansions. But what was a single theorem in the Fourier setting becomes an entire family of theorems in this more general setting. The problem solved in this paper is that of organizing the children of the Fourier theorems, and many new theorems besides, into a coherent theory. The most critical step in this organization is identifying a family of Banach spaces which include the sequences described in the

classical multiplier theorems as special cases. Once this family is found, the next step is to develop the methods of interpolation necessary to show that this family forms a *scale* of spaces—in the sense that if two spaces in the family act as multipliers on L^p, then all spaces "between" these two spaces act as multipliers on L^p.

Neither the family of Banach spaces nor the methods of interpolation mentioned above utilize facts about ultraspherical expansions or are restricted in application to ultraspherical expansions.

This material on interpolation and Banach spaces is gathered together in the first part of the paper to make these results accessible to those who would like to apply them to other settings. Next, the applications to ultraspherical expansions are given, and finally applications to other expansions are given.

PROCEEDINGS OF SYMPOSIA IN PURE MATHEMATICS

PROBABILITY
Edited by J. L. Doob

Volume 31
169 pages
List price $19.20; member price $14.40
ISBN 0-8218-1431-1; LC 77-2017
Publication date: 4 30 77
To order, please specify PSPUM 31

In March 1976, a symposium on probability was held at the University of Illinois at Urbana-Champaign. Following is the list of articles and authors included in these Proceedings: *Small random perturbations of dynamical systems with reflecting boundary* by R. F. Anderson and Steven Orey; *Brownian motion and classical analysis* by D. L. Burkholder; *A Liapunov principle for semimartingales* by Hans Föllmer; *Applications of dual processes to diffusion theory* by R. Holley, D. Stroock and D. Williams; *A general theorem of representation for martingales* by Jean Jacod; *Central limit theorem and related questions in Banach space* by Naresh C. Jain; *A renewal theorem for random walk in a random environment* by Harry Kesten; *On prediction processes* by Frank B. Knight; *A derivation of the Boltzmann equation from classical mechanics* by Oscar E. Lanford III; *Random times and decomposition theorems* by P. Warwick Millar; *Stochastic stability and boundary problems* by Mark A. Pinsky; *Some sample path properties of the asymmetric Cauchy processes* by William E. Pruitt and S. James Taylor; *The Martin boundary of a recurrent random walk has one or two points* by D. Revuz; *The cofine topology revisited* by John Walsh; *Poisson point process of Brownian excursions and its applications to diffusion processes* by Shinzo Watanabe; *Some Q-Matrix problems* by David Williams.

SPECIAL MEETINGS INFORMATION CENTER

THIS CENTER maintains a file on prospective symposia, colloquia, institutes, seminars, special years, and meetings of other associations, helping the organizers become aware of possible conflicts in subject matter, dates, or geographical area.

AN ANNOUNCEMENT will be published in these *Notices* if it contains a call for papers, place, date, subject (when applicable), and 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 volume and page of the issue in which the complete information appeared.

IN GENERAL, SMIC announcements of meetings held in the United States and Canada carry only date, title of meeting, place of meeting, speakers (or sometimes general statements on the program), deadline dates for abstracts or contributed papers, and name of person to write for further information. Meetings held outside the North American area may carry slightly more detailed information. Information on the pre-preliminary planning will be stored in the files, and will be available to anyone desiring information on prospective conferences. All communications on special meetings should be sent to the Special Meetings Information Center of the American Mathematical Society.

DEADLINES are the same as the deadlines for abstracts. They appear on the inside front cover of each issue.

1977-1978. **The Mittag-Leffler Institute**, Sweden (24, p. 70)

January 2-December 17, 1977. **Mathematisches Forschungs Institut Oberwolfach (Weekly Conferences)**, Federal Republic of Germany (23, p. 275; 24, p. 70)

March 21-November 24. **European Mechanics Colloquia** 1977 (24, p. 130)

Fall-Spring 1977-1978. **NSF Chautauqua-Type Short Courses for College Teachers**, Field Centers.

Sponsor: American Association for the Advancement of Science.

Support: National Science Foundation.

Program: Approximately fifty short courses will be offered in the 1977-78 academic year at field centers throughout the U.S. The program is designed to enable college teachers to keep abreast of advances in a variety of fields of science. Participants meet in groups of 25 for two-day sessions in the fall and in early spring. During the interim participants are able to work individually or in teams on problems or projects related to the courses.

Information: American Association for the Advancement of Science, Office of Science Education Box A2, 1776 Massachusetts Avenue, N.W., Washington, D.C. 20036.

JUNE

3-30. **Centro Internazionale Matematico Estivo** 1977.

Sponsors: Ministero della Pubblica Istruzione and Consiglio Nazionale delle Richerche of Italy.

Information: Information on all three sessions may be obtained from Antonio Moro, Secretary C.I.M.E. Istituto Matematico 'U. Dini' Viale Morgagni, 67 a 50134, Firenze, Italy.

FIRST SESSION - June 3-11

Title: Materials with Memory, Bressanone, Italy.

Lecturers: W. Alan Day, Hertford College, Oxford, England; G. Fichera, Universita di Roma, Italy; F. S. Rivlin, Lehigh University, Bethlehem, Pennsylvania.

SECOND SESSION - June 16-24

Title: Pseudo-Differential Operators with Applications, Bressanone, Italy.

Lecturers: G. I. Eskin, The Hebrew University, Jerusalem, Israel; J. J. Kohn, Princeton University, Princeton, New Jersey; F. Treves, Rutgers University, New Brunswick, New Jersey.

THIRD SESSION - June 22-30

Title: Algebraic Surfaces, Cortona, Italy.

Lecturers: A. Beauville, Université de Paris, France; E. Bombieri, Scuola Normale Superiore, Pisa, Italy.

5-10. **Regional Conference on Classical Analysis and the Function Theory of Solvmanifolds**, Cleveland State University, Cleveland, Ohio.

Principal Lecturer: Professor Louis Auslander, City University of New York.

Program: Professor Auslander will deliver ten lectures on the following material: multiplicity problem for solvmanifolds and its relation to number theory as in the work of R. Tolimieri and J. Brezin; the work of Brezin-Richardson-Penney on the nature of the orthogonal projection operator onto irreducible subspaces for nilmanifolds; use of the Heisenberg manifold and H. Lewy operator to structure the theory of Abelian varieties and Abelian function fields. Also included will be necessary background material for the development of the above material. Afternoon lectures and seminars will be organized according to interests expressed during the Conference.

Support: National Science Foundation and the Conference Board for the Mathematical Sciences. It is expected that funds from the National Science Foundation will be available to support 25 to 30 participants.

Information: Allan Silberger, Department of Mathematics, Cleveland State University, Cleveland, Ohio 44115.

5-10. **Symposium on Functional Analysis and Applications**, Mathematisches Institut der Universität, Germany.

Speakers: G. Birkhoff (Cambridge, Massachusetts); S. D. Chatterji (Lausanne); R. K. Getoor (San Diego); L. A. Harris (Lexington); G. G. Lorentz (Austin); W. A. Luxemburg (Pasadena); L. Nachbin (Rio de Janeiro); J. Neveu (Paris); W. Orlicz (Poznán); A. Wilansky (Bethlehem); J. Wright (Reading).

Program: The conference will take place on the occasion of the 500th anniversary of the foundation of the University of Tübingen. There will be ample time for scientific discussions.

Information: Mathematisches Institut der Universität, 74 Tübingen, Morgenstelle 10, Germany.

28-29. **New Zealand Statistical Association Annual Conference**, Wellington, New Zealand.

Information: Secretary, New Zealand Statistical Association, Box 1731, Wellington, New Zealand.

28-30. **Conference on Mathematics in Oceanography**, University of Bristol, England.

Sponsor: The Institute of Mathematics and its Applications, Essex, England.

Program: This conference aims to survey some of the fields of application of mathematics to oceanography which are both of practical importance and of mathematical interest. Papers have been invited from workers active in the study of surface waves, circulation of the oceans, tides and storm surges, internal wave propagation, mixing and diffusion, and other topics. Introductory lectures will define the physical and practical context of each subject and give an account of the present state of the art. There will be an emphasis on problems still to be attacked.

Speakers: Waves: M. S. Longuet-Higgins, FRS (University of Cambridge); M. J. H. Fox (University of Cambridge); E. D. Cokelet (Institute of Oceanographic Sciences); A. C. Newell (Clarkson College, USA); R. W. Smith, GradIMA (University of Cambridge); D. H. A. Jeffrey, FIMA (University of Newcastle-upon-Tyne); D. H. Peregrine, AFIMA (University of Bristol). Tides and the Circulation of Coastal Waters: M. S. Heaps (Institute of Oceanographic Sciences); I. Robinson (University of Southampton); B. A. Packham (University of Surrey); J. M. Huthnance (University of Liverpool). Hydrodynamics in Marine Technology: N. Hogben (National Maritime Institute); D. V. Evans (University of Bristol); B. M. Count (CEGB, Marchwood). Turbulence and Diffusion: K. F. Bowden (University of Reading); S. (University of Liverpool); B. Johns (University of Thorpe (Institute of Oceanographic Sciences). Ocean Currents: A. Gill (University of Cambridge); J. Crease (Institute of Oceanographic Sciences).

Information: The Secretary and Registrar, The Institute of Mathematics and its Applications, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY, England.

JULY

4-8. **Fifteenth International Symposium on the Applications of Computers and Mathematics in the Mineral Industry**, University of Queensland, Brisbane, Queensland, Australia.
Sponsors: The Australasian Institute of Mining and Metallurgy; the Australian Computer Society.
Information: The Secretary, The Australian Institute of Mining and Metallurgy, POB 310, Carlton South, Victoria, 3053, Australia.

5-9. **Conference on Graph Theory and Related Topics**, Canada (24, p. 72)

9-21. **LMS Durham Symposium on Applications of Sheaf Theory to Logic Algebra and Analysis**, England (23, p. 344)

10-August 6. **Summer Course on Complex Analysis**, Cortona, Italy.
Information: Scuola Normale Superiore, Pisa, Italy.

11-13. **Third Nonlinear Programming Symposium**, Wisconsin (24, p. 133)

11-15. **Sixth British Combinatorial Conference**, England (24, p. 72)

11-16. **First World Conference on Mathematics at the Service of Man**, Spain (23, p. 277; 344)

18-20. **Summer Computer Simulation Conference**, Illinois (24, p. 187)

18-22. **Regional Conference on Nonlinear Hydrodynamic Stability**, Rensselaer Polytechnic Institute, Troy, New York.
Support: NSF-CBMS support anticipated.
Principal Lecturer: J. Trevor Stuart.
Information: Ashwani Kapila, Department of Mathematical Sciences, Rensselaer Polytechnic Institute, Troy, New York 12181.

18-30. **École Internationale D'Été D'Informatique**, Canada (24, p. 187)

21-30. **Durham Symposium on Multivariate Approximation**, University of Durham, England (24, p. 187)
Sponsors: The London Mathematical Society and the European Research Office of the U. S. Army.
Membership: To be limited to about 50. It may be possible to provide modest financial help to participants in special need.
Information: D. C. Handscomb, Oxford University Computing Laboratory, 19 Parks Road, Oxford OX1 3PL, England.

25-27. **Twenty-third International Meeting of the Institute of Management Sciences**, Athens, Greece.
Sponsor: Association of European Operational Research Societies within IFORS (Euro).
Information: Arnold Oekene, I.B.M. World Trade, White Plains, New York 10601.

25-28. **Short Course on Two-Dimensional Digital Signal Processing**, Lake George, New York.
Sponsor: Rensselaer Polytechnic Institute.
Program: This intensive course will cover theory, practice, and application. It will provide the participant with an appreciation of the two-dimensional (2-D) signal processing problem and why 1-D procedures are inadequate for its solution; a working knowledge of the basic analytical tools used in 2-D digital processing of deterministic signals; a comprehensive survey of the latest 2-D filter design techniques for both FIR and IIR filters; and an awareness of current applications of 2-D Digital Signal Processing.
Information: John Woods, Course Director, Rensselaer Polytechnic Institute, Troy, New York 12181.

25-29. **Symposium on Algebraic and Geometric Topology**, University of California, Santa Barbara, California.
Program: Lectures and seminars in algebraic and geometric topology. A special emphasis on the area of generalized manifolds (homology manifolds, decomposition spaces, group actions, etc.) to honor Professor Raymond L. Wilder on the occasion of his 80th birthday.
Information: Kenneth C. Millett, University of California, Santa Barbara, California 93106.

25-29. **Conference on Affine Spaces and Polynomial Rings**, Illinois (24, p. 188)

25-August 12. **Workshop and Conference in Algebraic Topology**, University of British Columbia, Vancouver, British Columbia, Canada.
Program: Speakers will include: A. Dold (Heidelberg), R. Douglas (Vancouver), P. Hilton (Cleveland and Seattle), J. Segal (Seattle) and J. Stasheff (Philadelphia). There will also be Invited and Contributed talks.
Information: Algebraic Topology Summer Meeting, Mathematics, Statistics and Computer Science, Memorial University of Newfoundland, St. John's, Newfoundland A1C 5S7, Canada.

AUGUST

1-5. **Summer Institute of Applied Statistics**, Utah (24, p. 133)

1-5. **International Symposium on Continuum Mechanics and Partial Differential Equations**, Brasil (23, p. 344; 24, p. 72)

1-6. **International Symposium on Approximation Theory**, Brasil (23, p. 277)

1-12. **The 1977 European Summer Meeting of the Association for Symbolic Logic**, Poland (24, p. 72)

1-12. **Geometric Topology Conference**, University of Georgia, Athens, Georgia.
Program: There will be two invited addresses each day, and seminars will be organized in the areas of Group Actions, Foliations and Dynamical Systems, Low Dimensional Topology, Shape Theory and Infinite Dimensional Topology, and Structures on Manifolds. A tentative list of speakers includes Jim Cannon, Sylvain Cappell, Tom Chapman, Bob Edwards, David Galewski, Wu-Chung Hsiang and Bill Thurston.
Information: James C. Cantrell, Department of Mathematics, University of Georgia, Athens, Georgia 30602.

1-13. **International Advanced Study Institute on Nonlinear Equations in Physics and Mathematics**, Turkey (24, p. 133)

4-6. **ACM Symposium on Complexity Issues in Symbolic Computation**, Canada (24, p. 72)

7-13. **Eighth International Conference on General Relativity and Gravitation**, Canada (23, p. 85)

8-11. **Applications of Differential Equations and Probability Theory**, British Columbia, Canada.
Program: There will be twelve invited one-hour lectures during the four days. Time and facilities for arranging informal discussions will be available. The dates and location are convenient to the summer meeting of the American Mathematical Society and the annual meeting of the Institute of Mathematical Statistics, both of which will be held in Seattle, Washington, during the week of August 14.
Information: S. G. Ghurye, Department of Mathematics, University of British Columbia, Vancouver, B. C. V6T 1W5, Canada.

8-12. **NSF CBMS Regional Conference in Mathematical Sciences**, University of Wisconsin, Madison, Wisconsin.
Title: Representations of Finite Classical Groups.
Principal Lecturer: George Lusztig.
Program: The main theme of the lectures is to show how algebraic geometry (especially étale cohomology of algebraic varieties can be used to construct irreducible representations of finite groups. The lecturer will have to use some of the results of étale cohomology without proof, but will try to make them plausible by examples.
Support: It is expected that the conference will be funded by a grant from the National Science Foundation. Financial support for attendance for about 25 participants will be available.
Information: Louis Solomon, Department of Mathematics, University of Wisconsin, Madison, Wisconsin 53706.

8-12. **International Conference on Discrete Optimization**, Canada (24, p. 133)

8-20. **Advanced Study Institute on Statistical Modeling and Sampling for Ecological Abundance and Diversity with Applications**, Pennsylvania (23, p. 409)

15-17. **Conference on Theoretical Computer Science**, Canada (23, p. 409)

15-19. **Seventh Conference on Stochastic Processes and their Applications**, The Netherlands (24, p. 188)

15-19. **A Program of Instructional Lectures on Applied Matrix Computations**, Maryland (24, p. 133)

15-19. **International Conference on Applied General Systems Research: Recent Developments and Trends**, New York (23, p. 409)

16-27. **International Conference on Combinatorial Theory**, Australia (23, p. 85)

17-19. **Second International Symposium on the Operator Theory of Networks and Systems**, Texas (24, p. 73)

22-23. **New Zealand Operational Research Society Conference**, Wellington, New Zealand.
Information: B. Benseman, Operational Research Society Conference, Applied Mathematics Division, DSIR, Box 1335, Wellington, New Zealand.

22-26. **Tenth European Meeting of Statisticians**, Belgium (23, p. 345; 24, p. 188)

28-31. **Third National Conference of Australian Society for Operational Research**, Adelaide, South Australia.
Information: R. A. Stevens, P. O. Box 143, Rundle Street, Adelaide, South Australia 5000.

29-September 1. **International Conference on Mathematical Modeling**, Missouri (24, p. 73)

29-September 2. **Forty-Eighth ANZAAS Congress, Section Eight (Mathematical Sciences)**, Melbourne, Victoria, Australia.
Information: J. K. Strachan, Department of Mathematics, University of Melbourne, Parkville, Victoria 3052, Australia.

29-September 2. **International Symposium on the Theory of Sets, Foundations of Mathematics**, Yugoslavia (24, p. 73)

29-September 2. **Third International Symposium on Topology and its Applications**, Yugoslavia (24, p. 73)

SEPTEMBER

5-10. **Eighth IFIP Conference on Optimization Techniques**, Federal Republic of Germany (23, p. 345)

5-17. **NATO Advanced Study Institute on Representations of Lie Groups and Harmonic Analysis**, Belgium (23, p. 345)

6-9. **COMPCON 77—Fifteenth IEEE Computer Society International Conference**, Washington, D. C. (24, p. 188)

6-16. **LMS Durham Symposium on Homological and Combinatorial Techniques in Group Theory**, England (23, p. 345)

7-9. **Journees "Analyse des Donnees et Informatique"**, Rocquencourt, France.
Information: IRIA, Sec. Coll., Service Relations Exterieures, Domaine de Voluceau-Rocquencourt, B.P.5, F-78150 Le Chesnay, France.

11-21. **International Conference on Operator Algebras, Ideals and their Applications in Theoretical Physics**, Karl Marx University, Leipzig, German Democratic Republic.
Sponsors: IMU, Academy of Science of the GDR, Karl Marx University, Leipzig; Friedrich Schiller University, Jena.
Information: Department of Mathematics, Karl Marx University, Leipzig, German Democratic Republic.

12-15. **Numerical Analysis of Dynamic Interaction of Structures with Fluids**, Swansea, Great Britain.
Information: O. C. Zienkiewicz, Civil Engineering Department, University College of Swansea, Swansea, Great Britain.

18-21. **Applications of Numerical Software: Needs and Availability**, Brighton, England.
Information: Secretary and Registrar, Institute of Mathematics and its Applications, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY, United Kingdom.

19-22. **Conference on Applications of Numerical Software—Needs and Availability**, University of Sussex, England.
Sponsor: The Institute of Mathematics and its Applications, Essex, England.
Program: The main objective of this meeting is to encourage constructive criticism of the available numerical software from its principal users in industry, government departments and the universities. As far as possible, lectures have been paired so as to give first an exposition of the available software in a specific area followed by a discussion of the requirements of the relevant users.
Speakers: C. F. Banfield (Rothamsted Experimental Station); E. M. L. Beale, FIMA (SCICON Limited); T. Chambers (CEGB, Leatherhead); A. R. Curtis, FIMA (AERE, Harwell); L. M. Delves, FIMA (University of Liverpool); B. Ford AFIMA (NAG, Oxford); S. J. Hague (NAG, Oxford); J. G. Hayes, FIMA (NPL, Teddington); S. E. Hersom (Hatfield Polytechnic); A. K. Mallin-Jones (ICI Limited); R. McIntyre, AFIMA (Rolls-Royce Limited); J. K. Reid, AFIMA (AERE, Harwell); H. H. Robertson, FIMA (ICI Limited); H. H. Rosenhrock, FRS (UMIST); G. J. S. Ross (Rothamsted Experimental Station); B. T. Smith (Argonne National Laboratory, Illinois); H. Stetter (Institut Numerische Mathematik, Technisch Hochschule, Austria); J Walsh (University of Manchester); J. P. Whelan, FIMA (Mullard Research Laboratories); J. H. Wilkinson, FRS, FIMA (NPL, Teddington).
Guest Speaker: L. Fox, FIMA (Oxford University Computing Laboratory).
Information: The Secretary and Registrar, The Institute of Mathematics and its Applications, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY, England.

19-22. **US-Japan Seminar on Minimal Submanifolds, Including Geodesics**, Japan (24, p. 188)

19-23. **International Conference on Fundamentals of Computation Theory**, Poland (24, p. 73)

26-28. **Conference on Distributed Computer Control Systems**, England (24, p. 134)

26-28. **Symposium-Workshop on Moving Boundary Problems**, Tennessee (24, p. 189)

26-30. **Ninth Congress of Austrian Mathematicians**, Austria (24, p. 73)

30-October 1. **Fifth Annual Mathematics and Statistics Conference**, Ohio (24, p. 134)

OCTOBER

5-7. **Tenth Annual Workshop on Microprogramming**, New York (24, p. 189)

13-15. **Second Annual Conference of the Semiotic Society of America**, University of Colorado, Bolder, Colorado.
Call for Papers: Abstracts should be forwarded to the Secretariat of the Semiotic Society of America at the address below. The abstract must be no longer than one page with margins of 1 1/2 x 1 3/4 inches. Each abstract will be evaluated by the Program Committee on a "blind referee" basis.
Deadline for Abstracts: July 1, 1977.
Information: Semiotic Society Secretariat, P. O. Box 1214, Bloomington, Indiana 47401.

15. **Annual Midwest Conference on Differential and Integral Equations**, Iowa State University, Ames, Iowa
Information: George Seifert or R. K. Miller, Department of Mathematics, Iowa State University, Ames, Iowa 50010

17-19. **International Symposium on Nonlinear Evolution Equations**, Wisconsin (24, p. 134)

26-28. **Third ERDA Statistical Symposium**, Pacific Northwest Laboratories, Richland, Washington.
Program: There will be oral presentations of two types of papers: 1) Problems. These will be presentations of problems encountered by statisticians, scientists, engineers, or other investigators who are working on the nation's energy problems. The purpose is to present problems for discussion by the symposium attendees. 2) Technical papers. These will be presentations of statistical research results particularly relevant to the nation's energy problems. Problem selection will focus on the general applicability of research and the inclusion of nontrivial application to real data.
Information: Wesley L. Nicholson, Energy Systems Department, Battelle-Northwest, Battelle Boulevard, Richland, Washington 99352.

31-November 2. **Eighteenth Annual Symposium on Foundations of Computer Science**, Rhode Island (24, p. 134)

31-November 4. **Conference on Bifurcation Theory and Applications in Scientific Disciplines**, The Roosevelt Hotel, New York, New York.
Sponsor: The New York Academy of Sciences.
Program: This interdisciplinary meeting will make available to mathematicians, biologists, chemists, physicists and applied scientists a platform for the exchange of experience relating to the theory of hifurcations and its applications. Participants will examine the role played by nonlinearities in complex systems. Qualitative analysis of nonlinear systems has pointed out the examples of bifurcations; scientists with different backgrounds and interests will discuss their related experiences. The conference will sum up the present state-of-the-art.
Chairmen: Okan Gurel, IBM Scientific Centers, New York; Otto E. Rossler, University of Tübingen, West Germany.
Information: Conference Department, The New York Academy of Sciences, 2 East 63rd Street, New York, New York 10021.

NOVEMBER

7-9. **Joint National ORSA TIMS Meeting**, Georgia (24, p. 134)

DECEMBER

5-8. **Asian-South Pacific Regional Meeting in Astronomy**, Wellington, New Zealand.
Information: B. M. Lewis, Director, Carter Observatory, Wellington, New Zealand.

12-17. **Australian Number Theory Conference**, University of New South Wales, Sydney, Australia.
Programme: Surveys of recent research in various areas of number theory, with ample opportunity for individual or group discussion.
Speakers: H. Montgomery, M. Waldschmidt, K. Mahler, J. Coates, J. Loxton, G. Szekeres, A. van der Poorten.
Membership: Limited to 40.
Information: A. J. van der Poorten, School of Mathematics, University of New South Wales, P. O. Box 1, Kensington, New South Wales 2033, Australia.

12-18. **Australian Number Theory Conference** 1977, University of New South Wales, Australia.

Information: J. Mack, Department of Pure Mathematics, University of Sydney, New South Wales 2006, Australia.

16-17. **Hardy Centenary**, Trinity College, Camhridge, England.

Sponsor: Council of the London Mathematical Society.

Program: The purpose of the meeting is to commemorate the centenary of the birth of Godfrey Harold Hardy, major benefactor of the London Mathematical Society, whose bequest finances the Hardy Lectureship. The topics of the meeting are analysis and number theory.

Information: J. W. S. Cassels, University of Cambridge, 16 Mill Lane, Cambridge CB2 1SB, England.

** 1978 **

March 15-17. **Eleventh Annual Simulation Symposium**, Tampa, Florida.

Purpose: The Annual Simulation Symposium is a nonprofit corporation organized to provide a forum for the interchange of ideas, techniques, and applications among practitioners and to offer grants for the advance of the art.

Information: Annual Simulation Symposium, P. O. Box 22621, Tampa, Florida 33622.

April 4-8. **British Mathematical Colloquium**, Helsinki, Finland.

Information: I.C.M. 78, Department of Mathematics, University of Helsinki, 15 Hallituskatu, SF-00100 Helsinki 10, Finland.

May 14-17. **Working Conference on Codes for Boundary-value Problems for O.D.E.s**, University of Houston, Houston, Texas.

Program: This conference-workshop will emphasize the state of the art and developing trends in computer codes to implement numerical methods for the approximate solution of boundary-value problems for ordinary differential equations. In addition to formal lectures, workshops will feature demonstrations (including 'hands-on' practice) of working production codes and panel-audience discussions of important research areas, 'benchmark' test prohlems, et cetera. Formal lectures will include 15 to 20 half-hour contributed papers and about 10 invited major addresses including: a survey of methods for BVPs in ODEs; a survey of methods for solving systems of nonlinear equations as they arise in solving BVPs for ODEs; a survey of methods for initial-value problems for ODEs as they are used as part of methods for BVPs in ODEs; presentations of codes implementing various specific methods for BVPs in ODEs. Published proceedings are planned.

Call for Papers: Contributed papers are solicited on methods, both production and research codes, applications, et cetera. A 1-3 page summary should be sent for consideration by October 1, 1977, to: Bart Childs, Industrial Engineering Department, Texas A & M University, P. O. Box 6206, Texarkana, Texas 75501.

Support: Funds for travel support are being solicited.

Information: James W. Daniel, Department of Mathematics, The University of Texas at Austin, Austin, Texas 78712.

May 15-19. **Australasian Mathematical Convention**, Christchurch, New Zealand.

Speakers: Visiting speakers will include Professor A. H. Stone as well as other distinguished overseas mathematicians, including a visiting speaker to he sponsored by the Mathematical Society of Japan.

Program: This will be the first joint meeting of the Australian and New Zealand Mathematical Societies. There will be invited addresses of general interest, elective sessions, splinter groups and workshops as well as educational tours.

Information: 1978 Convention Secretary, Department of Mathematics, University of Canterbury, Christchurch 1, New Zealand.

June 25-July 2. **Eighth International Congress on the Application of Mathematics in Engineering**, German Democratic Republic (24, p. 134)

June 26-30. **Eighth U. S. National Congress of Applied Mechanics**, University of California, Los Angeles, California.

Sponsor: U. S. National Committee on Theoretical and Applied Mechanics, representing the following societies: American Society of Civil Engineers, American Society of Mechanical Engineers, American Mathematical Society, American Institute of Chemical Engineers, Society of Industrial and Applied Mathematics, American Institute of Aeronautics and Astronautics, Society of Experimental Stress Analysis, American Society for Testing and Materials, Society of Rheology, American Physical Society.

Call for Papers: Contributed papers of ten minutes duration may be presented by any member of one of the above societies (or if submitted by a member of a society).

Instructions for Authors: An abstract should be typed as one single spaced paragraph (indented 8 spaces on the first line) using elite type in a column 12.0 cm wide by not more than 10.5 cm long. This space includes, in order: title of paper, list of authors, affiliation, text, and footnotes. Send 3 copies of the abstract suitable for photoreproduction and a covering letter indicating society membership to the address below. Deadline for abstracts is December 31, 1977.

Information: Julian D. Cole, Mechanics and Structures Department, School of Engineering and Applied Science, University of California, Los Angeles, California 90024.

August 15-23. **The 1978 International Congress of Mathematicians**, Finland (24, p. 135)

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

120. G. F. Kohlmayr (Mathmodel Consulting Bureau, Glastonbury, Connecticut 06033). In numerous textbooks one finds without credit to, or mentioning of, a particular author the following theorem (or proposition): A complete ordered field is Archimedean. Does anyone know by whom and where this theorem was originally published and please supply history and/or reference?

121. G. F. Kohmayr (Mathmodel Consulting Bureau, Glastonbury, Connecticut 06033). A. Robinson writes in *Model theory as a framework for algebra,* MAA Studies in Mathematics, Vol. 8, Studies in Model Theory (1973), p. 151): "... the class of differentially closed fields which are extensions of a given differential field of characteristic 0 includes prime models, and recent work by S. Shelah shows these are all isomorphic. However, according to the latest news they may possess endomorphisms over the groundfield, in which case they are not minimal." Could someone please provide me the reference(s)?

122. G. F. Kohlmayr (Mathmodel Consulting Bureau, Glastonbury, Connecticut 06033). In *Nonstandard arithmetic,* Bull. Amer. Math. Soc. 73 (1967), 818–843 (MR 36 #1319), A. Robinson states without proof (p. 842): "In particular, we may thus obtain the real numbers R by taking a countable direct power of the rational numbers Q^N and a free ultrafilter D on N," and "The quotient ring Q_0/Q_1 is isomorphic to the field of real numbers." A similar statement occurs in *What is nonstandard analysis,* Amer. Math. Monthly 80 (1973), no. 6, part II, 38–67 (MR 48 #10802) by W. A. J. Luxemburg. Has anyone seen a proof of these statements, and if so, could he please provide me the references?

123. William Sit (Department of Mathematics, City College, New York, New York 10031). I am interested in finding out how successful (or unsuccessful) computer assisted instruction (CAI) has been in the area of remedial mathematics and elementary Calculus. I would like to obtain copies of reports (or references to reports) from individuals (or institutions) who have actually implemented CAI. I am aware of articles published in The Monthly.

RESPONSES

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

To Zorn's Lemma. (vol. 23, p. 214, June 1976, Minty). Professor George J. Minty is wondering why in referring to Zorn's Lemma one writes quite often "Of course it wasn't invented by Zorn ...".

This is true: it wasn't invented by Zorn.

One can find the needed reference in the well-known Kelley's *Gencral Topology,* (Van Nostrand, New York, 1955; MR 16, 1136), p. 33, where Kelley cites "Zorn" Lemma among other similar or almost identical statements (one of them – as Kelley mentions – was found by me as early as in 1922, i.e. 13 years prior to Zorn). (Contributed by K. Kuratowski)

111. (vol. 24, p. 82, Jan. 1977, Parker). Although it is not quite clear how to measure the difficulty of a proof, we present an example of an equivalence relation where according to our feeling transitivity is easier achieved than reflexivity and symmetry.

Let P and L be sets. Assume that P operates on L, i.e. there is given a map $t: P \times L \longrightarrow L$, $(p, l) \longmapsto pl$. Further assume the following conditions to be satisfied

(i) $p(ql) = pl$ for all $p, q \in P$ and $l \in L$

(ii) t is surjective.

Then define a relation $\sim$ on L by taking $k \sim l$ (for $k, l \in L$), if there is a $p \in P$ such that $pk = l$. The transitivity of this relation is an immediate consequence of (i), while reflexivity and symmetry depend on (i) and (ii) – more precisely: under the assumption of (i) the condition (ii) is equivalent to the reflexivity as well as to the symmetry of this relation. (The situation described here is very familiar in affine geometry: There P and L denote the point set and the line set respectively of an affine space. pl means the line parallel to l through p; thus the considered relation is the parallelism. Incidence comes out from the equation $pl = l$; thus the surjectivity of t means that any line contains at least one point.) (Contributed by Rudolf Fritsch)

113. (vol. 24, p. 136, Feb. 1977, Gunter). The Gossip problem: $f(n)$ = minimum number of calls between n people to exchange all information; $f(2) = 1$, $f(3) = 3$; $f(n) = 2n - 4$ for $n \geqslant 4$. This can be generalized to (connected) graphs; conjecture (Harary-Schwenk): for $n \geqslant 2$, if the graph contains no 4-cycle, then $f(n) = 2n - 3$. References: B. Baker and R. Shostak, Discrete Math. 2(1972), 191–193 (MR 46 #48); R. K. Guy, Amer. Math. Monthly 82(1975), 995–1004; A. Hajnal, E. C. Milner and E. Szmeredi, Canad. Math. Bull. 15(1972), 447–450 (MR 47 #3184); F. Harary and A. J. Schwenk, J. Franklin Inst. 297(1974), 491–495 (MR 50 #1980); W. Knödel, Discrete Math. 13(1975), 95 (MR 51 #15169); K. Lebensold, Studies in Appl. Math. 52(1973), 345–358 (MR 49 #4797); R. Tijdeman, Nieuw Arch. Wisk. (3) 19(1971), 188–192 (MR 49 #7151). The provenance of the problem is uncertain; Boyd or Chesters and Silverman may be the originators. First (unpublished) proof probably by Bumby and Spencer (1970). (Contributed by W. W. Adams, R. T. Bumby, J. R. Griggs, N. L. Johnson, D. J. Kleitman, Samuel Kotz, K. R. Rebman, Rochelle Ring, Eric Rosenthal, A. J. Schwenk, Daniel Zwillinger)

115. (vol. 24, p. 136, Feb. 1977, Demys). Write the class number of $Q(\sqrt[16]{-1})$ as $h_1 \cdot h_2$, with h_2 corresponding to the maximal real subfield. Then $h_1 = h_2 = 1$ (and so $h = 1$); this is essen-

tially due to H. Weber. For $\mathbf{Q}(\sqrt[32]{-1})$ one has $h_1 = 17$ (H. Weber); and either $h_2 = 1$ or $1601 \leqslant h_2 \leqslant 83{,}921$ (H. Cohn, *A numerical study of Weber's real class number of calculation*. I, Numer. Math. 2 (1960), 347–362 (MR 23A #142). Cohn states: "... the present type computer is just too slow by a factor of at least 100 for final results ..." (but that was in 1960). (Contributed by L. Washington)

T. Ojala, Math. Comput. **31** (1977), 268–273, shows that $\mathbf{Q}(\sqrt[8]{-1})$ is Euclidean, and hence has class number 1. J. M. Masley and H. Montgomery, J. Reine Angew Math. **286/7** (1976), 248–256, show that there are 29 fields $\mathbf{Q}(e^{2\pi i/m})$ with class number 1, and list them. (Contributed by R. Bumby)

116. (vol. 24, p. 136, Feb. 1977, Cater). The answer is no: For $x \in [0, 1)$ write the binary expansion $\Sigma b_i(x)/2^i$, terminating if possible; the functions b_i are right continuous. Define $f(x) = \Sigma b_{2i-1}/2^{2i-1}$, $g(x) = \Sigma b_{2i}/2^{2i}$, $f(1) = 1$, $g(0)$. Then f and g are right continuous, and have left limits (thus are "special") and satisfy $f(x) + g(x) = x$. On the other hand, one can show that the ranges of f and g are of measure 0. (Contributed by C.L. Belna, Kenneth Kunen, J.G. Wendel)

PROBLEM LIST

PROBLEMS IN MULTIPLIERS

The following problems were presented at the Special Session on Multipliers for Series and Transforms and their Applications at the 83rd Annual Meeting of the Society in St. Louis, January, 1977.

1. **Marshall Ash.** Suppose T is a strong restricted (p, p) multiplier for $1 < p < 2$; i.e., T is given by

$$\Sigma a_n e^{in\theta} \longrightarrow \Sigma a_n \lambda_n e^{in\theta}, \quad 0 \leqslant \theta < 2\pi$$

and $\|T\chi\|_p \leqslant C\|\chi\|_p$ for all characteristic functions of sets χ. Does this imply that T defines a strong (p, p) operator? This problem was posed to me by Misha Zafran and is equivalent to the question: "Does weak type imply strong type for $p > 2$?"

2. **Richard Askey.** Define

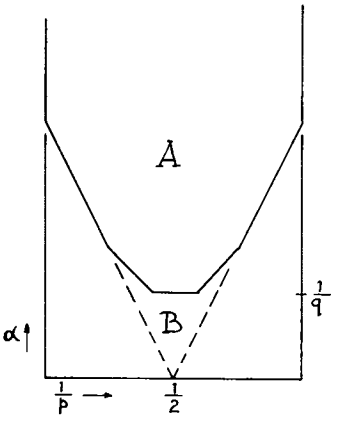
$$P_n(x^2) = \Sigma_{k=0}^{n} \frac{(-n)_k (n + a + b + c + d - 1)_k (a + ix)_k (a - ix)_k}{(a + b)_k (a + c)_k (a + d)_k \, k!}$$

where $(\alpha)_k = \alpha(\alpha + 1) \cdots (\alpha + k - 1)$, $a, b, c, d > 0$. J. Wilson has shown:

$$\int_0^\infty p_n(x^2) p_m(x^2) w(x)\, dx = 0 \text{ if } n \neq m \text{ where}$$

$w(x) = |\Gamma(a + ix)\Gamma(b + ix)\Gamma(c + ix)\Gamma(d + ix)|^2 x \sinh 2\pi x$. These polynomials contain Laguerre, Hermite, and Jacobi polynomials as limiting cases. Conjecture: Mean convergence of partial sums of Fourier series with respect to these polynomials holds for $4/3 < p < 4$. As a preliminary step it would be helpful to understand the asymptotic behavior of these polynomials.

3. **Alan Schwartz.** In our *AMS Memoir* (No. 183) Connett and I investigate the spaces $S(q, \alpha)$ obtained by localization of Bessel potential spaces. For each (q, α) with $\alpha q > 1$, $S(q, \alpha)$ acts as a multiplier on L^p for a range of p's, so if q is fixed, the set of p and α for which $S(q, \alpha)$ is a space of L^p multipliers looks something like region A in the diagram. No point of region A satisfies $\alpha q \leqslant 1$ because in this case $S(q, \alpha)$ does not consist of bounded continuous functions and hence $S(q, \alpha)$ is not even a space of L^2 multipliers. The problem is to find a family of spaces of functions or sequences which give multiplier theorems in $A \cup B$; in particular find spaces $R(q, \alpha)$ of bounded sequences or bounded continuous functions so that $R(q, \alpha)$ is an L^p multiplier if $(1/p, \alpha) \in A \cup B$, and so that $R(q, \alpha)$ is "close to" $S(q, \alpha)$ if $\alpha q > 1$.



LETTERS TO THE EDITOR

Editor, the *Notices*

I read with interest the article by Phoebe J. Murdock on 'New Alphabets and Symbols for Typesetting Mathematics' in the January issue of the *Notices*. However, I disagree with what she states concerning the desirability of an italic Greek font. Her argument is that symbols should be in italic to distinguish them from the regular text. In the case of capitals, however, I believe it is more important to make a distinction between the Greek and Roman fonts, particularly since these two alphabets have so many letters in common. Moreover, capital eta and rho deserve to be distinguished from the linguistically different letters $\underline{H}$ and $\underline{P}$. The practice, formerly more common than now, of setting Greek capitals as upright rather than inclined extends considerably the number of symbols available to the mathematician without resorting to other alphabets.

This was forcibly brought home to me recently when correcting proofs of a book in which at least 112 different letter symbols are used. I had erroneously assumed that the printer's capital Greek font would be upright and had therefore used capital rho for a set of elements analogous to a radius, $\underline{r}$ and $\underline{R}$ being required for other purposes. In the same chapter capital italic $\underline{P}$ occurred frequently with a different meaning and it was only with difficulty that I was able to find another, and less suitable, letter.

Robert A. Rankin

COMMENT from Phoebe Murdock: There are thirteen upper case Greek letters which are identical in appearance with the Latin alphabet. This is true whether they are vertical or slanting. A Latin capital letter H and Greek capital (Eta) H are identical unless they are distinguished by being spoken aloud. Professor Rankin has a point about the linguistic difference, but I'm afraid that if he uses H and P, whether italic or vertical, they will be understood to mean H and P—not Eta and Rho.
Other means of distinguishing similar characters exist in the many type fonts available and extensively used in advertising. An example of one of these is the half-open character: $\underline{A}$.

Editor, the *Notices*

Past practice has dictated that letters of recommendation, or letters of evaluation, be acknowledged. With current inflation of applications for jobs, this practice results in an enormous influx of postcards, extra letters. Would there be a consensus to stop sending such acknowledgments? I hope so, but let the mathematical community express itself on this.

Serge Lang

Editor, the *Notices*

The February 1977 issue of the *Notices* contains a letter by Allen L. Shields continuing discussion of the history of "Zorn's Lemma." Readers of the *Notices* interested in the subject may enjoy reading my paper "A short history of 'Zorn's lemma'," which was presented to the Society at the January 1977 meeting in St. Louis and abstracted in the January issue of these *Notices* (742-01-2, p. A-26). The paper treats the subject at the necessary greater length and depth than is feasible for a letter here, and it includes unpublished information kindly supplied by Professor Zorn. Preprints are available from me, at St. Olaf College, Northfield, Minnesota 55057.

Paul J. Campbell

Editor, the *Notices*

The budgetary crisis facing New York City has been well publicized. Perhaps not so well known is the on-going mass cut-backs of the City University of New York (C.U.N.Y.). There have been lay-offs of faculty and staff, increased work-load, threatened close-down or mergers of campuses just to mention but a few of the retrenchment actions already taken. Also, the 129 year tradition of Free Tuition and the relatively new Open Admissions policy have been abolished. In short C.U.N.Y. is in its death throes.

In its long history C.U.N.Y. has supplied this nation and perhaps even the world with an extraordinary number of prominent academicians, professionals, politicians, and competent technical personnel. It would be a gross calamity if C.U.N.Y. is forced to close some of its doors, the effects would be far reaching.

To pursue the point further, I mention the horrid conditions that exist in New York City; under-staffed hospitals, hospital shut-downs, vast areas of squalor and decay, pernicious alcoholism and drug addiction, and other degeneration of the city and of municipal services. These are not easy problems to solve! These knotty problems will take all the imagination, ingenuity, education and technology available today. They will require training on all levels for all groupings. If these problems are to be begun to be solved, an expanded C.U.N.Y. is needed not a retrenched one!

I would ask the A.M.S. to take a stand on the situation facing C.U.N.Y.; to solicit other professional societies, labor groupings, citizen groupings, ethnic and racial groupings to join in the struggle against the retrenchment of C.U.N.Y. and in fact to reverse the present course into one of expansion. The Money Exists in Washington! Only a strong concerted effort is required. I would implore the A.M.S. to take such action,

for who knows, perhaps Archemides or Gauss lives in the squalor of E. 172nd Street and Southern Blvd., The Bronx.

F. R. Buianouckas

Editor, the *Notices*

With sincere regret, I find it necessary to correct and disassociate myself from some serious misinformation circulated by the Mathematics Action Group (MAG) at the annual AMS meeting in St. Louis in January.

During the meeting, the MAG booth featured a leaflet and a petition alleging political repression of an Israeli mathematics teacher, Dan Vered, convicted of espionage in 1972. There was a panel discussion under MAG auspices held near the end of the AMS meeting (Sunday morning), during which most of the accusations in the leaflet were shown to be incorrect conjectures about events that had taken place and had been widely publicized five years ago. These included the major accusations that "no evidence was brought forward linking Vered directly to espionage" and that "his real offense in the eyes of the government was his open political activity: organizing to unite Arab and Jewish workers to end the slaughter in the Middle East." In fact, Vered was caught transmitting a code book across the border from Syria to his co-defendant, and both of them admitted to it in court.

As for political activity, most of the political groups in Israel claim to represent Arab and Jewish workers and to know the best solution for peace in the Middle East. Among them are about twenty political parties represented in the Knesset (parliament), including two communist parties, like Dan Vered's; as the Israeli election draws near, the number of parties contending for votes is rapidly approaching $\aleph_0$.

As a result of this discussion, the MAG panel did not even propose a resolution on the Vered case. However, to add insult to injury, one of the leaders of MAG mentioned that, to the best of his recollection, MAG has never protested political repression by the USSR or any other 'left-wing' government because there was 'no time'. (However, when pressed, the leaders promised to consider the case of Igor Shafarevitch if time permitted.) This is a singular statement for an organization that describes itself as an "action group" and claims to oppose political bias.

I originally joined MAG to oppose the bigotry and incompetence represented by racial discrimination and the Vietnam War, which intruded into mathematics via bias in employment, the Smale case, and war-related work. For the same reasons, I am now resigning from MAG, with sincere regret for unwittingly having supported it during its recent metamorphosis.

George Glauberman

PERSONAL ITEMS

LOKENATH DEBNATH has been appointed an adjunct professor of physics at East Carolina University and also was elected vice-president of the Calcutta Mathematical Society.

ROLANDO E. PEINADO of the University of Puerto Rico, Mayagüez Campus, has been appointed to a professorship in Pharmacology, Ad Honorem, at the University of Puerto Rico, Medical Sciences Campus, San Juan.

PROMOTION

To Professor, University of Saskatchewan: G. L. SAINI.

CALL FOR INFORMATION ON BLIND REFEREEING

During the past two years, the Proceedings has followed the procedure of "blind refereeing". When a paper is submitted, the referee receives a copy that does not contain the name or the institution of the author and makes his recommendation to the editor in ignorance of these two pieces of information (except insofar as these may be inferred from internal evidence).

The Council of April 16, 1977 agreed that the procedure of blind refereeing should be continued. At the same time, members of the Council are not uniformly convinced that the procedure is necessary or desirable or efficacious. The procedure is an obvious nuisance to editors and to referees in accomplishing certain desirable ends, such as an interchange of information with an author to improve an acceptable paper, particularly in the instance of an inexperienced author. Unless there is good evidence that the procedure of blind refereeing has positive values, there may well be a tendency and pressures to discontinue it.

At the Council meeting there were second- or third-hand reports, somewhat vague, of persons who had thought the reception of their papers quite different, depending on whether the paper bore the name of a prestigious institution and whether it was refereed blind. This notice is an appeal for direct, detailed, and factual statements from authors showing the real usefulness of blind refereeing. It was stated that there are individuals who are convinced by experience of the value of the process. Accounts of the experience would be very useful.

Please observe that this is not an opinion poll. The members of the Council have their own opinions and the Editors of the Proceedings also have the opinions of authors and referees. More opinions are not needed. What is sought is such things as case studies of papers submitted with and without blind refereeing, with comments of editors and reports of referees, that may reveal a relevant aspect of the refereeing process.

The Council, which authorized this request, is aware of the reluctance of someone with a rejected paper or with evidence suggestive of improper discrimination in the handling of a paper to come forward. Thus, information that is volunteered will be handled in strict confidence. Anonymous communications of factual material will be considered, though they may be of less value than communications that are identified and so can be accompanied with files of correspondence.

To participate, one may communicate no later than December 31, 1977 with the Secretary

Everett Pitcher, Secretary
American Mathematical Society
Lehigh University
Christmas-Saucon Hall #14
Bethlehem, Pennsylvania 18015

or with the Past President

Professor Lipman Bers
Department of Mathematics
Columbia University
New York, New York 10027

Everett Pitcher, Secretary

NEWS ITEMS AND ANNOUNCEMENTS

TWO MATHEMATICIANS RECEIVE NATO POSTDOCTORAL FELLOWSHIPS

Two mathematicians are among the forty recipients of North Atlantic Treaty Organization (NATO) Postdoctoral Fellowships in Science awarded by the National Science Foundation (NSF) and the Department of State. They are Charles J. Amick of the University of Cambridge, who will be at the University of Sussex, England; and Arthur E. Ogus of the University of California, Berkeley, who will be at the Institute des Hautes Etudes Scientifiques, France. Their fields of specialization are Applications of Mathematics and Algebraic Geometry, respectively.

This fellowship program was initiated by NATO in 1959 to advance science and technology and promote closer collaboration among NATO nations or countries that cooperate with NATO. Each 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.

NATO Fellows will receive a stipend of $10,800 for twelve months or $8,100 for nine months. In addition, dependency allowances and some allowance for round-trip travel will be provided.

VOLUNTEERS INVITED

The Committee on Committees sincerely invites all AMS members to suggest themselves or others for Society committee appointments. Letters suggesting committee membership should be sent with brief vitae and other relevant data to Everett Pitcher, Secretary, American Mathematical Society, Lehigh University, Christmas-Saucon Hall No. 14, Bethlehem, Pennsylvania 18015. For full consideration for 1978 assignments, suggestions should arrive before August 10, 1977. Members are referred to the 1977 Administrative Directory for an almost current list of Society committees. A revised current committee list will be published in the August 1977 *Notices*.

In a given year there are only about forty standing committee assignments, ten Editorships and fifteen Assistant Editorships that are available for appointment. Perhaps half the committee assignments are of a highly specialized or restricted character–for example, the four committees to select hour speakers for regional meetings include the Associate Secretaries for the regions concerned, together with other members chosen from among those in the region who have recently given invited hour talks. As another example, the Committee on Committees is required by Council action to have several members from the Council and the Executive Committee. In addition, there are various other constraints on the relatively few remaining appointments: there is need for some overlapping membership on committees that deal with related topics and there are always issues of desired committee balance in terms of specialized knowledge, experience, age, sex, mathematical areas, and geography, as well as representation of special groups.

Although several hundred names for committee membership have been suggested over the past two years, more are welcomed from those willing to do the necessary committee work, so that nominations can be made from a broad base in the mathematical research community.

R. D. Anderson, Chairman
AMS Committee on Committees

AMS RESEARCH FELLOWSHIPS AWARDED

Recipients of the AMS Postdoctoral Research Fellowships for 1977–1978 have been announced by the Selection Committee on Postdoctoral Fellowships. The four winners of the fellowship awards are David Vogan, Instructor at the Massachusetts Institute of Technology; Charles Patton, Lecturer at the State University of New York at Stony Brook; Duong-Hong Phong, L. E. Dickson Instructor of Mathematics at the University of Chicago; and Steven Kalikow, Graduate Student at Cornell University.

Honorable Mentions have been awarded by the Committee to the following applicants: Dale Alspach, Graduate Student, Ohio State University; Judith Arms, Graduate Student, University of California at Berkeley; Philip P. Green III, J. F. Ritt Assistant Professor, Columbia University; Adam Hausknecht, Instructor, University of Kansas; Leon Karp, Lecturer, Courant Institute of Mathematical Sciences, New York University; Michael Maller, Research Assistant, City University of New York; William L. Pardon, J. F. Ritt Assistant Professor, Columbia University; Phillip E. Parker, Graduate Student, Oregon State University; George Quart, Graduate Student, Brown University; and Judith Roitman, Assistant Professor, Wellesley College.

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 $10,000 each with an expense allowance of $500. The Selection Committee this year was Leonard Gillman, Daniel Gorenstein (chairman), Mark Kac, William P. Thurston, Myles Tierney, and Karen Uhlenbeck.

The continuation of the 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.

1977 SUMMER LIST OF APPLICANTS

The AMS-MAA-SIAM Joint Committee on Employment Opportunities plans to supplement the publication of EMPLOYMENT INFORMATION FOR MATHEMATICIANS by issuing, on an experimental basis, Semiannual Lists of Applicants seeking employment in the mathematical sciences. Distribution of the first list is planned at the 1977 Summer Meeting in Seattle.

Applicants who wish to appear in the list should complete the form and accompanying summary strip printed on page A-406 of this issue of these *Notices*, and mail it to the Providence office of the Society before the end of June. There is no charge to applicants for listing. Copies of the list will be sold at cost at the Seattle meeting, and by mail following the meeting.

The printed list will contain two-line summaries of the information supplied by applicants similar to those prepared for the employment register in St. Louis last January. Applicants who plan to participate in the employment register in Seattle (cf. page 199 of these *Notices*) are requested to indicate that fact on the form.

The members of the Joint Committee on Employment Opportunities are Richard D. Anderson, John A. Nohel, Edward C. Posner, and W. Norman Smith.

SEVENTEEN MATHEMATICIANS RECEIVE SLOAN FELLOWSHIPS

Sloan Fellowships for Basic Research have been awarded to ninety-five scientists including seventeen mathematicians, of whom thirteen are members of the Society. The scientists were selected on the basis of their exceptional potential to make creative contributions to scientific knowledge. The fellowships, granted by the Alfred P. Sloan Foundation, run for two years in varying amounts, averaging about $8,200 a year, and are administered by the Fellows' own institutions.

Candidates for fellowships are nominated by senior scientists familiar with their talents. No formal research proposal is required, and the Fellow is free to shift the direction of his research at any time. The Foundation requires a brief annual progress report.

Mathematicians awarded Sloan Fellowships for 1977–1978 are: William E. Beckner (University of Chicago), Grahame Bennett (Indiana University), James A. Carlson (University of Utah), Shiu-Yuen Cheng (New York University), Richard S. Ellis (University of Massachusetts), Stephen S. Gelbart (Cornell University), Dorian Goldfeld (Massachusetts Institute of Technology), Andrew J. Majda (University of California, Los Angeles), John J. Millson (Yale University), Henry C. Pinkham (Columbia University), Marina Ratner (University of California, Berkeley), Douglas C. Ravenel (University of Washington), Judith D. Sally (Northwestern University), Peter B. Shalen (Rice University), Joel H. Spencer (State University of New York, Stony Brook), J. Stephen Wilson (Princeton University), and Misha Zafran (Stanford University).

JOHN SIMON GUGGENHEIM FELLOWSHIP AWARDS

Fifteen John Simon Guggenheim Fellowships have been awarded in mathematics and related areas in the fifty-third annual competition. A total of 313 scholars, scientists, and artists were selected from a field of 3,050 applicants. Awards are made on the basis of "demonstrated accomplishment in the past and strong promise for the future." Eight of the award-winners are members of the AMS.

The recipients and their proposed studies are: James O. Berger, associate professor of statistics, Purdue University, Investigations in statistical decision theory; William Werner Boone, professor of mathematics, University of Illinois at Urbana-Champaign, Decision problems in group theory; Shelby J. Haberman, associate professor of statistics, University of Chicago, Analysis of qualitative data; Arthur M. Jaffe, professor of mathematical physics, Harvard University, Studies in mathematical physics; Shoshichi Kobayashi, professor of mathematics, University of California, Berkeley, Differential geometry and function theory of complex manifolds; Norman R. Lebovitz, professor of mathematics, University of Chicago, Theoretical studies in applied mathematics and astrophysics; Sol I. Rubinow, professor of biomathematics, Cornell University, Theoretical studies in mathematical biology; Paul E. Schupp, professor of mathematics, University of Illinois at Urbana-Champaign, Studies in the theory of infinite groups; Allan W. Snyder, senior fellow in applied mathematics and neurobiology, Institute of Advanced Studies, Australian National University, Analytical studies in visual neurobiology; Gabriel Stolzenberg, professor of mathematics, Northeastern University, The constructivist critique of contemporary mathematics; and Jean François Treves, professor of mathematics, Rutgers University, Linear partial differential equations.

SCIENTISTS AWARDED NSF NATIONAL NEEDS POSTDOCTORAL FELLOWSHIPS

Four mathematicians were among the 89 scientists awarded National Science Foundation National Needs Postdoctoral Fellowships. The awards, made to United States citizens who have received the doctorate degree, were made on the basis of merit from among 1,032 applicants. The awards are aimed at helping to meet national requirements for talented scientists capable of applying their knowledge of science and technology to societal problems. Fellowship recipients are provided a stipend of $12,000 per year for full-time study or research, with a tenure period of nine months to one year.

The four mathematicians, their current affiliations and their fellowship institutions are: Charles J. Amick (University of Cambridge, England), University of Sussex, England; Evans M. Harrell II (Haverford College), Massachusetts Institute of Technology; Andrew F. Siegel (Stanford University), Harvard University; and Stephen Wollman (University of New Mexico), New York University.

AMS COMMITTEES

COMMITTEE ON HUMAN RIGHTS OF MATHEMATICIANS

The Committee on Human Rights of Mathematicians was authorized by the Council of April 11, 1976. Its current membership is Lipman Bers, Charles Herbert Clemens, Chandler Davis, Morris W. Hirsch, Nathan Jacobson (chairman), and John A. Nohel. The charge to the Committee is not complete. That portion of the charge concerning foreign mathematicians has been accepted by the Council and is reproduced here.

Charge to the Committee on Human Rights, Concerning Foreign Mathematicians

1. In recent years, the AMS has intervened on behalf of several foreign mathematicians, mistreated by their governments, and even on behalf of whole groups of such mathematicians. This Committee will assist the Council, the Officers and the Business Meeting of the Society in such matters, by investigating alleged violations of human rights of foreign mathematicians and by recommending appropriate action whenever action seems warranted.

2. A foreign mathematician, for the purpose of the Committee, is a person residing outside the U.S. and professionally engaged in a mathematical science (like pure mathematics, applied mathematics, mathematical statistics, computing science, and operations research) or trained for such activity.

The purpose of this rule is to limit the activities of the Committee to cases in which our members may be presumed to have a feeling of genuine professional identification with the alleged victim.

3. By violations of human rights, the Committee is to understand violations of freedoms enumerated in the *Universal Declaration of Human Rights* and in the *Affirmation* adopted by the National Academy of Sciences, USA: in particular, torture, imprisonment for political reasons, dismissal from a job which deprives a mathematician of the opportunity to function professionally.

In most cases, it would be impractical to consider less drastic offenses like denial of promotion or of professional recognition.

4. The first duty of the Committee is to investigate complaints received by it or referred to it by officers of the Society. The Committee is empowered to make polite enquiries to foreign governments and embassies (this is important, since a timely polite inquiry may be more valuable than a vociferous protest later on).

In conducting its investigation, the Committee cannot always hope to prove a case beyond reasonable doubt or to hear all sides. In a conflict between an all-powerful government and an individual, especially one confined to jail, the Committee may be unable to elicit information from the government in question, and may have no way of direct communication with the victim. Rather, the Committee should arrive at recommendations for actions (or inaction) using common sense, any source of information available, and the advice of organizations which have had extensive experience in human rights cases (in particular, the International League for the Rights of Man, and Amnesty International).

5. The Committee should avoid any political orientation in its activities. It should defend human rights of mathematicians abroad even when their ideology or political pronouncements are repugnant to members of the Committee.

COMMITTEE ON ACADEMIC FREEDOM, TENURE AND EMPLOYMENT SECURITY

The Committee on Academic Freedom, Tenure, and Employment Security (CAFTES) was created by the Council in August 1972. The charge consisted of an orderly presentation of the arguments for existence of the Committee and other aspects of the discussion of the enabling resolution.

Subsequently, the Council sensed a need for rules to govern the consideration of individual complaints and authorized a separate Committee to Write Rules for the Operation of CAFTES. That Committee, consisting of Charles W. Curtis, Murray Gerstenhaber, Edwin E. Moise, M. Susan Montgomery, Calvin C. Moore, Karl K. Norton, and Charles E. Rickart (chairman), reported to the Council of January 26, 1977. The Council adopted the report as the rules under which CAFTES should operate during a three-year trial period, with review by the Council of January 1980.

Rules for the Operation of CAFTES

The possible activities of CAFTES are presented roughly in the order of increasing degree of involvement of the Society. No attempt is made to specify directly the *types* of cases to be considered. In fact, it seems desirable that every case should be accepted for *possible* consideration and that whatever immediate advice or help CAFTES is able to provide should be offered.

The following material, which is grouped into seven

sections, contains suggestions for the organization of CAFTES and a proposal for the establishment of a working arrangement with the American Association of University Professors (AAUP), as well as proposed rules for the operation of CAFTES. It also falls naturally into two parts. Part I concerns the regular business of CAFTES and Part II more controversial actions that require Council authorization. In addition, the final section consists of several items, relevant to CAFTES' operation, on which the Committee might appropriately have made recommendations but, for one reason or another, did not reach an agreement.

PART I

1. *Organization of CAFTES.* It is recommended that CAFTES be increased to nine members appointed by the President for (staggered) three-year terms with possible reappointment. The business of CAFTES should be directed by a three-member Executive Committee appointed by the President and including the Chairman. The membership of CAFTES should include individuals who are interested in, and have some experience in dealing with, the various kinds of complaints that arise. (Ultimately, such experience might be the result of working as a member of CAFTES.) The Chairman of CAFTES shall report regularly to the Council on CAFTES activities.

2. *Relationship of CAFTES to the AAUP.* It is expected that, in a substantial number of cases, CAFTES might appropriately request the cooperation of the AAUP. To facilitate this process, it is proposed that a formal agreement be negotiated by the President of the AMS with the President and General Secretary of the AAUP (possibly along with other senior members of both organizations) establishing a working arrangement between CAFTES and the AAUP staff. The main object here is to obtain prompt and efficient AAUP consideration of cases involving mathematicians. CAFTES would sponsor selected cases to the AAUP after careful preparation of the initial materials. CAFTES should be able to exert some influence on, as well as follow, the progress of each of its cases within the AAUP. In addition, CAFTES would supply the AAUP with a list of mathematicians qualified and willing to advise and participate in AAUP investigations. The opportunity, within a good working arrangement between CAFTES and AAUP, for the exchange of advice and information should be advantageous to everyone concerned. There are indications from the AAUP that such an arrangement would be both possible and desirable from their point of view. There is good reason to insist, however, that the agreement be formalized at the highest levels of both the AMS and the AAUP in order to insure its success.

3. *Procedures for the submission of complaints to CAFTES.* CAFTES should prepare an information form (or request for information) the completion of which (to the extent possible) will be *required* of each individual who wishes to submit a complaint to CAFTES. The form should include such items as the following:

(1) Complete vita of the complainant.

(2) Details of the complaint, including copies of all available documentation, with special emphasis on *written evidence* concerning terms of appointment, etc. and names of individuals whom CAFTES could contact for additional information or verification of undocumented claims.

(3) Appointment, promotion and evaluation procedures of both the department and institution involved in the dispute (when relevant to the complaint), or names of persons from whom such information might be obtained.

When CAFTES agrees to consider a case, the department and institution involved should be contacted immediately. They should be advised of the complaint and requested to provide whatever routine information they have concerning the dispute, including any information concerning administrative procedures, etc., that the complainant was unable to supply. CAFTES' role here must be strictly non-partisan with no suggestion of accusation or threat of action.

The type of information required by CAFTES with respect to a complaint should be published in the *Notices* along with a statement outlining CAFTES' purposes, etc. Complaint "forms" should be readily available both to departments and individuals. We regard the form as very important, not only as an efficient device for obtaining quickly necessary case information, but as an educational device. For example, it should alert both departments and prospective employees to the importance of specifying in writing the conditions of appointment as well as prospects and procedures with respect to reappointment and promotion. Documentation of this kind might reduce significantly the misunderstandings that give rise to complaints.

It is recognized that adequate information concerning cases other than the standard ones involving reappointment, etc. (e.g., discrimination cases) may be very difficult, or even impossible, to obtain.

4. *Classification of cases and preliminary action by CAFTES.* No complaint submitted to CAFTES should be considered in detail until the initial information form has been filled out as completely as possible under the circumstances. However, unnecessary delays should be avoided, since the speedy processing of each case within the statutory time limit is of utmost importance.

Except for the elimination of obviously frivolous or totally unsupported complaints, each completed form shall be examined by at least two members of the Committee and placed in one or more of the following categories:

C1. Cases that should be dropped (e.g., for lack of evidence or because there appears to be no legitimate complaint).

C2. Cases for the AAUP or other established agency.

C3. Cases for possible court action.

C4. Cases for mediation either by CAFTES or the AMS.

If the number of complaints is large, then limited resources may force the Committee to set up a priority schedule for further consideration of cases. Priorities, if necessary, should be proposed by the CAFTES Executive Committee and approved by the full Committee.

In general, the role of CAFTES in all complaints should be strictly impartial and unbiased toward either party in the dispute. However, in certain cases, where the complainant has not had access to internal grievance or similar proceedings (*required*, e.g., by Title IX in sex discrimination cases), CAFTES may respectfully urge the institution to provide such access. This should not be accompanied by any suggestions of bad faith on the part of the institution or threats of action by CAFTES. Also, for cases in which a university administration has overruled a departmental recommendation, a special effort should be made, but only at the request of the complainant, to obtain a detailed statement of reasons for the action. (See the AAUP 1966 Statement on Government of Colleges and Universities, AAUP Bull. 52 (1966), 375-379. This statement was endorsed jointly by the AAUP, the American Council on Education, and the Association of Governing Boards of Universities and Colleges.)

The CAFTES Executive Committee shall review the suggested classification of each complaint and initiate the

following actions with the approval of the full Committee.

For a complaint in C1, CAFTES should explain carefully to the complainant the evident weaknesses of the case and recommend that he consider dropping it.

For a complaint in C2, CAFTES may offer to sponsor the case with the appropriate agency.

For a complaint in C3, CAFTES may recommend that the complainant contact a lawyer and investigate the possibility of legal action. (For cases that do go to court, the council has voted that CAFTES may recommend Council authorization of an *amicus curiae* brief, and has also established loan procedures.)

For a complaint in C4, in which the difficulty appears to be based on differences that might admit of routine settlement through a neutral party, CAFTES may contact the institution and attempt to arrange an amicable settlement. If the complaint involves more substantial differences that might, however, be resolved through a more formal mediation attempt by the AMS, then CAFTES may request that the President of the Society initiate such a mediation process. Since mediation can lead to delay that might be disadvantageous to the complainant, CAFTES might suggest a deadline, appropriate to the case in question, for completion of the mediation process.

It is recognized that a case, as it develops, may shift from one category to another and so may need to be reexamined periodically.

PART II

5. *Investigations by the AMS.* There may remain certain cases that cannot be resolved by any of the procedures outlined in Part I, but which, in CAFTES' judgement, deserve further attention and possible action by the AMS. It is obviously important that any major action of the Society with respect to disputes between individual mathematicians and their institutions be backed up by carefully documented evidence. The required documentation may in some cases consist of material produced in an investigation conducted by the AAUP or other agency. However, if such material is not available, then it may be necessary for the AMS, either independently or jointly with the AAUP to make an on-site investigation.

A request by CAFTES for an investigation of a given case, either by the AMS alone or jointly with the AAUP must be submitted to the Council or the Executive Committee of the Council for authorization.

The report of the investigating team shall become a part of CAFTES' report on the case to the Council. In its report, CAFTES may recommend one or more of the actions outlined in the next section.

6. *Possible AMS actions concerning unresolved disputes.* CAFTES may, in a suitable case, recommend to the Council at various times that it take one or more of the following actions:

(1) A brief statement might be published in the *Notices* outlining the facts of the given case, but with no value judgements on the merits of the case.

(2) The CAFTES' report to the Council might be published in the *Notices*.

(3) The Council might pass a resolution identifying certain common practices or customs in the mathematics community. It might also declare its support of certain standards or principles. In a given case, it might vote to find that a particular action by an institution has not been in accord with the common practices, customs, standards or principles and might publish that resolution in the *Notices*.

(4) The Council might authorize the submission of an *amicus curiae* brief for cases that are being tried in court. It might also offer the services of expert witnesses to either party or to the court.

The above list is not intended to be exhaustive.

7. *Unsettled questions.* In this section we outline several items that have either been discussed by the Committee or communicated to the Committee in one form or another. They are obviously relevant to CAFTES' activity but do not appear explicitly in the suggested rules. Some are also controversial to an extent that the Committee was unable to agree on recommendations concerning them.

(a) *The status of CAFTES within the AMS.* It has been proposed that the members of the Executive Committee of CAFTES be made *ex officio* voting members of the Council. This proposal was discussed at length within the Committee but no agreement on a recommendation was reached.

(b) *Types of cases to be considered by CAFTES.* There have been several carefully worked out proposals that certain types of complaints be considered by CAFTES (e.g., Karl Norton's resolutions) that deserve more attention than the Committee was able to give them. Although the rules proposed here do not specify the types of cases to be considered, the understanding is that essentially all complaints, regardless of type, would be accepted for *possible* consideration, examined by at least the executive committee of CAFTES, and records kept on each case. The decision as to which cases would be actively pursued is left to CAFTES, although the Council may wish at some point to instruct CAFTES on the matter. In any given case, such decisions are always subject to possible review by the Council using CAFTES' case records.

(c) *Investigation.* The Committee is in general agreement that, as stated in the proposed rules, CAFTES must obtain approval of the Council, or the Executive Committee of the Council, before initiating an on-site investigation. However, there was *not* general agreement on whether such investigations should be permitted in the first place, or, if permitted, exactly how they should be conducted. Some members of the Committee would support a judgemental type of investigation while others would insist that an investigation be limited to the gathering of facts in the case without bias toward either the complainant or the accused.

(d) *Actions with respect to unresolved disputes.* The several actions that CAFTES might recommend to the Council, listed in section 6, have been suggested in one form or another by various interested members of the AMS. Although generally recognized as possible appropriate actions in certain situations, they have not been fully discussed within the Committee and there is far from general agreement on exactly what the actions of the Council should be in any given case. On the other hand, there has been extensive discussion concerning the possibility of censure by the AMS. Some members of the Committee would regard censure as an appropriate action in certain cases, while others believe that censure by the AMS would be inappropriate for *any* case, however complete the documentation or flagrant the violation. There is also opposition to a suggested substitute for censure, *viz.* a Council resolution "finding at fault", as being essentially equivalent to censure.

NEW COMMITTEES

The Organizing Committee for the 1978 Summer Seminar has been appointed by President R. H. Bing. The members are Frank Hoppensteadt (Chairman), William S. Childress, D. S. Cohen, Paul Waltman, and A. S. Winfree.

COMMITTEE DISCHARGED

The Council has decided to discharge the Editorial Committee of Current Mathematical Publications. Its duties will be taken over by the Editorial Committee of Mathematical Reviews. It is intended that CMP will be closely coordinated with index issues of MR.

Two additional committees have been discharged. They are the Committee to Write Rules for the Operation of CAFTES and the Committee on Meetings.

RECENT APPOINTMENTS

William Browder has been appointed by President R. H. Bing to the Committee on Committees. Other members include R. D. Anderson (Chairman), Philip T. Church, W. Wistar Comfort, Kenneth A. Ross, and Linda Preiss Rothschild. Everett Pitcher is a member ex officio.

President R. H. Bing has appointed Felix E. Browder and Gian-Carlo Rota to the Committee on Publication Problems. The other members of the committee are Robert M. Baer, Duane W. Bailey (Chairman), Hyman Bass, Philip T. Church, Leonard Gillman, Paul R. Halmos, D. J. Lewis, Barbara L. Osofsky, Carl M. Pearcy, Franklin P. Peterson, George B. Seligman, Stephen S. Shatz, I. M. Singer, Elias M. Stein, Hale F. Trotter, and Gordon L. Walker.

NEWS ITEMS AND ANNOUNCEMENTS

NATIONAL SCIENCE FOUNDATION GRADUATE FELLOWSHIPS

The National Science Foundation (NSF) has awarded 550 fellowships for graduate study to students of outstanding ability in the sciences, mathematics, and engineering. Sixty-one awards were made to students in mathematical fields.

More than 4,830 students competed for the fellowships, which were awarded on the basis of merit. Panels of scientists, appointed by the National Research Council of the National Academy of Sciences, evaluated applications; final selections were made by the NSF. In addition to the fellowship awards, NSF accorded honorable mention to 1,747 applicants.

Each fellowship, awarded for three years of graduate study, carries a stipend of $3,900 per year for full-time study. Graduate Fellows may attend any appropriate nonprofit United States or foreign institution of higher education.

ASSOCIATION FOR STATISTICAL COMPUTING

An International Association for Statistical Computing (IASC) has been formed as a section of the International Statistical Institute. The major objective of the Association will be to foster interest and knowledge in effective statistical computing through international contacts among statisticians, computing professionals, organizations, institutions, governments, and the general public in different countries of the world. The Association will pursue its objectives throughout the world with special attention to Developing Countries, promoting collaborative efforts with international, national, regional, and other organizations and institutions having similar aims. The Association will formally come into existence and have its inaugural meeting in December 1977 during the forty-first Session of the International Statistical Institute in New Delhi, India.

For further information, including details of membership, contact: International Statistical Institute, 428 Prinses Beatrixlaan, Voorburg, Netherlands. Annual dues for individual members will be $15 for members from developed countries, and $7 for members from developing countries who request a reduced rate.

ERRATA

A news item in the April 1977 *Notices* announced the availability of sets of copies of the lecture notes for the Colloquium Lectures presented by William Browder at the St. Louis meeting. These sets of lecture notes consist of 31 rather than 70 pages.

The new Committee on Applied Mathematics of the University of Arizona was described in a news item in the February issue of these *Notices*. Inadvertently the names of Mark Kac, Joel Cohen, Stanley Reiter, Joseph B. Keller, Gene H. Golub and Lloyd S. Shapley were added to the list of AMS members who are members of this new committee. These professors were lecturers in the Applied Mathematics Colloquia given this spring at the University. The complete list of members of the University Committee on Applied Mathematics includes: P. K. Bhattacharya, J. M. Cushing, D. G. Dudley, O. D. Duncan, W. G. Faris, P. C. Fife, H. Flaschka, J. F. Gross, R. L. Hamblin, D. L. Hetrick, F. A. Hopf, J. R. Jokipii, J. P. Keener, G. A. Korn, G. L. Lamb, Jr., W. E. Lamb, Jr., D. O. Lomen, D. Lovelock, D. W. McLaughlin, R. L. Morse, R. E. O'Malley, Jr., H. R. Pulliam, M. L. Rosenzweig, H. Rund, M. O. Scully, W. R. Sears, A. R. Seebass, D. F. Shanno, and V. L. Smith.

ABSTRACTS

The abstracts are grouped according to subjects chosen by the author from categories listed on the abstract form and are based on the AMS (MOS) Subject Classification Scheme (1970). Abstracts for which the author did not indicate a category are listed under miscellaneous.

* *Indicates that preprints are available from author.* • *Indicates invited addresses.*

Abstracts Presented to the Society

The abstracts printed in this section were accepted by the American Mathematical Society for written presentation. An individual may present only one abstract by title in any one issue of the *Notices*, but joint authors are treated as a separate category. Thus, in addition to abstracts from two individual authors, one joint abstract by them may also be accepted for the same issue.

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

77T-A105 **DAVID ZEITLIN, 1650 Vincent Ave. North, Minneapolis, MN., 55411. Parametric solutions for two equal sums of 22 fifth powers.**

V_0 and W_1 are integers; all identities hold for $k = 0,1,\ldots$. If $W_{k+2} = W_{k+1} + 2W_k$, then we have (1)

$$(4W_{k+6})^5+(5W_{k+6})^5+(7W_{k+6})^5+(16W_{k+6})^5+(21W_{k+6})^5+(13W_{k+5})^5+(16W_{k+5})^5+(2W_{k+4})^5+(19W_{k+4})^5+(34W_{k+4})^5 +$$
$$(5W_{k+3})^5+(8W_{k+3})^5+(14W_{k+3})^5+(17W_{k+3})^5+(27W_{k+3})^5+(12W_{k+2})^5+(32W_{k+2})^5+(34W_{k+2})^5+(52W_{k+2})^5+(64W_{k+2})^5 +$$
$$(52W_{k+1})^5+(64W_{k+1})^5 = (22W_{k+6})^5+W_{k+5}^5+(2W_{k+5})^5+(17W_{k+5})^5+(6W_{k+4})^5+(16W_{k+4})^5+(17W_{k+4})^5+(26W_{k+4})^5 +$$
$$(32W_{k+4})^5+(2W_{k+3})^5+(3W_{k+3})^5+(13W_{k+3})^5+(16W_{k+3})^5+(22W_{k+3})^5+(25W_{k+3})^5+(4W_{k+2})^5+(38W_{k+2})^5+(68W_{k+2})^5 +$$
$$(4W_{k+1})^5+(8W_{k+1})^5+(68W_{k+1})^5+(8W_k)^5.$$

Additional reports for two equal sums of fifth powers are forthcoming. (Received February 11, 1977.)

*77T-A106 Justin R. Smith, Rice University, Houston, Texas 77001. Acyclic Localizations.

This paper solves the following algebraic problem in many interesting cases: Given a finitely generated projective right chain complex C_* over a ring Λ and a surjective homomorphism of rings $f: \Lambda \to \Lambda'$, what conditions must be satisfied by the homology of C_* so that $C_* \otimes_{\Lambda} \Lambda'$ will be acyclic? This paper shows that, in many cases, the homology modules of such relatively acyclic complexes can be characterized in torsion-theoretic terms, i.e., a module can occur as a homology module if and only if it is a torsion-module in a suitable sense. This is applied to show that, in many cases, the homology surgery obstruction groups defined by Cappell and Shaneson are canonically isomorphic to ordinary surgery obstruction groups of suitable rings. (Received December 17, 1976.)

*77T-A107 Yehiel Ilamed, Soreq Nuclear Research Centre, Yavne, Israel. On polynomials orthogonal with respect to the trace bilinear form. II.

Let P be the ring generated by the noncommutative indeterminates x_i, y_i, y_{ij}, $i,j=1,2,\ldots$. We say that $p \in P$ is orthogonal to $q \in P$ if $tr(pq)=0$, i.e., evaluating pq by substituting arbitrarily chosen k×k matrices (any k) for the arguments in pq we obtain a trace zero matrix. Example. $R_2(x_1,y_1,y_2) = y_1x_1y_2-y_2x_1y_1$ is orthogonal to x_1. Let $R_m(x;y)$ be defined by* $R_m(x_1,\ldots,x_{m-1};y_1,\ldots,y_m) = \Sigma(sg\gamma)(sg\pi)y_{\gamma(1)}x_{\pi(1)}y_{\gamma(2)}x_{\pi(2)}\cdots y_{\gamma(m-1)}x_{\pi(m-1)}y_{\gamma(m)}$, where sg means the sign of and Σ means summation over γ and π ; γ in the set of the m powers of the cyclic permutation $(1,\ldots,m)$ and π in the set of the $(m-1)!$ permutations of $1,\ldots,m-1$. Theorem 1. $R_m(x;y)$ is the polynomial p that satisfies the following three conditions: (a) the coefficient of $y_1x_1y_2x_2\cdots y_{m-1}x_{m-1}y_m$ in p is 1 , (b) p is orthogonal to x_j , $j=1,\ldots,m-1$, (c) the number of the monomials with coefficient different from zero in p is minimal. Theorem 2. The list $p_1,p_2,\ldots$, $p_1=x_1$, $p_i=R_i(p_1,\ldots,p_{i-1},y_{1i},\ldots,y_{ii})$, $i=2,3,\ldots$, is a list of mutually orthogonal polynomials, i.e., $tr(p_hp_k)=0$ for $h\neq k$, $h,k=1,2,\ldots$.

* $R_m(x;y)$ was defined by Yu. P. Razmyslov [see S. A. Amitsur, On a central identity for matrix rings, J. London Math. Soc. 14(1976) 1-7] . (Received February 17, 1977.)

77T-A108 P. Pudlák and J. Tůma, Mathematical Institute of Czechoslovak Academy of Sciences, Žitná 25, 110 00 Praha 1, Czechoslovakia. Every finite lattice can be embedded in a finite partition lattice.

The Theorem given in the title answers in the affirmative a question raised in Ph. M. Whitman, Bull. Amer. Math. Soc. 52(1946), 507-522. Since every finite lattice L is a join-homomorphic image of the finite Boolean lattice P(L) (under $X \to \vee X$), it is sufficient to prove that if L has such an embedding, then so does $L/\Theta(u,v)$, where $0 < u < v$, $u,v \in L$, and $\Theta(u,v)$ is the smallest join-congruence under which $u \equiv v$. This is accomplished using some graph theoretical constructions and a combinatorial lemma. (Received February 22, 1977.) (Author introduced by Professor G. Grätzer).

*77T-A109 **K. CHANG, The Ohio State University, Lima, Ohio 45804. On handcuffed designs. Preliminary report.**

A handcuffed design, H(v, k, λ), with parameters v, k, λ consists of a family of ordered k-subsets of a v-set, called handcuffed blocks. In a block $(a_1, a_2, \ldots, a_k)$ each element is assumed to be "handcuffed" to its neighbors. Thus, a block contains k-1 handcuffed pairs, the pairs being considered unordered. Each element of the v-set appears in exactly r blocks, and each pair of distinct elements of the v-set is handcuffed in exactly λ blocks of the design. A necessary condition for the existence of a H(v, k, λ) is that (i) $\lambda(v - 1) \equiv 0 \pmod{(k - 1)}$, and (ii) if v or k is odd, then $\lambda(v - 1)/(k - 1)$ is even. Theorem 1. Let v and λ be positive integers and $k \in \{4, 5, 6, 7\}$ be given. Then the conditions (i) and (ii) above are sufficient for the existence of a H(v, k, λ). Theorem 2. Let v and k be given positive integers and $\lambda \in \{2, 3, 4\}$ be given. Then the conditions (i) and (ii) above are sufficient for the existence of a H(v, k, λ). (Received February 28, 1977.)

*77T-A110 R.VENKATARAMAN, Madurai College, Madurai 625011 and A.M.S.RAMASWAMY, A.V.C.College, Mayuram 609305 INDIA.
Some algebraic structures on Fuzzy sets - II Preliminary report.

In this paper we introduce further algebraic structures on fuzzy sets such as fuzzy vector spaces, Euclidean fuzzy space, fuzzy matric space, matrices and fuzzy algebras. We have given the concept of fuzzy matrices through fuzzy vector space homomorphisms which in a way is different from the one as introduced by Mr.M.Shimura in his paper -'Fuzzy Set concepts in rank-ordering objects' appeared in the J.Math.Anal.Appl. 43 (1973) 717-733. We remark that multiplication of fuzzy matrices, as introduced by us, differs from that of ordinary matrices. (Received February 28, 1977.) (Author introduced by Dr. T.V. Lakshminarasimhan).

77T-A111 HEISOOK LEE, Queen's University, Kingston, Ont., Canada. An Exact Sequence in Base Change of a Normal Variety, Preliminary Report.

An integral separated scheme X of finite type over a field k is called a variety over a field k if $X \underset{\text{spec } k}{\times} \text{spec } \bar{k}$ is integral, where $\bar{k}$ denotes the algebraic closure of k.

Theorem 1. Let $(X, \mathcal{O}_X)$ be a normal variety over a field k and k' an algebraic extension of k with Galois group G. Let $X' = X \underset{\text{spec } k}{\times} \text{spec } k'$ and let $X^{(1)} = \{x \in X \mid \dim \mathcal{O}_{X,x} = 1\}$. Then there is an exact sequence

$$0 \to H^1(G, \Gamma(X', \mathcal{O}_{X'}^*)) \to Cl(X) \to Cl(X')^G \to H^2(G, \Gamma(X', \mathcal{O}_{X'}^*)) \to \bigoplus_{x \in X^{(1)}} B(\mathcal{O}_{X',x'}/\mathcal{O}_{X,x}) \to H^1(G, Cl(X')) \to H^3(G, \Gamma(X', \mathcal{O}_{X'}^*)).$$

As a special case, we have $\bigoplus_{x \in X^{(1)}} B(\mathcal{O}_{X',x'}/\mathcal{O}_{X,x}) \cong B(X'/X)$ if X is regular variety. Using this we have:

Theorem 2. Let F be a nondegenerate n-ary ($n \geq 5$) quadratic form over a field k of characteristic zero and $X = \text{proj}\left(\frac{k[x_1, \ldots, x_n]}{(F)}\right)$; then $B(X) \cong B(k)$.

(Received March 7, 1977.)

*77T-A112 BRUCE A. MAGURN, Department of Mathematics, University of Oklahoma, Norman, Oklahoma 73019. SK_1 of Dihedral Groups.

If G is a finite group, and e_1, e_2 are orthogonal central idempotents of QG, the projections of $(e_1+e_2)ZG$ to e_1ZG and e_2ZG may be completed to a cartesian square of rings in which all maps are surjective. The fourth ring is ZG/C where C is the conductor from $e_1ZG \times e_2ZG$ to $(e_1+e_2)ZG$. If H is a cyclic normal subgroup of G, orthogonal central idempotents of QH remain central in QG and determine surjective cartesian squares on both the H and G levels. M. Keating and T. Obayashi (separately) proved $SK_1ZD_n = 1$ for D_n dihedral of order $2n$, n a prime power. An SK_1 Mayer Vietoris sequence derived from surjective cartesian squares (induced from the rotation subgroup) extends this result to all dihedral groups. (Received March 4, 1977.)

77T-A113 Stephen C. King, California State University at Los Angeles, Los Angeles, California 90032. The isoclinism class of a finite group. Preliminary report.

Although the isoclinism class of a finite group must include infinite groups, this class consists entirely of central-by-finite groups. By our theorem below, the isoclinism class of a central-by-finite group must include a finite group. Theorem. For any group G, the following are equivalent: (1) G has a finite isoclinic section; (2) G is isoclinic to some finite group; and (3) $[G:Z(G)] < \infty$. We also have examples to show each of the following: (1) The above three conditions imply neither "G has a finite isoclinic quotient" nor "G has a finite isoclinic subgroup". (2) For any natural number n, there is a finite group with n isoclinic quotient groups (respectively, subgroups), no two of which have the same order and none of which has a proper isoclinic section. (3) In particular, there is a finite group H such that for any natural number m, there is a finite group G isoclinic to H such that $|G| \geq m \cdot |H|$ but G has no proper isoclinic sections. (Received March 3, 1977.) (Author introduced by Marshall Cates).

*77T-A114 Pamela A. Ferguson, University of Miami, Coral Gables, Florida 33124. On a Problem of Frobenius. Preliminary report.

All groups considered are finite. Let p be a prime, then G_p denotes a Sylow p subgroup of a group G. If π_1 is a set of primes, then $|G|_{\pi_1} = \pi_{p \in \pi_1} |G_p|$. A group G is said to be π_1-closed if the set of

π_1-elements form a subgroup of G. G is weakly π_1-closed if for every subgroup U of G, the number of π_1-elements of U is exactly $|U|_{\pi_1}$. Frobenius posed the following problem: Let G be a weakly π_1-closed group. Is G, π_1-closed? In Theorem A, we show the answer is affirmative, if π_1 is a set of odd primes. Theorem A: Assume π_1 is a set of odd primes. If G is a weakly π_1-closed group, then G is π_1-closed. (Received March 7, 1977.)

*77T-A115 A.H. LACHLAN and ROBERT E. WOODROW, Mathematics Department, Simon Fraser University, Burnaby, B.C. V5A 1S6. Countable ultrahomogeneous undirected graphs Preliminary report:

Let $G = \langle V_G , E_G \rangle$ be an undirected graph. The complementary graph $\tilde{G}$ is $\langle V_G , E_G^{\sim} \rangle$ where $(V_1,V_2) \in E_G^{\sim}$ iff $V_1 \neq V_2$ and $(V_1,V_2) \notin E_G$. Let K(n) be the complete undirected graph on n vertices and let E be the graph • ——— •, i.e. $\langle \{a,b,c\} , \{(b,c) , (c,b)\} \rangle$. G is ultrahomogeneous just in case every isomorphism of subgraphs of smaller cardinality can be lifted to an automorphism of G. Let $\mathcal{D} = \{K(n) : n\in\omega\} \cup \{E,\tilde{E}\} \cup \{\tilde{K(n)} : n\in\omega\}$. Theorem: Let G_1,G_2 be two countable (infinite) ultrahomogeneous graphs such that for each $H \in \mathcal{D}$ H can be embedded in G_1 just in case it can be embedded in G_2. Then $G_1 \cong G_2$. Corollary: There are a countable number of countable ultrahomogeneous (undirected) graphs. (Received March 8, 1977.)

*77T-A116 DANIEL BATIGNE, George Washington University, Washington, D.C. 20052
Note on integral {1}-inverses of integral matrices.

Let A be an m×n complex matrix. B is a {1}-inverse of A if it satisfies the equation AXA = A ; the complete set of solutions is denoted by A{1} . A matrix is said to be integral if all its entries are rational integers. A matrix P is unimodular if it is square, non-singular, and $|\det(P)| = 1$. We prove the following theorem: Let A be and integral matrix and write

$$A = P \begin{bmatrix} D & 0 \\ 0 & 0 \end{bmatrix} Q ,$$

where P and Q are unimodular, and D is non-singular and diagonal. Then, A has an integral {1}-inverse if and only if $|\det(D)| = 1$. Furthermore, such an integral {1}-inverse is given by

$$B = Q^{-1} \begin{bmatrix} D^{-1} & 0 \\ 0 & 0 \end{bmatrix} P^{-1}$$

Also, letting C = BAB , we find that the set of all integral {1}-inverses of A is

$$\{ C + Z - CAZAC : Z \text{ is integral } \}.$$

(Received March 9, 1977.) (Author introduced by Dr. Irving J. Katz).

*77T-A117 R. J. Duffin, Carnegie-Mellon University, Pittsburgh, PA, 15213, and I. D. Morley, University of Illinois, Urbana, IL 61801, Inequalities Induced by Network Connections.

It has been found that interesting mathematical relationships arise from a vertorial generalization of Kirchhoff's and Ohm's laws, in which the "resistors" become positive semi-definite (PSD) linear operators. In analogy to the parallel connection of resistors Anderson and Duffin studied the parallel sum P:S of two PSD operators on a finite dimensional space, defined by $R:S = R(R+S)^{\dagger}S$. This paper extends the results of Anderson and Duffin that

$\|R:S\| \leq \|R\| : \|S\|$ and $tr[R:S]$ $trR:trS$ to a wide class of operations derived by a vertorial analog of Kirchhoff's and Ohm's laws. These inequalities remain true in Hilbert space. [Some of the above results were reported at the 1975 Summer Meeting of the AMS.] (Received March 10, 1977.)

*77T-A118 Don Pigozzi, Iowa State University, Ames, Iowa 50011. Finite groupoids without finite bases for their identities.

Let K be the class of groupoids described in title. Let τ,σ be arbitrary terms in one binary operation symbol, and x a variable occurring in τ. $\tau[\sigma]$ is the term obtained from τ by replacing every occurrence of every variable by σ. $\overline{\tau}_x$ is the term obtained from τ by fixing the left-most occurrence of x and then replacing every other occurrence of every variable y by $\tau[\tau[y]]$. Theorem. For every τ and every x there exists an $\mathfrak{A} \in K$ such that $\mathfrak{A} \models x \approx \overline{\tau}_x$. Corollaries. (1) K includes an infinite subset independent in sense of Foster, Math. Z., 62(1955). (2) Let $HSP(L)$ be the variety generated by any $L \subseteq K$. $\langle \{HSP(\{\mathfrak{A}\}): \mathfrak{A} \in K\}, \subseteq \rangle$ includes a sublattice isomorphic to all finite subsets of natural numbers; it also includes infinite non-distributive lattices. (3) If $\mathfrak{A}$ is any finite groupoid such that $\mathfrak{A} \models x \approx \tau$ where τ contains a variable distinct from x, then $\mathfrak{A} \in S(K)$. (4) $HSP(K)$ is the class of all groupoids. (Received March 11, 1977.)

77T-A119 BRIAN J. DAY, Department of Pure Mathematics, University of Sydney, N.S.W. 2006. Note on Pontryagin duality.

A result on density type of a functor is combined with results by D.W. Roeder on category theory applied to Pontryagin duality to produce a more efficient proof of the duality between discrete abelian groups and compact hausdorff abelian groups. (Received March 14, 1977.)

77T-A120 William A. Lampe, University of Hawaii, Honolulu, Hawaii 96822. A note on algebras of fixed similarity type. Preliminary report.

For any similarity type there is an algebraic lattice L such that L is not isomorphic to the congruence lattice of any algebra of that given type. This refutes a long-standing conjecture on the congruence lattices of groupoids. (Received March 14, 1977.)

*77T-A121 D. Suryanarayana, Memphis State University, Memphis, TN 38152; Andhra University, Waltair, India. On some asymptotic formulae of S. Wigert.

Let $\phi(n)$ and $\psi(n)$ respectively denote Euler's ϕ and Dedekind's ψ-functions. Let $\gamma(n)$ denote the maximal square-free divisor or the core of n, which may be called Wigert's γ-function; since Wigert was the first person to discuss in some detail about it in 1931. In this paper we improve the O-estimates of the error terms in the asymptotic formulae established by Wigert for $\sum_{n\leq x} \frac{\gamma(n)\phi(n)}{n}$, $\sum_{n\leq x} \frac{\gamma(n)\psi(n)}{n}$, $\sum_{n\leq x} \frac{\phi(n)}{\psi(n)}$. We also establish asymptotic formulae for $\sum_{n\leq x} \phi^2(n)$, $\sum_{n\leq x} \gamma^2(n)$ and $\sum_{n\leq x} \psi^2(n)$ with better O-estimates for the error terms than those that exist in the literature so far, in case of the first two sums and a new formula in the case of the third sum. The methods used in this paper are elementary, whereas those of Wigert are analytical. (Received March 14, 1977.)

*77T-A122 Antonio M. Lopez, Jr., Loyola University, New Orleans, Louisiana 70118.
The maximal right quotient semigroup of a strong semilattice of semigroups.

Let S be a strong semilattice Y of monoids. If S is right nonsingular then Y is nonsingular. The converse is true when S is a sturdy semilattice Y of right cancellative monoids. Should S have trivial multiplication then each monoid of more than one element has as its index an atom of Y. Finally, if S is a right nonsingular strong semilattice Y of principal right ideal Ore monoids with onto linking homomorphisms then Q(S), the maximal right quotient semigroup of S, is a semilattice Q(Y) of groups. (Received March 17, 1977.)

*77T-A123 Alexander R. Bazelow, Polytechnic Institute of New York, Brooklyn, 11201 and Frank Brickle, Princeton University, Princeton New Jersey, 08540. A Partition Problem Posed By Milton Babbitt (Part I). Preliminary Report

The recognition of contemporary twelve-tone music theory as a significant source of mathematical problems owes much to the work of Milton Babbitt. For background (and key terminology) see Edwin Hewitt and G.D.Halsey, A Group Theoretic Method In Musical Theory (to appear in Selecta Mathematica as Eine Gruppentheoretische Methode In Der Musiktheorie) as well as Abstract # 74T-A213, in Notices Amer. Math. Soc. 21, # 6 (Oct. 1974), p. A-526. Recently Babbitt has posed the following partition problem. Consider the ring $M_4(Z_{12})$ of 4 X 4 matrices over the integers mod-12. Let $(g_{i,j})$ be the 4 X 12 matrix obtained from a sequence of any four transformations of Z_{12} by elements g_k of the group G of music-theoretic transformations.

(I) Find an algorithm to compute the number "n" of elements of $M_4(Z_{12})$ with the property that their rows and columns add up to twelve. Here 0 is excluded as a matrix element, repetitions of integers are allowed, and ordinary addition is assumed.

(II) Find an algorithm to compute the number "m" of tableaux (T) derivable from columns (C) of solutions to (I) with the property that they can be filled by elements of $(g_{i,j})$ in such a way that each tableau "T" contains all of Z_{12}.

In the above paper we discuss a procedure that generates a large class of solutions to (II) and (I). (Received March 21, 1977.)

*77T-A124 WALTER TAYLOR, Mathematics Department, University of Colorado, Boulder, Colorado 80309. Cohomology rings of topological algebras.

Let V be an idempotent variety which is non-trivial in the sense that it contains no subvariety equivalent to the variety of sets. THEOREM. If A is a topological algebra in V whose rational cohomology ring $H^*(A;Q)$ is finite-dimensional over Q, then $H^*(A;Q)$ is an exterior algebra with generators in odd dimensions. (For a related result, see my earlier abstract 76T-A215.) Of course this result is in the spirit of Hopf. (Received March 23, 1977.)

*77T-A125 DAVID E. DOBBS, University of Tennessee, Knoxville, Tennessee 37916. Weak global dimension of pseudo-valuation domains.

Let R be a pseudo-valuation domain, i.e., a quasilocal integral domain whose maximal ideal, M, coincides with the maximal ideal of some valuation overring of R. (Of course, R is a valuation domain iff each ideal of R is R-flat iff w.gl.dim(R) $\leq$ 1.) Theorem. Let R,M be as above, and suppose that R is not a valuation domain. Then: (a) $M = M^2$ iff M is R-flat iff each prime ideal of R is R-flat iff w.gl.dim(R) = 2; (b) $M \neq M^2$ iff the weak dimension of ${}_RM$ is infinite iff w.gl.dim(R) = ∞. Corollary. The only possible weak global dimensions for a coherent pseudo-valuation domain are 0, 1 and ∞. New characterizations of coherent pseudo-valuation domains are also obtained. The proofs consist of adapting certain arguments of the author, Comm. in Algebra 1 (1974), 439-458; the author and I. J. Papick, Proc. Amer. Math. Soc. 56 (1976), 51-54; and the author, Canad. Math. Bull. 18 (1975), 657-660. The adaptation of those arguments, which were originally designed for the less general D + M- construction, proceeds with the aid of recent work of Hedstrom-Houston, "Pseudo-valuation domains," Pac. J. Math., to appear. (Received March 25, 1977.)

A126 B. A. Davey and M. S. Goldberg, La Trobe University, Bundoora, Australia, 3083. Varieties of p-algebras and double p-algebras as reflective subcategories of distributive lattices. Preliminary report.

the category of bounded distributive lattices; B_ω is the category of distributive p-algebras, and $n \leq \omega$) are the subvarieties of B_ω; B_m^n $(m,n \leq \omega)$ is the category of distributive double p-algebras, ch lie in B_m and whose duals lie in B_n. Let X, X_ω, X_n, and X_m^n be their topological dual categories la Priestley).

orem 1: $G : X \to X_\omega$ defined on objects by $G(Y) = \{\langle x, A\rangle \in Y \times \Gamma(Y) \mid A \subseteq (x]\}$ (where $\Gamma(Y)$ is the space of sed subsets of Y with its usual topology and order); and on arrows by $G(\phi)(\langle x, A\rangle) = \langle x\phi, A\phi\rangle$, is a ctor, and is right adjoint to the forgetful functor from X_ω to X. □ The right adjoint $G_n : X \to X_n$ the forgetful functor from X_n to X is obtained by setting $G_n(Y) = \{\langle x, A\rangle \in G(Y) \mid |A| \leq n\}$. orem 2: $F_1 : X_n \to X_n^1$ defined on objects by $F_1(Y) = \{\langle x,y\rangle \in Y^2 \mid x \leq y\}$; and on arrows by $F_1(\phi)(\langle x,y\rangle) = \langle x\phi, y\phi\rangle$ is a functor, and is right adjoint to the forgetful functor from X_n^1 to X_n. □ Thus we have nd left adjoints to the forgetful functors between B_n^1, B_n and D. Corollary 1: $FB_n(S) = O(G_n(2^S))$. □ Corollary 2: $FB_n^1(S) = O(F_1(G_n(2^S)))$. □ This generalizes the description of $FB_1^1(S)$ given in se *Notices* (76T - A156). These functors G, G_n, and F_1 are also used to describe coproducts in B_n, and B_n^1. (Received March 28, 1977.)

T-A127 Dr. V.R. Chandran, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2. A Note on Padmanabhan's Paper.

In a paper titled "Regular identities in lattices" (Trans. A.M.S., Vol. 158, No. 1, 1, page 188), R. Padmanabhan mentions that the independence of the axioms of quasi-lattice is settled. In this paper we establish the independence of the axioms of quasi-lattice. ceived January 27, 1977.) (Author introduced by Professor R. Padmanabhan).

T-A128 EDUARD W. WETTE (DR.), 14 Blumenstrasse, D 5608 Radevormwald, Fed. Rep. of Germany. Untruth and explicit end of elementary computations.

refer to my 1973 Varna report (International Logic Review 9 (1974), 51 – 62) on a system-ternal ⌜consistency⌝-deduction within pure number theory, and to my calculus $\mathfrak{R}_0$ (: The efutation of number theory I, insert to ILR 10 (1974)). Such a deduction can be performed y an induction-free induction step for a primitive recursive predicate on one variable — en without parameter-⌜derivations⌝ (l.c., §§ 2.3, 3.2). The arithmetizing number $\ulcorner \mathcal{D}_\Lambda \urcorner$ of e new ⌜consistency⌝-inconsistency deduction is $\leq 16^{100000} \approx 10^{120412}$; moreover, $\log_{16} \ulcorner \mathcal{D}_\Lambda \urcorner \gg 10000$.

conversion of a masked inconsistency into a direct one within logic-free recursive putations (cf. The Journal of Symbolic Logic 41 (1976), 279 – 280) yields a new bound of e first inconsistent "natural" number M: $M < 10^{10^{240830}}$. Boolean algebra can be refuted n without simple computations with indices, since $100\,M^3 < 10^{10^{240830}}$. Power-iteration forbidden — far beyond the ban of L. Kronecker. (Received March 31, 1977.)

T-A129 MING-CHANG KANG, The University of Chicago, Chicago, Illinois 60637. Projective modules and Picard groups.

Theorem 1. Let R be a 1-dim commutative noetherian ring so that the integral closure of R in its total quotient ring is a finitely generated R-module, and $A = R[X_1, \ldots, X_n]$ the polynomial ring of n variables over R. Then every projective module over A is isomorphic to the direct sum of a free module and a projective module of rank one. Theorem 2. Let A be any commutative integral domain, G a group of automorphisms acting on A, $A^G = \{a \in A \mid a$ is fixed by every element in $G\}$. Suppose there is a prime ideal P in A so that $U(A) = U(A^G)(1+P)^*$ where $U(A)$ and $U(A^G)$ are the groups of units and $(1+P)^*$ is the set of units of A in 1+P. Assume for any f in G, $f(P) = P$ and f induces the identity map on A/P. Then there is an injection from the kernel of $\mathrm{Pic}(A^G) \to \mathrm{Pic}(A)$ into $H^1(G, (1+P)^*)$. Theorem 3. Let $A = K[X_1, \ldots, X_n]$ where K is either the

field of real numbers or the field of complex numbers. Suppose G is any group of K-automorphisms acting on A^G so that G can be generated by elements of finite order. Then $\mathrm{Pic}(A^G)$ is trivial. AMS (MOS) subject classifications (1970). 13. Commutative rings and algebras. (Received March 22, 1977.)

77T-A130 Yechezkel Zalcstein, University of Southern California, Los Angeles, California 90007. Solvability of the finiteness problem for linear semigroups.

This is a revision of abstract 77T-A45, February 1977. Theorem. There is an algorithm for deciding whether a finitely generated semigroup of finite-dimensional matrices over a field is finite. The proof is based on a bound on the size of a finite semigroup generated by a fixed number of nxn matrices, using a technique of McNaughton and Zalcstein (J. Alg. 34(1975), 292-299). A simpler, but considerably less explicit, proof is obtained by the proof of Theorem 3 in Kopytov (Algebra and Logic 7(1968), 388-393) in conjunction with a theorem of McNaughton and Zalcstein in the paper quoted above, that a finitely generated periodic semigroup of finite dimensional matrices over a field is finite. This result has been proved independently by Gérard Jacob using a different method. (Received March 31, 1977.)

*77T-A131 WILLARD E. BLEICK and PETER C. C. WANG, Naval Postgraduate School, Monterey, California 93940. Asymptotic representation of Stirling numbers of the second kind.

The distribution of the Stirling numbers S(n,k) of the second kind with respect to k has been shown by Harper [Ann. Math. Statist. 38 (1967), 410-414] to be asymptotically normal near the mode. A new single-term asymptotic representation of S(n,k), more effective for large k, is given here. It is based on Hermite's formula for a divided difference and the use of sectional areas normal to the body diagonal of a unit hypercube in k-space. A proof is given that the distribution of these areas is asymptotically normal. A numerical comparison is made with the Harper representation for n=200. (Received January 28, 1977.)

*77T-A132 COLIN D. WALTER, University College, Belfield, Dublin 4, Ireland. A class number relation in Frobenius extensions of number fields.

Let G be a Frobenius group with kernel N of order n and complement F of order f. Suppose G is maximal or metacyclic, i.e. $n = f+1$, or N and F are cyclic, and the normal extension K/k of number fields has G as its Galois group. For the subfield K^H fixed by a subgroup H let h(H) be the class number, and r(H) the rank of the unit group U^H. Then $h(1)h(G)^f / h(N)h(G)^f = QI^{1-f}n^{-A}$ where $Q = [U : U^N \prod' U^{F'}]$; I is the order of $\mathrm{Tor}(U^F/U^G)$; $A = \frac{1}{2}(r(N) - r(G) + (f-1)(r(F) - 2r(G) + 1))$ in the maximal case and $A = f - 1 + \frac{1}{2}f(r(N) - r(G))$ in the metacyclic case. Here $\prod'$ denotes a product over all complements F' in the maximal case, and over the complements $F' = \eta^i F \eta^{-i}$ $(0 \leq i < f)$, where η generates N, in the metacyclic case. (Received April 1, 1977.) (Author introduced by Thomas J. Laffey).

77T-A133 Ann Bateson, University of Colorado, Boulder, Colorado 80309. Groupoids in a Variety. Preliminary report.

A groupoid is a small category in which every morphism is an isomorphism. We will denote a groupoid by $(G, D, \circ, {}^{-1})$ where G is the category, D is the domain of the binary operation $\circ$, and ${}^{-1}: G \to G$ the full operation of forming inverses. A groupoid in a variety (equational

class) V is a structure $(G, D, \circ, {}^{-1}, f_t)$ where $(G, D, \circ, {}^{-1})$ is a groupoid, $(G, f_t)_{t \in T} \in V$ and satisfying: (i) D is a subalgebra of $(G, f_t)^2_{f \in T}$, (ii) $\circ: D \to G$ is an f_t-homomorphism, and (iii) ${}^{-1}: G \to G$ is an f_t-homomorphism. $(A, \mathfrak{T}, f_t)_{t \in T}$ is a topological algebra in a variety V if $(A, f_t)_{t \in T} \in V$, $(A, \mathfrak{T})$ is a Hausdorff topological space and each $f_t: A^{n_t} \to A$ is continuous. We show that the automorphism group of every object of every groupoid in V is isomorphic to a subgroup of the fundamental group of some arc-component of some topological algebra in V. (Received April 1, 1977.)

*77T-A134 G. J. Rieger, Université de Bordeaux I, Dép. de Math., F-33405 Talence. On a certain class of non-linear congruences.

Let $s \in \underline{N}$ (positive integers), $a_j \in \underline{Z}$ (integers), $b_j \in \underline{Z}$, $F_j(x) \in \underline{Z}[x]$, $F_j(x) \geq 0$ for $0 \leq x \in \underline{Z}$ $(1 \leq j \leq s)$, $0 \neq a \in \underline{Z}$, $m \in \underline{N}$, $(m, a) = 1$, $(m, b_1 \ldots b_s) = 1$, $t \in \underline{N}$, $c_k \in \underline{Z}$, $d_k \in \underline{Z}$, $g_k \in \underline{Z}$, $H_k(x) \in \underline{Z}[x]$, $H_k(x) \geq 0$ for $0 \leq x \in \underline{Z}$ $(1 \leq k \leq t)$, $(m, d_1 \ldots d_t) = 1$, $(\varphi(m), g_1 \ldots g_t) = 1$ with the Euler function φ. With $\alpha \setminus \beta := \alpha^{\beta}$ let $B(x) := \sum_{1 \leq j \leq s} a_j \cdot (b_j \setminus F_j(x))$, $C(x) := \sum_{1 \leq k \leq t} c_k \cdot (d_k \setminus (g_k \setminus H_k(x)))$. Obviously $a x + B(x)$, $a x + C(x)$, $a x + B(x) + C(x)$ has period $M_1 := [m, \varphi(m)]$, $M_2 := [m, \varphi(\varphi(m))]$, $M_3 := [m, \varphi(m), \varphi(\varphi(m))]$ respectively. Theorem 1. $ax + B(x)$ with $0 \leq x < M_1$, $a x + C(x)$ with $0 \leq x < M_2$, $a x + B(x) + C(x)$ with $0 \leq x < M_3$ produces every residue mod m equally often. Let $b \in \underline{Z}$, $c \in \underline{Z}$. A similar theorem holds for $x \cdot (b + B(x) + C(x))$. These theorems make it possible to apply the sieve method to sequences of the forms $a x + c + B(x) + C(x)$, $x \cdot (b + B(x) + C(x)) + c$. This continues earlier work (see Abstract 76T-A247, these Notices 23 (1976), A-577; misprint: read G(x+k) instead of G(x)+k). (Received April 4, 1977).

*77T-A135 WILLARD E. BAXTER, University of Delaware, Newark, Del. 19711 and WALLACE S. MARTINDALE, 3rd, University of Massachusetts, Amherst, Mass. 01003. Jordan automorphisms of semiprime rings. Preliminary report.

For an arbitrary nonassociative semiprime ring R the notion of extended centroid C and central closure RC are defined. If R is semiprime associative C is shown to coincide with the extended centroid of R regarded as a Jordan ring. These results are then applied to the study of a Jordan automorphism ϕ of an associative semiprime ring R. Theorem. ϕ can be extended to a Jordan automorphism ψ of RC and $\psi = \sigma + \tau$, where σ is a homomorphism of RC into RC and τ is an antihomomorphism of RC into RC. An example is given of a semiprime ring R with Jordan automorphism ϕ which cannot be written in the form $\sigma + \tau$, with $\sigma(R) \subseteq R$ and $\tau(R) \subseteq R$. (Received April 4, 1977.)

77T-A136 Kit-sum Lee, University of British Columbia, Vancouver, Canada V6T 1W5. The global dimension of group rings of nilpotent groups. Preliminary report.

Let R be an associative ring with unity. Let G be a nilpotent group with cardinality $\leq \aleph_n$, $n = -1, 0, 1, \ldots$ The Hirsh number of G is denoted by h(G). Theorems: (1) If G is R-torsion-free, then (a) $h(G) \leq \mathrm{cd}_R G \leq h(G) + n + 1$. (b) $\mathrm{cd}_R G \leq \mathrm{lgld}\, RG \leq \mathrm{lgld}\, R + h(G) + n + 1$. (2) The following statements are equivalent: (a) lgld RG is finite. (b) lgld R is finite, h(G) is finite, G is R-torsion-free. (c) lgld R is finite, $\mathrm{cd}_R G$ is finite. (Received April 4, 1977.)

77T-A137 RONSON J. WARNE, University of Alabama in Birmingham, Birmingham, Alabama 35294. Cliffordian semigroups.

A Cliffordian semigroup is a semigroup which is a union of its subgroups. For definitions, see, for example, [R. J. Warne, Bands of maximal left groups, Revue Roumaine de Mathématiques Purés et Appliquées, 17(1972), 1705-1707]. Let $(I, \circ)$ $((J, *))$ be a lower (upper) partial chain Y of left groups (right groups) $(I_\alpha : \alpha \in Y)$ $(J_\alpha : \alpha \in Y)$ and let $I_\alpha \cap J_\alpha = H_\alpha$, a maximal subgroup of I_α and J_α. Elements of I (J) will be denoted by cap (lc) roman letters. If $A \in I_\delta$, then $a \in J_\delta$. If $B \in I_\eta$, $A \sim a$ and $B \sim b$ means $\delta = \eta$ and there exists $u \in H_\delta$ s.t. $A = B \circ u$ and $a = u^{-1} * b$. If $A \in I_\delta$ and $b \in J_\beta$, there exists unique $Ab = (Ab)^2 \in I_{\alpha\beta}$ and $bA \in J_{\alpha\beta}$. If $\alpha \leq \beta$, $A \in I_\alpha$, $B \in I_\beta$, $u \in H_\beta$, $F \in I_\gamma$, and $w \in H_\gamma$, $(a * b)C = aC' * bC$ where $C' = Cb$, $C(a * b) = (Cb)a$, $(B \circ A)d \sim Bd * Ad'$ where $d' = dB$ and $d(B \circ A) \sim (dB)A$, $uA \in H_\alpha$, $Au = u \circ A \circ (uA)^{-1}$, $(F \circ w)e = Fe$, $e(F \circ w) = eF * w$. Let $X = \cup (I_\alpha \times J_\alpha : \alpha \in Y)$. Define $(A, a) \sim (B, b)$ if $A \sim B$ and $a \sim b$ and let $[A, a]$ denote the $\sim$ class containing (A, a). Let $(Y, I, J, a, A) = U$ denote $X/\sim$ under the multiplication $[A, a]\,[B, b] = [A \circ (Ba), (aB) * b]$. Theorem. S is a Cliffordian semigroup if and only if S is isomorphic to some U. This theorem is a modification of [R. J. Warne, On the structure of semigroups which are unions of groups, Trans. Amer. Math. Soc. 186(1973), 385-401, Theorem 1.12]. (Received November 15, 1976.)

77T-A138 MILTON WANNIER, 2000 University Street, Eugene, Oregon 97403. The Wannier spectrum.

Let R be a commutative ring. Let $P \cup N$ be a disjoint covering with $PP \subset P$, $P + P = P$, $0 \in P$, $NN = -N$, $-1 \in N$. $\{P\}$ is the Wannier spectrum of R. (P could be a prime ideal or an ordering.) (Received April 5, 1977.)

*77T-A139 William C. Brown, Michigan State University, East Lansing, Michigan 48824. Differentially Simple Rings.

Let R denote a commutative, associative ring with identity. In this paper, we prove the following theorem: Let R be a noetherian ring; let $\bar{R}$ be the integral closure of R (in its total quotient ring); let H(R) denote the group of all higher derivations of infinite rank on R. Suppose R is H(R)-simple. Then

(1) R is an integral domain containing a field.

(2) The conductor of R in $\bar{R}$ is (0) or R.

(3) R is geometrically unibranched at every prime ideal $p \subset R$.

We also give examples which show that R need not be normal at p. (Received April 6, 1977.) (Introduced by Wellington Ow).

77T-A140 M. Zubair Khan, Guru Nanak Dev University, Amritsar-143005. Modules behaving like torsion abelian groups.

Singh introduced two conditions on a module M(Lecture note volumes 25, Marcel Dekker) and showed that some of the decomposition theorems known for torsion abelian groups hold for said module. Let M be a module as cited above, then for any submodule N of M, denote by $H^n(N)$ the submodule generated by all those uniform elements x in M such that $e(x+N) \leq n$. A submodule N of M is said to be h-neat if $N \cap H_1(M) = H_1(N)$. M is said to be of horizontal height (denoted by h(M)) n if $soc(M) \subset H_{n-1}(M)$ but $soc(M) \not\subset H_n(M)$. In this paper above two concepts are specially studied. Following are among the main results proved: 1. If $h(M) = n$, then $M = N_1 \oplus N_2$ where N_1 is an elementary module of exponent n and either $N_2 = (0)$ or $h(N_2) > n$. 2. $H^n(H_n(N)) = N + H^n_M(0)$ 3. Following are equivalent (a) N is h-pure in M, (b) N is a direct summand of $H^n(N)$. (c) if U/N is finitely generated, then N is a direct summand of U.

$N \subset U \subset M$, $e(d)$. For every uniform element $x \in M/N$, there exists a uniform element $x' \in M$ such that $x' = x$ and $e(x) = e(x')$. 4. If N is h-neat in M with same socle then $N = M$. 5. If U is complement of N in M then U is h-neat, conversely if U is h-neat in M and T a subsocle of M with $T \cap N = 0$ and $T \oplus \mathrm{soc}(N) = \mathrm{soc}(M)$ with $T = \mathrm{soc}(U)$, then U is a complement of N. 6. If N and U are h-pure submodules of M with same socle and if $M = U \oplus T$ then $M = N \oplus T$. (Received April 8, 1977.) (Author introduced by Professor Surjeet Singh).

*77T-A141 JOE W. FISHER, University of Cincinnati, Cincinnati, Ohio 45221
Finiteness Conditions for Rings with Finite Group Actions, Preliminary report.

Let R be an associative ring with a subring S. Theorem 1. Assume that there exists a finite subset $\{u_1,\ldots u_m\}$ of R such that $R = \sum\{Su_i : 1 \le i \le m\}$, $Su_i = u_i S$ for $1 \le i \le m$, and $\{u_1,\ldots,u_m\}$ forms a group under multiplication. Then a left R-module is Artinian if and only if it is Artinian as a left S-module. Our proof dualizes to give the corresponding "Noetherian" result which was proved by Formanek-Jategaonkar, Proc. AMS. 46 (1974), 181-186. Other results and applications include the following. Let G be a finite group of automorphisms acting on R (possibly with $|G|$-torsion) and let R*G denote the skew group ring. Theorem 2. A left R*G-module is Artinian (Noetherian) if and only if it is Artinian (Noetherian) as a left R-module. Theorem 3. A ring R which does not necessarily have a unity satisfies the DCC (ACC) on left (two-sided) ideals if and only if R satisfies the DCC (ACC) on G-invariant left (two-sided) ideals. Theorem 4. R satisfies the ACC on semiprime ideals if and only if R satisfies the ACC on G-invariant semiprime ideals. (Received April 11, 1977.)

*77T-A142 BARRY J. ARNOW, Kean College of New Jersey, Union, New Jersey 07083. Dedekind completions of lattices by ends.

It has been established that a regulated semilattice can be represented as a basis for a locally compact Hausdorff space defined on the collection of ends (generalized ultrafilters) from the semilattice. In this work, a lattice structure which is suitable for generating a semilattice of this type is determined. This lattice structure is then passed onto the associated topological space of ends giving Dedekind completions of the original lattice and the generated semilattice. The interaction of the topological and lattice structure of the collection of ends is also considered. (Received March 25, 1977.)

*77T-A143 THOMAS J. LAFFEY, University College, Dublin, Ireland. The Hughes problem for exponent nine. Preliminary Report.

Let G be a finite group, n a natural number and let $H_n(G) = \langle g \in G \mid g^n \neq 1 \rangle$. We have proved the following Theorem. If G is not a 3-group, then $|G/H_9(G)| = 1,3,9$ or 27. All four possibilities can arise. This result is similar to a result of Hughes and Thompson (Pacific J. Math. 9 (1959), 1097-1101) for the case n prime and to a result of the author (these Notices, Abstract # 77 TA-2) for the case $n = 4$. In proving the result for $n = 9$, the following results of independent interest are obtained : (1) Let X be a finite 3-subgroup of $GL(d,F)$ where $d \ge 1$ and F is a field. Let $x,y \in X$ be such that (i) $x^3 = y^3 = 1$ and (ii) neither x nor y has 1 as an eigenvalue. Then $xy = yx$. (2) Let P be a finite 3-group such that $|Z(P)| = 3$ and that $x^3 \in Z(P) - \{1\}$ for all $x \in P - \phi(P)$. Then $|P/\phi(P)| \le 27$. (Received April 12, 1977.)

77T-A144 WILLIAMS K. FORREST, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2.
Upper and Lower Integration on Algebraic Manifolds in Characteristic p. Preliminary Report.

A theory of upper and lower integration on varieties embedded in the space $S_A^n(F)$ for F an arbitrary countable algebraically closed field is developed. We outline the theory as follows. Given a variety V we define the content $C(v)$ of V and the r-content $C_r(v)$ of V in terms of a notion of partition of mesh r. Theorem. If V is a variety of $S_A^n(F)$ then for each real number

$r > 0$ we have $C_r(v) = C(v)$. Corollary. Given $\varepsilon > 0$ and $r > 0$ there is a partition of mesh r such that for the upper and lower sums U and L of a regular function $\varphi : V \to S_A^r(F)$ we obtain the expression $U - L < \varepsilon$. Defining the upper and lower integrals of φ we show the existence of the lower integral $L\int_r \varphi$ thus obtaining a lower integral $L\int_\Gamma \varphi$ on V via the representation of subvarieties as points of V. (Received April 12, 1977.)

Analysis (26, 28, 30–35, 39–47, 49)

*77T-B35 Albert A. Mullin, 6840 Todd Street, Patton Park, Ft. Hood, Texas 76544. On imbrication theory.

Imbrication theory deals with mathematical properties of the ways that sets can be covered or packed when they meet or join. Lemma 1. Let A be a non-empty subset and S a compact convex subset of E^n. Let C be a non-empty commuting family of non-expansive mappings of S into S. Let m be a positive integer. Then each m points of the convex hull of A can be covered by a translate of the set $F \subseteq S$ of all common fixed-points over C iff each m points of A can be covered by a translate of F. Lemma 2. Let A be a compact convex subset of E^n. Let C be a non-empty commuting family of non-expansive mappings from A into A. Let $B \subseteq A$ be the set of all common fixed-points over C. Let $\{S_f : f \in F\}$ be a non-empty family of compact convex subsets of E^n. Let $\{C_f : f \in F\}$ be a class of non-empty commuting families of non-expansive mappings from S_f into S_f. Let $\{G_f : f \in F\}$ be the class of all sets of common fixed-points over C_f, $f \in F$. If each (n + 1) or fewer members of $\{G_f\}$ have a translate of B in common then all members of $\{G_f\}$ have a translate of B in common. Applications to combinatorial geometry are discussed informally. (Received August 24, 1976.)

*77T-B36 Johannes C.C. Nitsche, University of Minnesota, Minneapolis, Minnesota 55455 Contours Bounding at Most Finitely Many Solutions of Plateau's Problem.

One of the most vexing questions in connection with the classical Plateau problem which remains unanswered today, although it has been a challenge since 1939, is concerned with the phenomena of uniqueness and non-uniqueness and with the isolated character of minimal surfaces. It is unknown whether every solution of Plateau's problem, stable or unstable, is isolated (in a suitable topology), so that only a finite number of disc-type minimal surfaces could be spanned in a given contour. The present investigation addresses itself to these matters. We denote by $\mathfrak{A}$ the class of regular analytic Jordan curves Γ for which it is known a priori that no solution of Plateau's problem can have (interior or boundary) branch points. [The assumption of analyticity is not essential.] Notable examples for curves of class $\mathfrak{A}$ are described by the Lemma: "If there is a straight line such that no plane through this line intersects Γ in more than two distinct points, then Γ is of class $\mathfrak{A}$." Theorem: "A Jordan curve of class $\mathfrak{A}$ whose total curvature does not exceed the value 6π bounds at most finitely many isolated solutions of Plateau's problem." (Received February 17, 1977.)

*77T-B37 Howard A. Levine and John T. Montgomery, University of Rhode Island, Kingston, Rhode Island 02881. On Quenching of Solutions of a Nonlinear Parabolic Equation with a Finite Singularity. Preliminary report.

Considered is a class of non-linear parabolic equations which includes $u_t = u_{xx} + 1/(1-u)$, $0 \le x \le \ell$ and $0 \le t \le T$, $u(x,0) = u(0,t) = u(\ell,t) = 0$. Kawarada (P.R.I.M.S. Math. Sci., Kyoto U. 3(1975)(729-736).) showed for this equation that when $\ell > 2\sqrt{2}$, (a) the solution u reaches 1 in finite time and that (b) quenching occurs, i.e., $u_t(\ell/2,t) \to +\infty$ in finite time. This result is considerably sharpened in

that a number ℓ_0 is found such that for $\ell \leq \ell_0$, the solution exists for all time, is bounded away from 1 on any half-strip and in fact tends to a solution of the stationary equation. Furthermore, if $\ell > \ell_0$ the solution reaches 1 in some finite time, and in fact, quenches. ℓ_0 is $2\sqrt{2}\, D_0 \approx 1.5303$, where D_0 is the maximum value of Dawson's integral. The arguments rely heavily on maximum principles. (Received February 16, 1977.)

*77T-B88 FRANK GILFEATHER, University of Nebraska-Lincoln, Lincoln, NE 68588 Norm conditions on resolvents of similarities of Hilbert space operators and applications.

For bounded operators on a separable Hilbert space we obtain the following results. Let K and D be compact subsets of the plane so that $K \subset \text{int}(D)$. For any constant $M < \text{dist}(K, \setminus \text{int}(D))^{-1}$ and for any operator T with $\sigma(T) \subset K$, there is a similarity S of T so that: (1) $||f(S)|| \leq ||f(T)||$ for all functions f analytic on a neighborhood of $\sigma(T)$, (2) $||(S-\lambda I)^{-1}|| \leq M$ for $\lambda \in \setminus D$ and (3) $||S|| \leq \sup\{|\lambda| : \lambda \in D\}$. This result is used to show that if T is a direct integral of operators, if δ is a set of full measure and if $\overline{\cup\{\sigma(T(\lambda)) : \lambda \in \delta\}} = K$, then T is quasisimilar to an operator S with $\sigma(S) \subset K$. If T is a direct sum of operators $\{T_n\}$, then K reduces to $\overline{\cup \sigma(T_n)}$. This latter case is a result obtained independently by D. Herrero (Notices A.M.S. to appear). (Received February 24, 1977.)

77T-B89 Jeffery Cooper, University of Maryland, College Park, MD, and University of Victoria, Victoria, B.C.; and Walter Strauss, Brown University, Providence, R.I., Scattering Theory for a Moving Obstacle. Preliminary Report.

We consider the scattering problem for the wave equation in the exterior of a moving obstacle with zero boundary condition. The obstacle is assumed to remain in a fixed sphere for all time, and no part of the boundary moves faster than the wave speed. In addition, we impose an interior illumination condition which is the space time analog of the star shape condition. It is not required that the motion of the body be asymptotically stationary. With these assumptions, we prove the existence of a scattering operator and determine the form of the scattering matrix and scattering kernel. The scattering matrix is of the form I-K where K is an integral operator in frequency and direction variables. The kernel of K is a tempered distribution on R^2 with values in $L^2(S^2_{n-1})$, determined by the asymptotic values as $t \to \infty$ of the outgoing reflection of a plane harmonic wave incident on the moving obstacle. These results are valid for n space dimensions, n odd, $n \geq 3$. (Received February 22, 1977.)

77T-B90 ALLEN R. FREEDMAN, MARC RAPHAEL and JOHN J. SEMBER, Simon Fraser University, Burnaby, British Columbia, Canada V5A 1S6. Some Cesàro Type Summability Spaces. Preliminary report.

Let σ_1, $|\sigma_1|$, AC, $|AC|$ denote the spaces of C-1 summable, strongly C-1 summable, almost convergent and "strongly almost convergent" sequences respectively. The space $|AC| = \{(x_i) \mid \exists\, L$ such that $n^{-1} \sum_{i=m+1}^{m+n} |x_i - L| \to 0$ $(n \to \infty$, uniformly in $m)\}$. Let $\theta = (k_r)$ denote a lacunary sequence: i.e. θ is an increasing sequence of integers such that $k_r - k_{r-1} \to \infty$ $(r \to \infty)$. Let B_θ be the (regular) matrix whose r^{th} row is $b_{ri} = (k_r - k_{r-1})^{-1}$ if $k_{r-1} < i \leq k_r$ and $b_{ri} = 0$ otherwise. Let C_θ be the convergence

field of B_θ and N_θ be the corresponding strong convergence field: $N_\theta = \{(x_i) \mid \exists\, L$ such that $(k_r - k_{r-1})^{-1} \sum_{i=k_{r-1}+1}^{k_r} |x_i - L| \to 0\ (r \to \infty)\}$. Let $q_r = k_r/k_{r-1}$. RESULTS:

1) $\sigma_1 \subset C_\theta$ and $|\sigma_1| \subset N_\theta$ iff $\liminf q_r > 1$. 2) $N_\theta \subset |\sigma_1|$ iff $\limsup q_r < \infty$.

3) $C_\theta \subset \sigma_1$ iff $\lim q_r = 1$. 4) For each θ, $\sigma_1 \neq C_\theta$, $AC \overset{\subset}{\neq} C_\theta$ and $|AC| \overset{\subset}{\neq} N_\theta$.

5) $AC = \cap \{C_\theta \mid \lim q_r = 1\}$. 6) $|AC| = \cap \{N_\theta \mid \lim q_r = 1\}$. (Received February 22, 1977.)

*77T-B91 Harold Widom, University of California, Santa Cruz, CA 95060. Asymptotic expansions of determinants for families of trace class operators.

A procedure is developed for finding such expansions. The context is general enough to include a Szegö expansion on Riemannian manifolds with boundary. A particular case: Let k be a well-behaved function on R^d, Ω a bounded subset of R^d with smooth boundary B. Then the determinant of the operator on $L_2(\Omega)$

$$f(x) \to f(x) + \alpha^d \int_\Omega k(\alpha(x-y))\, f(y)dy$$

has an asymptotic expansion $a_0\alpha^d + a_1\alpha^{d-1} + \cdots$. If $s = [\log(1+\hat{k})]^\vee$ then

$$a_0 = s(0)\ \mathrm{vol}(\Omega), \quad a_1 = \frac{1}{4}\int_B\int |z\cdot n|\ s(z)\ s(-z)dz\ dA(x)$$

$$a_2 = \frac{1}{2}\int_B\int |z\cdot n|\ L(z_t \otimes [z\cdot n\ \mathrm{grad}_t s(z) - \frac{1}{2}\frac{\partial s(z)}{\partial n} z_t])\ s(-z)dz\ dA(x)$$

where $dA(x)$ is the surface element on B, n the unit inner normal to B at x, the subscript t denotes component tangent to B at x, and L is the second fundamental form of B relative to the inner normal. (Received February 21, 1977.)

*77T-B92 Pedro Alson, I.V.I.C. and U.C.V., Caracas, Venezuela. Convexoid compact perturbations of operators. Preliminary report.

THEOREM 1. Let H be a complex Hilbert space. Let T be an operator on H. Then there exists a compact operator K such that T + K is a convexoid operator. Furthermore, K depends continously on T.

THEOREM 2. Let H be a separable complex Hilbert space. For an operator T on H, let $W(T)$ and $W_e(T)$ be the numerical range of T and the essential numerical range of T, respectively. If U is an open set in $\mathbb{C}$ and $W_e(T) \subset U$ then there exists a compact operator K such that T + K is a convexoid operator and $\overline{W(T+K)} \subset U$. (Received February 28, 1977.) (Author introduced by Professor José Barría).

77T-B93 Steven B. Bank, University of Illinois, Urbana, Illinois 61801. Some results on the Gamma function and other hypertranscendental functions.

O. Hölder proved that $\Gamma(z)$ cannot satisfy any algebraic differential equation whose coefficients are rational functions. In [Funkcialaj Ekvacioj (Serio Inter.) 19 (1976), 53-63], R. Kaufman and the author extended Hölder's result from the field of rational functions to the field K of meromorphic functions f for which $T(r,f) = o(r)$ as r tends to infinity. In particular, if $T(r,g) = o(r)$, then $\Gamma + g$ cannot satisfy any algebraic differential equation over K. However, since $T(r,\Gamma)$ behaves like $r(\log r)/\pi$ at infinity, it is natural to ask whether $\Gamma + g$ can satisfy any algebraic differential equation over K if $T(r,g) = o(r(\log r))$ as r tends to infinity. We show that the answer is in the negative even for those g for which $T(r,g)/r(\log r)$ tends to 0 on a sequence which tends to infinity. (Received March 30, 1977.)

77T-B94 DAVID A. HOROWITZ, Golden West College, Huntington Beach, California 92647. A further refinement for coefficient estimates of univalent functions. Preliminary report.

Let $S = \{f(z) = z + a_2z^2 + a_3z^3 + \cdots : f$ is analytic and one-to-one in the unit disc$\}$. The Bieberbach Conjecture asserts that if $f(z) \in S$, then $|a_n| \leq n$ for $n = 2,3,4,\ldots$. FitzGerald (Arch. Rat. Mech. Anal. 46(1972), 356-368) showed that $|a_n| < (7/6)^{1/2}n \simeq (1.0802)n$ and suggested a method for further improvements of this estimate. Subsequently this author (Proc. Amer. Math. Soc. 54(1976), 176-178) refined this bound to $|a_n| \leq (209/140)^{1/6}n \simeq (1.0691)n$. This estimate has now been further improved to:

$$|a_n| \leq \left(\frac{1,659,164,137}{681,080,400}\right)^{1/14} n \simeq (1.0657)n$$

It is also noted that the method suggested by FitzGerald cannot possibly yield a result better than $|a_n| \leq (1.0572)n$. (Received March 7, 1977.)

77T-B95 G. D. Allen, Texas A&M University, College Station, Texas 77843. Duals of Lorentz spaces. Preliminary report.

Let $\pi_1 \geq \pi_2 \geq \cdots \geq 0$, with $\lim \pi_j = 0$. The sequence $\{\pi_j\}$ is called regular if $\sum_{j=1}^{n} \pi_j = O(n\pi_n)$. (For example, the sequences $\{j^{-\alpha}\}$, $0 < \alpha < 1$, are regular.) Denote by $d^*(\pi,p)$ the dual of the Lorentz sequence space generated by $\{\pi_j\}$ and p. Theorem. Let $\{\pi_j\}$ be a regular sequence. Then for $p \geq 1$, $d^*(\pi,p) = \ell_q \cdot d^*(\pi^{1/p},1) = \{\{\eta_j\xi_j\} | \{\eta_j\} \in \ell_q, \{\xi_j\} \in d^*(\pi^{1/p},1)\}$. If $p = 1$, $d^*(\pi,1) = \{\{\eta_j\} |$ the decreasing rearrangement of $\{|\eta_j|\}$, $\{\eta_j^+\}$, satisfies $\eta_j^+ = O(\pi_j)\}$. Here $p^{-1} + q^{-1} = 1$, and $\pi^{1/p} = \{\pi_j^{1/p}\}$. (Received March 7, 1977.)

77T-B96 G. P. KAPOOR and K. GOPAL, V. V. Post Graduate College, Shamli 247776, India. On the mean values of functions analytic in the unit disc. Preliminary report.

Let $f(z)$ be analytic and unbounded in the unit disc $D = \{z : |z| < 1\}$. Consider the mean values $I_\delta(r) = (1/2\pi)\int_0^{2\pi} |f(re^{i\theta})|^\delta d\theta$ and $m_{\delta,k}(r) = (1/(\pi(1-r)^{-k-1})) \int_0^r \int_0^{2\pi} |f(xe^{i\theta})|^\delta (1-x)^{-k} dx\, d\theta$ of $f(z)$ for $0 < \delta, k < 1$ and $0 < r < 1$. In the present paper the rates of growth of $I_\delta(r)$ and $m_{\delta,k}(r)$ are determined in terms of the order ρ and the lower order λ of $f(z)$ (for the definitions of order and lower order see these Notices, 20(1973), Abstract 73T, B-226, A-490). Further define $L_{\delta,k}(l_{\delta,k}) = \limsup (\inf)_{r\to 1} \{I_\delta(r)/m_{\delta,k}(r)\}^{1/(-\log(1-r))}$. Theorem. Let $f(z)$ be analytic and unbounded in D having order ρ and lower order λ. Then, $L_{\delta,k} = \exp(\rho)$ and $l_{\delta,k} = \exp(\lambda)$. Some relations involving the geometric mean values, ρ and λ of $f(z)$ are also found. (Received March 7, 1977.) (Author introduced by Professor J. N. Kapur.)

*77T-B97 William S. Hall, Department of Mathematics and Statistics, University of Pittsburgh, Pittsburgh, Pa 15260. A Rayleigh Wave Equation.

The asymptotic behavior of an equation for a vibrating string with a Rayleigh perturbation can be analyzed for long but finite times using a recently developed convergent two-time method. In addition it is possible to predict the existence of infinitely many periodic solutions, and their form can be approximately calculated. Finally, a subset of the periodic steady states can be shown to be exponentially asymptotically stable, and for these, exact formulas can be presented. (Received March 11, 1977.)

*77T-B98 GARY WEISS, University of Cincinnati, Cincinnati, Ohio 45221. Fuglede's Commutativity Theorem Modulo the Hilbert-Schmidt Class and Generating Functions for Matrix Operators II.

Let H be a separable, complex Hilbert space and let L(H) denote the set of all bounded linear operators on H. Let C_2 denote the Hilbert-Schmidt class. In this paper, we extend the results of paper I and prove that if N is a normal operator, and $X \in L(H)$, and $NX - XN \in C_2$, then $N^*X - XN^* \in C_2$. In any case $||NX - XN||_{C_2} = ||N^*X - XN^*||_{C_2}$. This is the Fuglede commutativity theorem modulo C_2.

Furthermore we make a connection between generating functions and commutants of analytic Toeplitz operators. Let $\phi(z) \in H^\infty(T)$, let $(T_\phi)'$ denote the commutant of the analytic Toeplitz operator T_ϕ. Then the following are equivalent:

(1) $(T_\phi)' \cap C_2 \neq \{0\}$

(2) There exists $F(z,w) \in H^2(T^2)$ with $\langle F, z^i w^j \rangle = 0$ for all $i,j \leq 0$ such that $(\phi(z) - \phi(w))F(\bar{z},w) \in H^2(T^2)$. (Received March 14, 1977.)

77T-B99 Russell G. Bilyeu and Paul W. Lewis, North Texas State University, Denton, Texas 76203. Compact and weakly compact operators on C(H). Preliminary Report.

Let E and F denote Banach spaces, let H be a compact Hausdorff space, let C(H,E)(C(H)) be the Banach space of E-valued (real-valued) continuous functions on H, and let L:C(H,E) → F be an operator represented by the vector measure μ (via the Riesz Representation Theorem). Theorem. The dual of C(H,E) possesses smooth points iff H is countable and E* possesses smooth points. If T is a smooth point in the space of compact operators from C(H,E) to F, then (a) $H = \{x_i\}$ is countable and (b) $T(f) = \Sigma T_n(fx_i))$, where ΣT_n is an unconditionally converging series of compact operators, $f \in C(H,E)$. Theorem. The operator L:C(H) → F is weakly compact iff γ achieves its supremum on range (μ) for each $\gamma \in F^{***}$. Theorem. The operator L:C(H) → F is weakly compact iff every sequence in range (μ) has a subsequence whose areithmetic means converge. (This theorem is a converse to a recent result of Diestel and Seifert [Bull. Am. Math. Soc., 82(1976), 907-909].) (Received March 14, 1977.)

*77T-B100 Mourad E. H. Ismail, McMaster University, Hamilton, Ontario, Canada, L8S 4K1. Bessel Functions, Stieltjes Transforms and Infinite Divisibility.

We prove that $x^{(\nu-\mu)/2} I_\mu(\sqrt{x})/I_\nu(\sqrt{x})$ is a completely monotonic function of x when $\mu > \nu \geq 0$. This result and the complete monotonicity of $x^{(\nu-\mu)/2} K_\nu(\sqrt{x})/K_\mu(\sqrt{x})$ for $\mu > \nu > 0$, are used to introduce two continuous infinitely divisible probability distributions. The limiting cases contain the reciprocal of a gamma distribution and a distribution whose probability density function is a "generalized" theta function. The first distribution is used as a mixing distribution to introduce a new, two parameter, symmetric infinitely divisible distribution on $(-\infty,\infty)$ which contains the student t distribution as a limiting case. We also established the complete monotonicity of $K_\nu(b\sqrt{x})/K_\nu(a\sqrt{x})$ and $I_\nu(a\sqrt{x})/I_\nu(b\sqrt{x})$ for $b > a > 0$ and $\nu > 0$ and obtained results on the zeros of combinations of modified Bessel functions. (Received March 15, 1977.)

77T-B101 Manuel Lopez, McMaster University, Hamilton, Ontario, Canada, Matrix Differential Operators.

Let M_n be the set of all n×n complex matrices and [a,b] be a finite real interval. Let $L^2(a,b,M_n)$ be the set of all functions f: [a,b] → M_n such that all entry functions belong to $L^2(a,b)$. Under the usual addition, scalar multiplication, and inner-product defined by $(F,G) = \int_a^b \mathrm{tr}(G^*(t)\, F(t))dt$,

$L^2(a,b,M_n)$ is a Hilbert space. Consider the differential operator L defined by $L\,Y = \sum_{s=0}^{n} (-1)^s [P_{m-s}(t)\, Y(t)^{(s)}]^{(s)}$, where the superscript (s) denotes s-times differentiation with respect to t, P_i and Y are $n \times n$ matrix functions and the domain of L is a linear subspace S of $L^2(a,b,M_n)$. Under very general hypotheses on the coefficients P_i, and an appropriate domain S given by end-point conditions, the operator L is symmetric, with finite and equal deficiency indices. The self-adjoint extensions T of L are explicitely obtained and the following result holds: The self-adjoint operator T has only a point spectrum, all its eigenvalues are of finite multiplicity, and every finite interval contains only a finite number of them. The classical Inversion Theorem is also generalized to obtain an isometric mapping from $L^2(a,b,M_n)$ onto L^2_σ, where σ is an appropriate matrix distribution function. (Received March 15, 1977.) (Author introduced by Professor Claude E. Billigheimer).

*77T-B102 J. GLOBEVNIK, University of Ljubljana, Ljubljana, Yugoslavia. The ranges of analytic functions with continuous boundary values.

Let P be a subset of a metric space and let $\varepsilon > 0$. Call a finite set $S_\varepsilon \subset P$ a ε-path-net for P if given any $x \in P$ there exist $y \in S_\varepsilon$ and a path in P joining x and y whose diameter is less than ε. Call P totally path-connected if it is path-connected and if for every $\varepsilon > 0$ there exists a ε-path-net for P. Let A be the disc algebra, i.e. the algebra of all continuous complex-valued functions on the closed unit disc $\overline{\Delta}$ in C, analytic on the open unit disc.

Theorem Let a subset K of C consist of more than one point. Then $K = f(\overline{\Delta})$ for some $f \in A$ if and only if (i) K = closure(interior(K)) and (ii) interior(K) is totally path-connected. (Received March 10, 1977.)

77T-B103 Douglas Cenzer and R. Daniel Mauldin, University of Florida, Gainesville, Florida 32611. On a theorem of Wesley.

An improvement of a measurable choice theorem of Wesley [Israel J. Math. 14 (1973), 104-114] is obtained. Theorem. Let W be a Borel subset of I x I, where I = [0,1], such that, for each x, $W_x = \{y: (x,y) \in W\}$ is uncountable. Then there is an S(I x I)-measurable map h of I x I into I such that (i) for each x, $h(x,\cdot)$ is a Borel isomorphism of I onto W_x, and (ii) for each y, $h(\cdot,y)$ is an S(I)-measurable uniformization of W. Here, if X is a topological space, S(X) is the smallest family containing the open subsets of X which is closed under operation (A) and complementation. Notice that S(X) is included in the family of universally measurable subsets of X. (Received March 16, 1977.)

77T-B104 Max Ashkenazi, Rutgers University, New Brunswick, New Jersey 08903. On periodic solutions of functional differential equations. Preliminary report.

A result of Sell, (J. Diff. Eq. 2 (1966), 143-157, Theorem 1), is applied to the study of periodic solutions of autonomous functional differential equations. Let $C = C([-\tau,0],\mathbb{R}^n)$ and suppose $L: C \to \mathbb{R}^n$ is continuous, satisfies a local Lipschitz condition and takes closed bounded sets of C into bounded sets of $\mathbb{R}^n$. The solutions of (*) $x'(t) = f(x_t)$ define a dynamical system. Therefore the result of Sell can be applied to f.d.e. to yield the following result: Suppose that $f: C \to \mathbb{R}^n$ is continuous, compact and satisfies a local Lipschitz condition. Then if x(t) is a bounded and phase asymptotically stable solution of (*), (phase asymptotic stability means asymptotic orbital stability with an asymptotic phase, see Coddington and Levinson, page 323), there exists a phase asymptotically stable periodic solution y(t) of (*) such that the orbit of y(t) is the Ω limit set of x(t). (Received March 16, 1977.)

77T-B105 Igor Krol, The University of Iowa, Iowa City, Iowa 52242. The existence of a "smooth truncation" operator bounded on $W_{m,p}(R^n)$. Preliminary report.

It is well-known that if a uniformly Lipschitz function $\psi(t)$ on R^1, $\psi(0) = 0$, has only finite number of discontinuities, then $u \in W_{1,p}(R^n)$ implies $(\psi \circ u) \in W_{1,p}(R^n)$, $1 \le p \le \infty$. Such ψ sometimes is referred to as a "smooth truncation" operator on $W_{1,p}$. Let $\psi(t), \psi(0) = 0$ be a sufficiently smooth function on R^1. Will ψ be a "smooth truncation" operator on $W_{m,p}$ for $m \ge 2$?

Theorem. Let $\psi(t) \in C^m(R^1)$ satisfy $\sup_{t \in R^1} |t^{k-1}\psi^{(k)}(t)| \le M < \infty$ for $k = 0,1,\cdots,m$. Then there exists a constant C, C depends on n,m,p,M and does not depend on u, such that $\|\psi \circ u\|_{m,p} \le C\|u\|_{m,p}$ for all $u \in W_{m,p}(R^n)$, $1 < p < \frac{n}{m}$.

This fact is well-known for $mp \ge n$; it has also been proven for $u \in W^+_{2,p}$ by V. G. Maz'ya (1972) and for Riesz potentials of L^+_p-functions, $1 < p < \frac{n}{m}$, by D. R. Adams (1975). The proof relies upon a minor alteration of Maz'ya's technique and an interpolation-type argument. (Received March 17, 1977.) (Author introduced by Professor Lipman Bers).

77T-B106 FRANCISCO J. NAVARRO, Widener College, Chester, Pennsylvania 19013. Topologically equivalent measures in the Cantor space. Preliminary report.

The Cantor space is realized as a countable product X of two-element sets. Two measures μ and ν in X are topologically equivalent if there is a homeomorphism h of X onto itself such that $\mu = \nu h$. Let $\mathcal{F}$ be the family of product measures in X which are shift invariant. The members $\mu(r)$ of $\mathcal{F}$ are in one-one correspondence with the real numbers r in the unit interval. The relation of topological equivalence partitions the family $\mathcal{F}$ into c many classes with at most countably many measures each. A class contains only the measures $\mu(r)$ and $\mu(1-r)$ when r is a rational or a transcendental number. Equivalently, if r is rational or transcendental and $\mu(s)$ is topologically equivalent to $\mu(r)$ then s=r or s=1-r. (Received March 21, 1977.)

77T-B107 Clark P. Rhoades, University of Colorado, Boulder, Colorado 80309. A multiplicity theory and decomposition theory for closed operators. Preliminary report.

The global theory of Ernest, Charting the operator terrain (Mem. Amer. Math. Soc. No. 171, 1976) is generalized for closed (not necessarily densely defined) operators on a separable Hilbert space. The concepts of C^* and W^* algebras generated by a closed operator, weak containment, spectrum, weak and quasi-equivalences, and type classes of operators are defined so as to agree with those of bounded operators. The theorems of the global theory are then generalized. Nussbaum's theory of direct integral decompositions of closed operators is used to give the central decomposition of a closed operator. (Received March 21, 1977.)

*77T-B108 RICHARD BELLMAN. University of Southern California, Los Angeles, California 90007. Generalizations of the Pade Approximation. Preliminary Rep.

Consider the sequence of functions $u_n = x(x-1)\ldots(x-n)/n$: The expansion of a function in terms of these functions is the well known Newton interpolation formula. The coefficients in this expansion can easily be found by using the difference operator $\Delta f = f(x+1) - f(x)$.

Consider the polynomials ϕ_n and q_n determined by the relation $\phi_n(x)u(x) - qn(x) = u_{m+n+2}(x) + \ldots$ where the ... represent terms of higher index.

As in the classical case, there are two routes to pursue, either we can determine theoretical properties or else we can find the expansion of special functions. Both can be done. Of particular interest are the expansions for a^x and $\Gamma(x)$.

The product of two members of the sequence can be easily determined by using the analog of the formula for differentiation $\Delta(fg) = f\Delta g + g\Delta f(\Delta f)(\Delta g)$.

Another generalization can be obtained by using the Heine functions: see R. Bellman, "A q-Version of the Newton Interpolation Formula and Some Eulerian Identities," Boll. D'unione Matematico, Volume 16, 1961, pp. 285-287. (Received March 21, 1977.)

77T-B109 C. BELNA, Penn. State U., 16802, D. BONAR, Denison U., 43023, F. CARROLL, Ohio State U., 43210, P. COLWELL, Iowa State U., 50010, G. PIRANIAN, U. of Michigan, 48109. An annular Tsuji function, and its Julia points.

Let D denote the unit disk, C its boundary, f a meromorphic function in D, and $f^{\#}$ the spherical derivative of f. If the function $\int_0^{2\pi} f^{\#}(re^{i\theta})d\theta$ is bounded on the interval $0<r<1$, then f is said to be a Tsuji function. A point P of C is a Julia point for f if, in each open triangle in D with a vertex at P, f attains every value in $\mathbb{C} \cup \{\infty\}$ with at most two exceptions. Finally, f is strongly annular if f is holomorphic and if $\min\{|f(z)|: |z| = r\}$ is an unbounded function of r on the interval $0 < r < 1$.

Theorem 1. There exist strongly annular Tsuji functions; indeed, some for which every point on C is a Julia point.

Theorem 2. If f is a strongly annular Tsuji function, then the set of Julia points for f is a residual subset of C. (Received April 4, 1977.)

77T-B110 J.C. OXTOBY and V.S. PRASAD, Bryn Mawr College, Bryn Mawr, Pa. 19010. Homeomorphic measures in the Hilbert cube.

Let λ denote product Lebesgue measure in the Hilbert cube $Q=\prod_{n=1}^{\infty} [0,1]_n$.

Theorem If μ is a nonatomic, locally positive, normalized Borel measure in Q and if B is the union of any finite number of faces of Q with $\mu(B)=0$, then there is a homeomorphism h of Q onto itself such that h leaves fixed each point of B and $\mu = \lambda \circ h$. In case μ vanishes on every face of Q, h can be chosen so that it leaves invariant each face of Q as well as fixing each point of B. Several applications of this result are made. (Received April 5, 1977.)

77T-B111 Michael Keisler, Arkansas Tech University, Russellville, Arkansas 72801. A condition yielding an integral representation of the members of $ba(S,\Sigma)^*$. Preliminary report.

A necessary and sufficient condition for the existence of an integral representation of $ba(S,\Sigma)^*$ is given, where the integral is the refinement-wise limit of appropriate sums over finite subdivisions of S. Let Σ^* represent the field generated by the set of intervals of the form $(k/2^n,(k+1)/2^n]$, where k and n are non-negative integers and $k+1 \leq 2^n$. Let U represent the collection of all ultrafilters in Σ. Definition. If K is the set of all cardinals $\aleph \geq \aleph_0$ for which there is $E \subseteq U$ such that for $v \in \Sigma$ $\{F \in E \mid v \in F\}$ has cardinality $\aleph$ or 0, then $ba(S,\Sigma)$ is said to be $\aleph$-space when $K \neq \phi$ and $\aleph = \inf K$, and a 1-space when $K = \phi$. Theorem. $ba(S,\Sigma)^*$ has an integral representation iff $ba(S,\Sigma)$ is a 1-space. Theorem. $ba(S,\Sigma)^*$ fails to have an integral representation $\Leftrightarrow$ $ba(S,\Sigma)$ is an $\aleph$-space $\Leftrightarrow$ $ba(S,\Sigma)$ is an $\aleph_0$-space $\Leftrightarrow$ there is $\Sigma_0 \subseteq \Sigma$ such that $\Sigma_0 \cong \Sigma^*$. (Received April 8, 1977.)

77T-B112 GERHARD F. KOHLMAYR, Mathmodel Consulting Bureau, Glastonbury, Connecticut 06033. A topological division ring setting for linear partial differential equations with constant coefficients.

For background information, see Abstract 77T-E28, these NOTICES, 24 p. A-300. THEOREM 1. Let X be a locally compact connected Hausdorff topological division ring (not necessarily a copy of R, C, or Q). Let R^n be a finite dimensional Euclidean space, let cone(R^n) be the cone of nonnegative elements of R^n, and let $L = L(\partial_1, \partial_2, \ldots, \partial_n)$ be a nonzero linear partial differential operator with X-valued constant coefficients defined on cone(R^n). Then there is a smallest locally compact connected Hausdorff topological division ring which contains L^{-1}, the unique continuous inverse of L. THEOREM 2. Let $L = L(\partial_1, \partial_2)$ be a nonzero linear partial differential operator with real-valued constant coefficients defined on cone(R^2). Then L has a representation as a nonzero linear ordinary differential operator $\lambda = \lambda(D)$ with constant coefficients in a Dedekind complete non-Archimedean ordered field X and there is a smallest Dedekind complete non-Archimedean ordered field which (i) is a proper overfield of X and (ii) contains λ^{-1}, the unique continuous inverse of λ. (Received April 8, 1977.)

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*77T-C31 MASSAM, Hélène, McGill University, Montreal, Canada.
Optimality criterion for a cone-convex program without constraint qualification. Preliminary Report.

Consider problem (P) Maximize $f(x)$
such that $g(x) \in B$

where X is a Banach space, $f: X \to R$ is Fréchet-différentiable and concave, $g: X \to R^m$ is Fréchet-différentiable and B-concave and B is a closed convex cone with vertex 0 and containing no line. A primal and a dual characterization of optimality is given for problem (P) without constraint qualification in terms of a new generalized cone of constancy denoted $C(g, B, \overline{x})$

Theorem, A feasible $\overline{x}$ is optimal if and only if there is no d in X such that
$\nabla f(\overline{x})(d) > 0$
$\nabla g(\overline{x})(d) \in T(B, g(\overline{x}))$
with $\nabla g(\overline{x})(d) \in \partial T(B, g(\overline{x}))$ only if $d \in C(g, B, \overline{x})$. (Received February 18, 1977.)

77T-C32 MIRIAM LIPSCHUTZ-YEVICK, Rutgers The State University, New Brunswick, New Jersey 08903.
Primitive signs as marks and as one symbol sequences.

Given a set of primitive signs (marks on paper) which are juxtaposed in some order. The correspondence between the individual signs and their gn does not inform us as to the order of their appearance in the juxtaposition. (Similarly if the primitive signs are represented by thin transparent regions of incommensurable areas, the total light intensity transmitted determines the component symbols but not their order; whereas the hologram informs us as to both.) Let now $x = \Pi_{i=1}^{\ell} \Pr(k_i)^{n_i}$ where the k_i are some permutation of the first ℓ primes and n_i is the gn of a primitive sign. Then x is the gn of $(a_{i(1)}a_{i(2)}\cdots a_{i(\ell)})$ where $n_{i(j)}$, the gn of $a_{i(j)}$, is the power of the j'th prime in the factorization. Thus $x = 2^{n_i(1)} * 2^{n_i(2)} * \cdots * 2^{n_i(\ell)}$ corresponds to a juxtaposition of ranked (ordered) symbols (sequences of one symbol) and not merely of marks (as displayed). The gn, x, of a sequence informs as to both shape and rank (order) of the component primitive signs. This further supports our contention that a formal expression appears in two distinct modes: sequential and ostensive (Notices, August 1976, January 1977) and that the inconsistencies rest on a confusion of these two modes. (Received March 2, 1977.)

77T-C33 D.V.Choodnovsky, Tarasovskaya 10a, ap.17, 252033, Kiev, USSR. Infinite chains of non-linear equations of evolution associated with one-dimensional many-body problems. I. Preliminary report.

Let $H=\sum_{i\in I}\dot{x}_i^2/2+G\sum_{i\neq j}\wp(x_i-x_j)$ be Hamiltonian associated with many-body problem for Weierstrass function $\wp(x)$. This system possesses a Lax pair $\dot{L}=[L,A]$ for $L_{ij}=(1-\delta_{ij})\sqrt{-G}\,\alpha(x_i-x_j)+\delta_{ij}\dot{x}_i$, $\alpha^2=\wp$ and first integrals $J_k=1/k\ \mathrm{trace}\,(L^k)=\sum_{i\in I}\dot{x}_i^k/k+\dots$. We consider the system of functions $\hat{u}_k(z,t)=\sum_{i\in I}\frac{\partial J_k}{\partial\dot{x}_i}(z-x_i)^{-2}$ or $\hat{u}_k(z,t)=\sum_{i\in I}\frac{\partial J_k}{\partial\dot{x}_i}\wp(z-x_i)$ for $k=0,1,\dots$ and $\frac{\partial J_k}{\partial\dot{x}_i}=(L^{k-1})_{ii}$. Let $u_{k,x\cdots x}^{(s)}$ have the weight $k+2+s$. We find the chain of equations of the form

$$(C)\qquad u_{k,t}+u_{k+1,x}+\frac{\partial}{\partial x}\Omega_k(u_0,\dots,u_{k-1})=0:$$

$k=0,1,2,\dots$ where Ω_k is a polynomial in $u_{0,x\cdots x}^{(s)},\dots,u_{k-1}^{(r)}$ of degree two and having all the monomials of the weight $k+3$ with the following property: The system of functions $\hat{u}_k$ satisfies (C) iff $x_i=x_i(t)$ moves according to Hamiltonian H. Here we give the first four members of (C): $\Omega_0=0$, $\Omega_1=-G/2\,u_0^2+G/12\,u_{0xx}$, $\Omega_2=-G\,u_0u_1+G/6\,u_{1xx}$, $\Omega_3=-G/2\,u_1^2-G\,u_0u_2-G^2/8\,u_{0x}^2-G^2/12\,u_0u_{0xx}+G^2/120\,u_{0xxxx}+G/4\,u_{2xx}$.

(Received March 21, 1977.)

77T-C34 REUBEN HERSH, University of New Mexico, Albuquerque, New Mexico 87131. Higher-order approximations for C_0 semigroups.

Let $T(t)$ be a C_0 semigroup of operators on a Banach space, with generator A. Let $r(z)$ be a rational function such that $*\{r(\infty)=0$, $|r(z)|\le 1$ for $\mathrm{Re}\,z\le 0\}$ and, for some constants c, $|r^n(z/n)-e^z|\le c_1n^{-\alpha}$ for $|z|\le c_2$. Then, for all x in the domain of $A^{\alpha+1}$, $\|T(t)x-r^n(tA/n)x\|\le c_3n^{1-\alpha}$. In particular, $(*)$ is satisfied by the (p,q)th Pade approximant to e^z for $p-q=-1$ or -2, and $\alpha=p+q$. If A is self-adjoint (respectively, skew adjoint) on a Hilbert space, instead of $(*)$ we need only $|r(z)|\le 1$ for z real and negative (respectively, for z pure imaginary) and we get $\|T(t)x-r^n(tA/n)x\|\le c_3n^{-\alpha}$. (Received March 25, 1977.)

*77T-C35 Charles E. Blair, Department of Business Administration, University of Illinois, Urbana, Illinois 61801. Approximate Fixed Points in Rectangular Arrays.

Let A_k be those points in $[0,1]^n$ whose coordinates are rationals with demoninator k. Let $f:A_k\to[0,1]^n$ be arbitrary. An approximate fixed point for f is a cube in $[0,1]^n$ of edge length $\frac{1}{k}$ such that, for each $1\le i\le n$, there are points x, y in the cube such that $f(x_i)\le x_i$ and $f(y_i)\ge y_i$. The existence of approximate fixed points is guaranteed by Kuhn's cubical Sperner lemma. We extend the lemma and use the extension to give an algorithm which locates an approximate fixed point after evaluating f at $O((k+1)^{n-1})$ points of A_k. (Received April 1, 1977.)

77T-C36 HAROLD M. HASTINGS, Department of Mathematics, Hofstra University, Hempstead, NY 11550, JACK M. FRANCIS, Department of Economics and Finance, Bernard Baruch College, CUNY, New York, NY 10010, and FRANK J. FABOZZI, Department of Finance and Investments, Hofstra University, A model for bankruptcy using catastrophe theory.

We use catastrophe theory, developed by R. Thom, to obtain a model for bankruptcy with the following useful features: the model incorporates past history of a firm as well as its present profitability and liquidity; the model does not require a perfect market- we substitute a parameter which measures the flow of information; and the model allows for noise in the economic environment. Catastrophe theory provides a basic "potential function", the cusp catastrophe $V=1/4\,x^4-1/2\,bx^2-ax$, whose stable equilibria describe the state of the firm, and Thom's classification theorem which expains the generality of the model (compare the atmospheric modeling

of R. C. Lacher and R. McArthur). C. Zeeman used the cusp catastrophe to model the stock market. Further, the concept of "tunneling" in quantum mechanics allows us to discriminate between short-term and long-term stability with an "information flow" parameter. The other parameters are liquidity (b), profitability (a), and noise. Our model shows how erosion of capital, market information, and noise all contribute independently to the failure of an unprofitable firm. (Received April 6, 1977.)

*77T-C37 JOE THRASH, University of Southern Mississippi, Hattiesburg, MS 39401. A Modification of the Generalized G-transform.

In "The Generalized G-transform," Math. of Comp., Vol. 22, No. 103, 1968, pp. 595-606 Gray and Atchison introduced a nonlinear transformation called the generalized G-transform which is used to numerically evaluate certain improper integrals of the first kind. This transformation was shown to work quite well except when $f(g(t))g'(t)/f(t) \to R \neq 1,0$ as $t \to \infty$, where f is the integrand and g is a function associated with the generalized G-transformation. It is the purpose of this paper to show how a nonlinear transformation called the L-transformation introduced in "A Note on the G-transformation," J. Res. Nat. Bur. Standards Sect. B., Vol. 72B, No. 1, 1968, pp. 29-31 by Gray and Atchison can be extended to the generalized G-transformation. This new transformation can be used to evaluate certain improper integrals when R = 1 and it will reduce to the generalized G-transformation when $R \neq 1$. (Received April 11, 1977.)

*77T-C38 LUIGI GATTESCHI and GIULIANA VINARDI, University of Turin, Turin, Italy. The degree of exactness of Chebyshev's quadrature formulas.

It is well known that for Chebyshev's quadrature formula $\int_{-1}^{1} f(x)dx = (2/n) \sum_{k=1}^{n} f(x_{n,k}) + R_n(f)$, with all real nodes $x_{n,k}$ in $(-1,1)$, to have polynomial degree of exactness N, i.e., $R_n(x^i) = 0$ for $i = 0,1,\ldots,N$, it is necessary that Bernstein's inequality $N < 4\, n^{1/2}$ be satisfied. We give an improved inequality for the number N. Theorem. Let $j_{0,1}$ be the first positive zero of the Bessel function $J_0(x)$; if the degree of exactness N of Chebyshev's formula is odd, then (1) $(N + 1)(N + 3) < 4\, n\, J_1^{-2}(j_{0,1})$. If we put (1) in the less precise form $N < 2\, J_1^{-1}(j_{0,1})\, n^{1/2}$, we see that the constant 4 in Bernstein's inequality can be replaced by the smaller one $2J_1^{-1}(j_{0,1}) = 3.852469\ldots$. Inequality (1) is very sharp and yields a powerful method for proving nonexistence results. If we assume, as in the classical Chebyshev quadrature formula, $N = n + 1$ (if n is even), $N = n$ (if n is odd), it is easily seen that (1) is violated for $n = 8$ and for $n \geq 10$. We have also good results for the Chebyshev-type quadrature formula with $N = n - 1$ (if n is even), $N = n - 2$ (if n is odd), studied by W. Gautschi and H. Yanagiwara (Math. Comp. 28 (1974), 173-184). In this case we indeed find that (1) is not satisfied for $n \geq 14$. More general results, arising from Chebyshev-type quadrature formulas involving the weight function $(1 - x^2)^{\lambda - 1/2}$, are obtained. Preprints may be obtained from the Authors. (Received April 11, 1977.)

77T-C39 P.A.Mishnaevsky, A.G. Kamm, Inst. Fine Mech. & Optics, Leningrad 197101. Uniqueness theorem of use in relativity I.

Let $g^{\mu\nu}(x,t)$ be the fundamental tensor, $u = u(t,x)$, $x \in R^3$, $|x|$ be the Euclidean norm, C, l, C_m, $N, \varepsilon, \delta, a, R_0$ be some positive constants, $\tilde{u}(\kappa, x)$ be the Fourier transform of $u(t,x)$, S be the unit sphere in R^3, $r = |x|$, $C^2, L^2_x, L^2_t, C^2_x, R^3_0 = R^3 \setminus 0, R^4_0 = R^4 \setminus 0$ be the usual notations, $\partial_\mu = \partial/\partial x_\mu$, $x_0 = t$, $\partial_r = \partial/\partial r$. Over the repeating indexes one must to sum, $0 \leq \nu, \mu \leq 3$, $1 \leq i, j \leq 3$. Let the following assumptions hold: 1) $\partial_t g^{\mu\nu} = 0$, $0 \leq \mu, \nu \leq 3$, $g^{ij}(x) \in C^2(R^3_0)$, $c_1|\xi|^2 \leq g^{ij}\xi_i\xi_j \quad \forall x \in R^3$, 2) $0 < g^{00}(x) = c^2(1 - Q(x))$, $Q = Q_1 + Q_2$, $r\, Q_2 \to 0$ as $r \to +\infty$, $\partial_r(r^\varepsilon Q_1) \leq N r^{-1-\varepsilon}$, $r \geq R_0$; $g^{ij}(x) = -\delta_{ij} + c(r^{-\delta})$, $\partial_r g^{ij} = O(r^{-1-\delta})$, 3) $|r\, g^{0i}| \leq c_2$, $r \geq R_0$. Th.1. If i) assumptions 1)-3) hold; ii) $u \in C^2$, $\partial_\omega(g^{\mu\nu}\partial_\nu u) = 0$; $\tilde{u}(k,x) = a(k)u_0(k,x)$, $u_0 \in C^2_x$ for all k, $a(k)$ being a distribution; $r\,\tilde{u}(0,x)$ is bounded from below or above; $\liminf \int_S |\partial_r(r\tilde{u}) - i\kappa r\tilde{u}|^2 dS = 0, |\kappa| > 0$ (A), then $u(t,x) \equiv 0$. Corollary 1. If $u \in C^2$, $u(t,x) \in L^2_x$ for all t; assumptions 1)-3) hold with $g^{ij} = 0, \ldots, \delta > 1, |Q| \leq c_3 r^{-2+\varepsilon}, c_3 < 0.25, r \geq R_0$ uniformly in $x r^{-1} \in S$ and t running over a finite interval $\lim_{R \to \infty} \int_{|x| \leq R} \{|\partial_t(ru) + \partial_r(ru)|^2 + |ru|^2\} dx = 0$ (B), then $u(t,x) = 0$. Corollary 2. If $\int_S \{|\partial_t(ru) + \partial_r(ru)|^2 + |ru|^2\} dS \in L^2_t$, then (A) can be substituted by $\liminf \int_S |\partial_t(ru) + \partial_r(ru)|^2 dS = 0$ and the one side boundedness of $r\,\tilde{u}(0,x)$ by $\int_{-\infty}^{\infty} \int_S r^2 |u|^2 dS\, dt < \infty$. Th.1. implies the uniqueness of the garmonic coordinates in general relativity (see Fock. Theory of space, time, gravitation. Moscow, 1961). (Received April 12, 1977.)

77T-D7 IVAN NIVEN, University of Oregon, Eugene, Oregon 97403. Polygonal coverings of the plane.

Let α and β be positive real numbers. It is proved that it is impossible to cover the Euclidean plane with convex polygons each having 7 or more sides, area $> \alpha$, and perimeter $< \beta$. This result is stronger than one announced in a preliminary report, where an additional assumption was made that there is an upper bound on the number of sides of each polygon. The result is best possible in the sense that if any of the conditions on the polygons is removed, it is possible to cover the plane with polygons satisfying the remaining conditions. (Received February 25, 1977.)

77T-D8 HUNG-HSI WU, Mathematics Dept., University of California, Berkeley, Ca. 94720 On the Volume of a Noncompact Manifold.

Theorem. Let M be a noncompact complete Riemannian manifold whose Ricci curvature is nonnegative outside a compact set. Then M has infinite volume. Previously, it was known that the same conclusion holds if the sectional curvature is nonnegative outside a compact set (R. E. Greene-H. Wu, Inventiones Math. 27 (1974), 265-298), or if the Ricci curvature is everywhere nonnegative (E. Calabi, Notices Amer. Math. Soc. 22 (1975), A 205; S. T. Yau, Indiana Univ. Math. J. 25 (1976), 659-670). Details will appear in "An elementary method in the study of nonnegative curvature" (to appear). (Received March 18, 1977.)

*77T-D9 Larry Graves and Katsumi Nomizu, Brown University, Providence, Rhode Island 02912. On Sectional Curvatures of Indefinite Metrics. Preliminary report.

We extend E. Cartan's criterion for constancy of sectional curvature to indefinite metrics, and consider the axiom of r-planes and the axiom of r-spheres for indefinite Riemannian manifolds. We prove that such a manifold whose dimension $n \geq 3$ and which satisfies one of the axioms for some r, $2 \leq r < n$, has constant sectional curvature. This extends the result in Leung-Nomizu, J. Differential Geometry 5 (1971) 487-489. For a Lorentz metric, stronger versions of our theorems hold which only involve conditions on space-like planes. (Received April 7, 1977.)

77T-D10 HANS SCHWERDTFEGER, McGill University, Montréal, Québec, Canada H3A 2K6. A generalization of the cross ratio.

It is known that the cross ratio of four points on a straight line is the essentially (i.e. up to an arbitrary function) unique 4-point invariant under projective transformation. C. F. Möbius (J.f. Math. (Crelle) 4, (1829), 101-139, or: Gesammelte Werke Bd. I, 445-480) has constructed projective invariants of five points in the plane, five points of which no three are colinear. The uniqueness problem for two (scalar) Möbius invariants is solved by means of a general theorem (H. Schwerdtfeger, Aequationes Math. 14(1976), 105-110) according to which for an exactly r-fold transitive transformation group G operating in a "space" S there is one, and essentially only one $(r+1)$-point invariant $f : S^{r+1} \to S$ for which the theorem gives an explicit expression in terms of elements of G. Taking S as the projective plane over a field, represented by the cartesian model, and G as the corresponding projective group, the 5-point invariant appears as a point of S whose coordinates are double ratios of four 3×3-determinants whose elements are the (homogeneous) coordinates of the five points. (Received April 11, 1977.)

*77T-E31 MATI RUBIN, Department of Mathematics, University of Colorado, Boulder Colorado 80309. Vaught's Conjecture for linear oderings. Preliminary report.

Let $I(T)$ be the number of non-isomorphic countable models of T. Theorem: If $\psi \in L_{\omega_1\omega}$, the language of ψ contains $=, <$, and at most countably many unary predicates, and ψ implies the axioms of linear order; then $I(\{\psi\}) \leq \aleph_0$ or $I(\{\psi\}) = 2^{\aleph_0}$. Remark: If $0 < n \leq \aleph_0$ or $n = 2^{\aleph_0}$, and $\alpha < \aleph_1$ is a limit ordinal, then there is a complete theory T in $\mathcal{F}_\alpha = \{\varphi | \varphi \in L_{\omega_1\omega}$ and the quantifier depth of φ is $< \alpha\}$ such that the language of T is $\{=, <\}$, T implies the axioms of linear order and $I(T) = n$. Theorem: If $M = \langle A, < \rangle$ is a linear ordering, $a,b,c \in A$ and b is first order definable in (M,a,c), then b is first order definable either in (M,a) or in (M,c). (Received February 21, 1977.) (Author introduced by Jerry Malitz).

77T-E32 Eric Ellentuck, Rutgers University, New Brunswick, New Jersey 08903. Isolated fields. Preliminary report.

A field $\mathcal{A}$ is isolated if it has the form $(\alpha,+,\cdot)$ where α is an isolated set of integers and $+,\cdot$ have partial recursive extensions. Req (α) is the number of elements in $\mathcal{A}$. Then (i) two isolated fields are recursively field isomorphic iff they contain the same number of elements. (ii) an isolated field has p^T elements where p is the fields prime characteristic and T is an isol. (iii) a separable subfield of an isolated field with p^T elements has p^S elements where S divides T. (iv) an isolated field has at most one subfield with a given number of elements. (v) there are S dividing T and an isolated field with p^T elements having no subfield containing p^S elements. (Received February 21,1977.) (Author introduced by Professor J.C.E. Dekker).

*77T-E33 MELVIN FITTING, Stephentown Center, New York 12169

A Model theoretic characterization of the Π^1_1 and the r.e. relations

Let L be a first order language with the natural numbers as constants, a relation symbol for the successor relation, and other relation symbols. Let X be a formula of L (free variables allowed). By a standard model for X we mean a model in which: the domain is ω, the successor relation symbol is interpreted by the successor relation, and each instance of X is true. Let P be an n-place relation symbol. By $\langle X, P \rangle$ we mean $\{\vec{v} \in \omega^n \mid P\vec{v}$ is true in every standard model for $X\}$. We say a relation R on ω is characterizable if, for some X and some P, $R = \langle X, P \rangle$. Theorem: Being characterizable is the same as being Π^1_1; Being r.e. is the same as being characterizable using a quantifier free formula of L. Theorem: Each r.e. relation can be characterized using a Horn formula; Each Π^1_1 relation can be characterized using a formula like a Horn formula, but allowing universal quantifiers in the 'premises'. The method of proof uses a modification of elementary formal systems (Theory of Formal Systems, R. Smullyan, Princeton, 1961) treated model theoretically. The forms of formulas above arise directly out of elementary formal system machinery. (Received March 1, 1977.)

77T-E34 PAUL E. HOWARD, Eastern Michigan University, Ypsilanti, MI 48197, ARTHUR L. RUBIN, California Institute of Technology, Pasadena, CA 91125, and JEAN E. RUBIN, Purdue University, West Lafayette, IN 47907. Independence results for class forms of the axiom of choice.

Let NBG be von Neumann, Bernays, Godel set theory without the axiom of choice and let NBGA be the modification which allows atoms. We consider some of the well known class or global forms of the well ordering theorem, the axiom of choice, and maximal principles which are known to be equivalent in NBG and show they are not equivalent in NBGA. For example, if W1: Each proper class is equipollent to the class of ordinals; W2: Each class can be well ordered; W3: There is a relation which well orders each set; and W4: There is a function F such that for each set x, F(x) well orders x; then it is known that NBGA $\vdash$ W1 $\rightarrow$ W2 $\rightarrow$ W3 $\rightarrow$ W4. We show that none of those arrows are reversible in NBGA even though NBG $\vdash$ W4 $\rightarrow$ W1. We have similar results for forms of the axiom of choice and maximal principles. (Received March 3, 1977.)

*77T-E35 WILLIAM H. WHEELER, Indiana University, Bloomington, Indiana 47401. Model-complete theories of pseudo-algebraically closed fields.

Let E be a field of absolute numbers. Let T_E be the theory consisting of the standard axioms for fields in the language with symbols 0, 1, +, -, $\cdot$ together with axioms for the characteristic of E and the collection $\{\forall x \neg(p(x) = 0) : p(x)$ is a polynomial with integer coefficients and $E \models \forall x \neg(p(x) = 0)\}$. Theorem 1. The existentially complete models of T_E are the perfect, pseudo-algebraically closed fields which are regular extensions of E and have no proper algebraic extensions that are regular extensions of E also. Theorem 2. T_E has a model-companion T_E^* if and only if E has at most finitely many extensions of each finite dimension; T_E^* is complete if it exists. Corollary. T_E has a model-companion for each field E of absolute numbers of finite corank, for example, each procyclic field E of absolute numbers, such as the absolute number fields of nonzero characteristic and the field of real, algebraic numbers. The model-companion in the latter example is not the theory of real closed fields. Theorem 3. A theory T is a complete, model-complete theory of perfect, pseudo-algebraically closed fields if and only if there is a field E of absolute numbers such that T is the model-companion T_E^* of T_E, in which case E is the field of absolute numbers of T. (Received March 3, 1977.)

77T-E36 C.T.Chong, University of Singapore, Republic of Singapore 10. Generic sets and minimal α-degrees. Preliminary report.

Let α be an admissible ordinal. We refer to Shore, Minimal α-degrees, *Ann. Math. Logic*, 4(1972), for the definitions of trees and splitting trees. Definition. A tree T is indiscernible for the reduction procedure e if there is an α-recursive function f from T unboundedly into α such that for p, q in T, computations through e using p and q respectively as inputs agree on the initial segment of length min $\{f(p), f(q)\}$. Call a set X generic if whenever the reduction procedure e is total for the set X, then there is a tree T containing X as a branch such that T is either indiscernible or splitting for the reduction procedure e.

Theorem. A regular, hyperregular subset T of α is of minimal α-degree if and only if it is generic. (Received March 7, 1977.)

*77T-E37 Paul Bankston, University of Kansas, Lawrence, Kansas 66045. On the Ultrapower Theorem.

Using techniques from the theory of topological ultraproducts, we show that the following two well-known consequences of ZFC+($\exp(\alpha)=\alpha^+$) are independant of ZFC: (1) Let L be a predicate language of power $\leq\alpha$; and let $A \equiv B$ be L-structures of power $\leq\exp(\alpha)$. Then $\prod_D(A) \cong \prod_D(B)$ for every good ultrafilter D on α. (2) Let L be a predicate language of power $\leq\alpha$; and let $A \equiv B$ be α^+-saturated L-structures of power $\exp(\alpha)$. Then $A \cong B$. (Received March 21, 1977.)

77T-E38 A. KANAMORI, University of California, Berkeley, California 94720. On Vopenka's and Related Principles. Preliminary Report.

Analogies to Baumgartner's n-subtle and n-ineffable cardinals are developed in the context of strong principles of infinity: A sequence $\langle M_\xi | \xi<\kappa \rangle$ of models of the same similarity type is called natural iff each $M_\xi = \langle V_{f(\xi)}, \in, A_\xi, \{\xi\} \rangle$, and $\xi < \bar{\xi}$ implies $\xi < f(\xi) \leq f(\bar{\xi}) < \kappa$. If $X \subseteq \kappa$, X is Vopenka-n-subtle (Vopenka-n-ineffable) iff for any natural sequence, there is a $Y \subseteq X$ sc that $|Y| = n + 1$ (Y is stationary in κ) and given $\alpha_0 < \ldots < \alpha_n$ in Y, there is an elementary embedding j of one model in the sequence into another, so that α_0 is the first ordinal moved and $j(\alpha_i) = \alpha_{i+1}$.

Typical results: (a) If κ is Vopenka-n-subtle, then κ is n-subtle. (b) Those $X \subseteq \kappa$ so that $\kappa - X$ is not Vopenka-n-subtle form a normal filter containing $\{\alpha<\kappa | \alpha$ is (n-1)-huge$\}$ when $n > 1$, and $\{\alpha<\kappa | V_\kappa \models \alpha$ is extendible$\}$ when $n = 1$. (c) Statements analogous to (a) and (b) hold for Vopenka-n-ineffable. (d) If κ is n-huge, then κ is Vopenka-n-ineffable. (e) κ is Vopenka-n-ineffable iff the Π^1_2 - indescribable filter and Vopenka-n-subtle filter over κ are proper and coherent.

(Received March 21, 1977.)

*77T-E39 Robert P. Daley, Computer Science Department, University of Pittsburgh, Pittsburgh, PA 15260. Busy beaver sets and the degrees of unsolvability. Preliminary report.

In this paper using the primitives of abstract complexity theory a solution to Post's problem (i.e., a non-recursive incomplete recursively enumerable set) is constructed without using priority arguments. Moreover, the elements belonging this set admit explicit and rather simple descriptions. (Received March 23, 1977.)

77T-E40 BERNHARD FALKENBERG , Universität Freiburg,Math.Inst.,Albertstr.23b D-7800 Freiburg,Fed.Rep.Germany. Halting problems of tag-systems with arbitrary deletion number. Preliminary report .

Hao Wang has shown (Math.Annalen,Vol 152) , that the halting problems of tag--systems with deletion number 1 are decidable . We prove the theorem : Let d be a non-empty r.e. set of natural numbers and p an integer greater than then there exists a tag-system with deletion number p whose halting problem is many-one equivalent to d . As corollaries we get results of Maslov (Amer.Math Soc.Transl. Vol 97) and Aanderaa,Belsnes,Hughes (JSL Vol 36 , Vol 39) .

(Received March 28, 1977.)

*77T-E41 H.Volger, Math.Institut,Univ.Tübingen,D7400 Tübingen,Fed.Rep.of Garmany, Σ^1_1-relations of structures and interpolation for sentences, preliminary report

Let K be a similarity type, let L(K) be the set of sentences of a first-order language over K and let Str(K) be the class of structures of type K . For $R \subseteq (Str(K_1) \times Str(K_2))$ define $[R] \subseteq (L(K_1) \times L(K_2))$ as follows: $\phi_1 [R] \phi_2$ if $A_1 \models \phi_1$ implies $A_2 \models \phi_2$ whenever $A_1 R A_2$. Similarly, for $\Gamma \subseteq (L(K_1) \times L(K_2))$ define $(\Gamma) \subseteq (Str(K_1) \times Str(K_2))$ as follows: $A_1 (\Gamma) A_2$ if $A_1 \models \phi_1$ implies $A_2 \models \phi_2$ whenever $\phi_1 \Gamma \phi_2$. The operations [ ] and ( ) determine a galois connexion whose fixelements can be determined as follows: (1) If Γ is closed under $\wedge$ and $\vee$ then $\bar{\Gamma} = [(\Gamma)]$,where $\phi_1 \bar{\Gamma} \phi_2$ if $\phi_1 \models \psi_1 \Gamma \psi_2 \models \phi_2$ for some ψ_1, ψ_2 . (2) If R is Σ^1_1 (cf. Barwise) then $\bar{R} = [[R]]$,where $A_1 \bar{R} A_2$ if $A_1 \equiv B_1 R B_2 \equiv A_2$ for some B_1, B_2 . Moreover, Feferman's uniform reduction or Σ^1_1-relations can be extended as follows: (3) If R_1, R_2 are Σ^1_1 then $[R_1 \cdot R_2] = [R_1] \cdot [R_2]$, in particular if R is Σ^1_1 then

$[R^{-1}\cdot R]=[R^{-1}]\cdot[R]$. Using Flum's notion of first-order convergence of Σ^1_1-relations we obtain: (4) If R and R_n for n in ω are Σ^1_1 and if $R_n \to R$ then $[R]=U<[R_n]|n\in\omega>$. Specializing to $K=K_1=K_2$ we define $inv(R)=\{\phi:\phi[R]\phi\}\subseteq L(K)$ and Δ^i (resp. Δ^{int})$\subseteq(L(K)\times L(K))$ for $\Delta\subseteq L(K)$, where $\phi_1\Delta^i\phi_2$ (resp. $\phi_1\Delta^{int}\phi_2$) if $\phi_1\vdash\delta\vdash\phi_2$ for some δ in Δ (with $\delta\in L(\phi_1)\wedge L(\phi_2)$). The above methods can now be used to study the relations between preservation theorems i.e. $inv(R)=\Delta$ and interpolation theorems i.e. $[R]=\Delta^i$ resp. Δ^{int}. (Received April 5, 1977.)

77T-E42 O. V. BELEGRADEK, Kemerovo State University, Kemerovo, 650043, USSR. An algebraic characterization of groups with solvable occurrence problem.

Let G be a finitely generated (f.g.) group. Neumann (pp. 553-562 of "Word problems", Amsterdam, London 1973), Macintyre (J. S. L., 37(1972), 512-520) and Boone and Higman (J. Austral. Math. Soc., 18(1974), 41-53) proved that G has a solvable word problem iff G is embeddable in every nontrivial algebraically closed (a.c.) group iff G can be embedded in a simple subgroup of a finitely presented (f.p.) group. Let K be a f.g. subgroup of G. Define $G \leqq_K H$ as follows: $G \leqq H$ and K is the centralizer of h in G for some $h \in H$. Let $G \leqq^* H$ mean that $G \leqq_K H$ for all K. We prove the following. Theorem 1. Suppose G has a solvable word problem. The occurrence problem is solvable for a f.g. subgroup K of G iff $G \leqq_K H$ for some simple subgroup H of a f.p. group iff G is K-embeddable in every nontrivial a.c. group. Theorem 2. G has a (uniformly) solvable occurrence problem iff $G \leqq^* H$ for some simple subgroup H of a f.p. group. Theorem 3. G has a solvable occurrence problem for every f.g. subgroup of G iff G is *-embeddable in every nontrivial a.c. group. (Received April 8, 1977.)

Statistics and Probability (60, 62)

*77T-F9 A.G. Miamee and H.Salehi, Michigan State University, East Lansing, MI 48824. Harmonizability, V-Boundedness and Stationary Dilation of Stochastic Processes.

It is shown that a Hilbert space valued process is harmonizable, i.e., it is the Fourier transform of a vector valued measure of bounded semi-variation if and only if it has a stationary dilation. It is also shown that these classes of processes are the same as the class of continuous V-bounded stochastic processes. (Received March 28, 1977.)

*77T-F10 G. A. EDGAR and L. SUCHESTON, The Ohio State University, Columbus, Ohio 43210. Martingales in the limit and amarts.

The notion of amart is compared to that of martingale in the limit, and game fairer with time. Every real-valued amart is a martingale in the limit. More generally, a Banach space E is finite-dimensional if and only if every E-valued amart is a martingale in the limit (or a game fairer with time). Several crucial properties possessed by amarts fail both for martingales in the limit and games fairer with time: the maximal inequality, the optional stopping theorem, the optional sampling theorem, the Riesz decomposition; therefore a general theory analogous to the amart theory cannot be based on martingales in the limit even though they possess the L^1-bounded convergence theorem. It is also observed that either a weak form of the optional sampling theorem or the property $E(X_n) \to$ must fail for any class of sequences of random variables strictly larger than the class of amarts. References: A. G. Mucci, Pacific J. Math. 64(1976), 539-541; Edgar-Sucheston, J. Multivariate Analysis 6(1976), 193-221; 572-591. (Received April 7, 1977.)

77T-G58 Themistocles M. Rassias, University of California, Berkeley, California 94720. A criterion for two Riemannian manifolds in the framework of Global Variational Analysis to be isometric.

Consider M to be a compact oriented Riemannian manifold. Define an inner product on $C^\infty(M)$ by (1) $\langle\phi_1,\phi_2\rangle = \int_M \phi_1(x)\phi_2(x)dx + \int_M \langle d\phi_1, d\phi_2\rangle dx$. Let $L_1^2(M)$ be the Hilbert space obtained by completion with respect to the norm described by (1). Consider the Dirichlet integral $D: L_1^2(M) \to \mathbb{R}$, defined on $C^\infty(M)$ by (2) $D[\phi] = \frac{1}{2}\int_M \langle d\phi, d\phi\rangle dx$. Consider $\tilde{M}$ to be another such manifold with Dirichlet integral $\tilde{D}$. Definition [J. Eells, Jr. & J.H. Sampson]. *Two pairs* $(L_1^2(M),D)$ *and* $(L_1^2(\tilde{M}),\tilde{D})$ *are equivalent if there exists a mapping* σ: $L_1^2(M) \to L_1^2(\tilde{M})$, *from* $L_1^2(M)$ *onto* $L_1^2(\tilde{M})$, *so that* $\tilde{D}\circ\sigma = D$ *on* $L_1^2(M)$ *and moreover* $\langle\phi_1,\phi_2\rangle = \langle\sigma\phi_1,\sigma\phi_2\rangle$ *for all* $\phi_1, \phi_2 \in L_1^2(M)$. J. Eells, Jr. and J.H. Sampson [see S. Kobayashi & J. Eells, Jr., *Problems in Differential Geometry*, Proc. U.S.-Japan Seminar in Differential Geometry, Kyoto, 167-177 (1965)] posed the following *problem: Are any two such manifolds* M *and* $\tilde{M}$ *isometric if and only if the two pairs* $(L_1^2(M),D)$ *and* $(L_1^2(\tilde{M}),\tilde{D})$ *are equivalent?* An answer to the above problem is given in the framework of Global Variational Analysis. (Received February 21, 1977.)

*77T-G59 MURRAY G. BELL, University of Alberta, Edmonton, Alberta, A Cellular Constraint in Supercompact Hausdorff Spaces.

In a topological space X, let c(X) denote the cellularity of X and w(X) denote the weight of X. It is shown that if X is a supercompact Hausdorff space and Y is a closed neighbourhood retract of X, then for all D dense in Y, $c(Y-D) \leq w(D)$. This yields new examples of compact Hausdorff non-supercompact spaces. A necessary condition that the space of closed subsets of X with the Vietoris topology be supercompact immediately follows. (Received February 22, 1977.)

77T-G60 G. R. Gordh, Jr., Guilford College, Greensboro, North Carolina 27410 and C. B. Hughes, University of Kentucky, Lexington, Kentucky 40506. On freely decomposable mappings of continua.

We define a surjective mapping $f:X\to Y$ of metric continua to be freely decomposable if for each decomposition $Y = A\cup B$ (of Y into proper subcontinua) there is a decomposition $X = A'\cup B'$ such that $f(A') \subseteq A$ and $f(B') \subseteq B$. Among the results established are the following: (1) The limit of an inverse sequence of locally connected (semi-locally connected) continua with freely decomposable bonding maps is locally connected (semi-locally connected). (2) Every freely decomposable mapping onto a locally connected continuum without separating points is monotone. (3) Every freely decomposable mapping on a locally connected unicoherent continuum is monotone. (4) Every freely decomposable mapping onto $[0,1]$ is confluent. (Received February 21, 1977.)

*77T-G61 John Ginsburg, The University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2. L-spaces in complete spaces of countable tightness using $\diamondsuit$.

The set theoretic principle $\diamondsuit$ is used to construct hereditarily Lindelof, non-separable subspaces of given complete spaces of countable tightness. The construction is patterned after R.B. Jensen's original use of $\diamondsuit$ to construct a Souslin line, and yields the following result: Suppose X is a regular space of countable tightness having weight at most c. If no non-empty G_δ set in X is contained in a separable subspace of X, and if either X is countably complete or has all closed subsets Baire, then X contains an L-space. (Received February 23, 1977.)

*77T-G62 SCOTT W. WILLIAMS, State University of New York at Buffalo, Amherst, N. Y. 14226. Boxes of Compact Ordinals. Preliminary report.

If $\prod_{n\in\omega} X_n$, as a cartesian product of spaces, is given the box topology, then it is denoted by $\square_{n\in\omega} X_n$. We prove ($\exists$ an ω_1-scale in ${}^{\omega}\omega$) implies $\square^{\omega}(\lambda+1)$ is paracompact $\forall$ ordinals λ. A crucial lemma is $\square^{\omega}(\lambda+1)$ is paracompact whenever $cf(\lambda) \geq \omega_1$ and $\square^{\omega}(\alpha+1)$ is paracompact $\forall \alpha < \lambda$. (Received February 23, 1977.)

*77T-G63 Ronald H. Rosen, University of Michigan, Ann Arbor, Michigan 48109. Regular Neighborhoods of Graphs in Manifolds.

The author proves the following. Theorem A. Let M be a triangulated n-manifold. If G is a graph which is a sub-complex of M, and if N is a regular neighborhood of G in M, then the double of N is homeomorphic to an n-sphere with handles.

This result was announced by M. Brown and the author for oriented manifolds, Notices A.M.S., Vol. 10 (1963), p. 460. The author also shows that the construction in Theorem A always leads to a space homeomorphic to a canonic PL n-sphere with handles. (Received February 23, 1977.)

77T-G64 Bang-yen Chen, Michigan State University, East Lansing, Michigan 48824. Non-immersion theorems for non-linear algebraic hypersurfaces.

The following theorems are proved. Theorem 1. Every (real) 2n-dimensional algebraic hypersurface of degree > 2 cannot immerse in a euclidean space with codimension $4[\frac{n-1}{4}]$, where $[\frac{n-1}{4}]$ denotes the greatest integer less than or equal to $\frac{n-1}{4}$. Theorem 2. If either $n = 9$, 10 or $n > 12$, every 2n-dimensional algebraic hyperquadric cannot immerse in a euclidean space with codimension $4[\frac{n-1}{4}]$. Theorem 3. Every 16-dimensional (resp., 22- and 24-dimensional) algebraic hyperquadric cannot immerse in a euclidean space with codimension 4 (resp., 6). By an algebraic hypersurface we mean a complex manifold which is the zero set of a homogeneous equation in terms of homogeneous coordinates of a complex projective space. (Received February 25, 1977.)

*77T-G65 Ira Rosenholtz, University of Wyoming, Laramie 82071.
There is no differentiable metric for R^n.

The usual metric on R^n is not differentiable. This makes the proof of the "smooth" Urysohn Lemma, for example, differ markedly from the "metric proof." It would be nice to have a differentiable metric for R^n. Unfortunately, we show that no such metric exists. (Received March 4, 1977.)

*77T-G66 STEWART S. CAIRNS, University of Illinois, Urbana, Illinois 61801 and Ulm University, Ulm, West Germany. Canonical knot projections and double point structures.

Each isotopy class of tame oriented knots contains one with a canonical projection $\pi: K \to E^2$, defined thus: (1) $\pi(K)$ is a union of an oriented circle C_0 and $n \geq 0$ disjoint chords (a chord is a segment inside or an arc outside C_0, save for endpoints on C_0); (2) as p traces K from a point whose projection q_0 is not on a chord, $q = \pi(p)$ traces C_0 positively from q_0 to the first chord, traces that chord, goes negatively on C_0 to the next chord, etc., reversing sense on C_0 after each tracing of a chord; (3) the chords are traced twice, the rest of $\pi(K)$ once. If $\pi(K) = C_0 \cup C_1 \cup \cdots \cup C_n$, with chords in order of their first tracings, then $C_0 \cup \cdots \cup C_{n-1}$ is a projection with $n+1$ ordered chords iff $C_1, \ldots, C_{n+1}$ are disjoint, both ends of C_{n+1} are beyond the first tracing of C_n in $\pi(K)$ and are on possibly equal arcs of C_0 of like sense in that tracing. Number all transits

of chords from 1 to 2n in tracing $\pi(K)$. If C_h is traced on transits i_h, j_h with $i_h < j_h$, then $\{(i_1,j_1),\ldots,(i_n,j_n)\}$ is a double point structure of $\pi(K)$. L. B. Treybig (Trans. Amer. Math. Soc. 130(1968), 223-247) characterized these structures, using polygonal knots in regular position. Canonical structures and rules for passing from one for $C_0 \cup \cdots \cup C_n$ to one for $C_0 \cup \cdots \cup C_{n+1}$ offer a relatively simple method. (Received March 14, 1977.)

*77T-G67 J. L. Bryant and R. C. Lacher, Florida State University, Tallahassee, Florida 32306. Resolving 0-dimensional singularities in generalized manifolds. Preliminary Report.

Let X be a generalized n-manifold, i.e., a euclidean neighborhood retract satisfying $H_*(X,X-x;Z) \cong H_*(R^n,R^n-0;Z)$ for each $x \in X$. A singular point of X is a point that has no neighborhood homeomorphic to euclidean space R^n. Let S(X) denote the set of singular points of X. An n-resolution of X is a pair (N^n,f) where N^n is a topological n-manifold (without ∂) and f is a proper, cell-like mapping of N^n onto X. Now suppose $\dim S(X) = 0$ and $n \neq 5$. Then results of Bryant and Hollingsworth [Top. 14(1975), 191-201] and R. D. Edwards [to appear] show that X admits a resolution if and only if $X \times R$ is a manifold. We prove existence. Theorem: X admits a resolution and $X \times R$ is a manifold. The proof uses surgery to construct a PL manifold N^n and a limiting process to construct a cell-like map of N^n onto X. A discussion of the preservation of homotopy normal invariants by cell-like mappings between generalized manifolds is included. (Received March 18, 1977.)

*77T-G68 **Alexander ABIAN, Math. Inst., Univ. of Oxford, Oxford, England and Iowa State Univ., Ames, Iowa, 50011. Conditionally Compact Rings of Functions and their Compactification.**

Let R be a ring of functions from a set X into a ring Y. We say that R is conditionally totally compact iff every ideal of R which misses an element f of R is contained in an ideal J of R which also misses f and for which R/J is isomorphic to a subring of Y.

Let E' be a set of functions from a set X' into the above Y and let f' be a function from X' into Y. We say that f' is covered by the elements of E' iff for every $x \in X'$ if $f'(x) \neq 0$ (the zero of Y) then $g'(x) \neq 0$ for some $g' \in E'$.

Theorem. Let R, X and Y be as in the above. Then X can be extended to a set X' and every element f of R can be extended to a function f' from X' into Y such that the resulting set $R' = \{f' \mid f \in R\}$ is a ring of functions f' from X' into Y and the correspondence $f \to f'$ is a ring isomorphism from R onto R'. Moreover, if an element f' of R' is covered by the elements of a subset E' of R' then f' is already covered by finitely many elements of E'.

Remark. If in the above R has a unit u and the appropriate definitions are restricted to u rather than to an arbitrary f then R is called conditionally compact and the Theorem then ensures the finite subcover of an arbitrary cover of only the unit u' of R'. (Received March 28, 1977.)

*77T-G69 JAMES L. BAILEY, University of British Columbia, Vancouver, Canada. V6T 1W5 A characterization of Alexander invariants of links. Preliminary report.

Let $L \subset S^3$ be an oriented 2-component link, $X = S^3 - L$, and $\tilde{X}$ the universal abelian cover of X. The Alexander invariant of L is $H_1(\tilde{X})$ with the usual Λ_2-module structure where $\Lambda_2 = ZH_1(X)$ (the integral group ring of $H_1(X) \cong Z \oplus Z$) = the ring of finite Laurent polynomials in 2 commuting variables x, y. Theorem: A Λ_2-module is isomorphic to $H_1(\tilde{X})$ for some L iff it has a presentation matrix of the form $\begin{bmatrix} \frac{1-(xy)^\ell}{1-xy} & -(1-x)(1-y)\frac{1-(xy)^{\ell-1}}{1-xy}\beta(x,y) \\ \beta(x^{-1},y^{-1})^t & \alpha(x,y) \end{bmatrix}$ where $\alpha(x,y) = \alpha(x^{-1},y^{-1})^t$ (t=transpose) is a square matrix, $\beta(x,y)$ is a row matrix, both with entries in Λ_2, $\alpha(1,1) = \mathrm{diag}(\pm 1)$ is a diagonal matrix. Further, ℓ is the linking number of the two components and $\alpha(x,1)$ (resp. $\alpha(1,y)$) is a presentation matrix for the Alexander invariant of the first (resp. second) component. Cor: the Alexander polynomial of a link is of the form $\frac{1-(xy)^\ell}{1-xy}A(x,y) + (1-x)(1-y)\frac{1-(xy)^{\ell-1}}{1-xy}B(x,y)$ where $A(x,y) = \det\alpha(x,y)$, $B(x,y) = \det\begin{bmatrix} 0 & \beta(x,y) \\ \beta(x,y)^t & \alpha(x,y) \end{bmatrix}$. Hence the problem of characterizing link polynomials is reduced to characterizing pairs A(x,y), B(x,y) in the corollary. (Received March 29, 1977.)

*77T-G70 BRADD CLARK, University of Southwestern Louisiana, Lafayette, Louisiana 70504. Surgery on torus and cable links.

Theorem If M is a 3-manifold obtained by surgery along a torus link with n components, then M has genus at most n + 1. Theorem If (p_i, q_i) surgery is performed on the ith component of a torus link for $1 \leq i \leq n$ and M is simply connected, then $M \sim S^3$, $q_i = 1$ for $1 \leq i \leq n$ and $\Sigma p_i = 0$. Certain submanifolds of M are considered and embedding theorems are given for homology spheres with finite fundamental groups. This yields: Theorem If M is obtained by surgery on a link which contains a cable sublink about an arbitrary knot k, and the surgery on at least two of the cable sublink components cannot be replaced by surgery on k itself, then M is not simply connected. (Received March 29, 1977.)

77T-G71 Wolfgang Heil, Florida State University, Tallahassee, Florida 32306 and Jeffrey Tollefson, University of Connecticut, Storrs, Connecticut 06268. Deforming a homotopy-involution of a 3-manifold to an involution.

Let $g:M \to M$ be a map of a compact n-manifold M such that g^2 is homotopic to the identity. Is g homotopic to a homeomorphism of period p? For $n = 2$ this is Nielsen's Theorem. F. Raymond and L. Scott have given examples of the failure of this property for $n \geq 3$.

Theorem 1: Let g be a map of a 3-dim, orientable Seifert fiber space M with $\partial M \neq \emptyset$ such that $g^2 \simeq 1$ rel M. Then there is a fibering of M and a fiber preserving involution h of M homotopic to g rel ∂M.

More generally, given a map g of M such that $g^2 \simeq 1$ there exists an obstruction $k(g) \in H^3(Z_2, \text{center } (\pi_1(M)))$ whose vanishing is necessary for g to be homotopic to an involution of M.

Theorem 2: Let g be a map of a sufficiently large, irreducible, orientable, Seifert fiber space M such that $g^2 \simeq 1$. Then g is homotopic to a fiber preserving involution of M if and only if $k(g) = 0$. (Received March 31, 1977.)

*77T-G72 ROBERT A. HERRMANN, U. S. Naval Academy, Annapolis, MD. 21402
Point monads and P-closed spaces.

For each $p \in X$, the w-monad, $\mu_w(p) = \cap\{{}^*f^{-1}[\mu(f(p))] \mid f \in C(X)\}$, is defined and as a corollary to the major result it is shown that a [resp. completely Hausdorff] space X is completely-closed [resp. completely Hausdorff-closed] iff ${}^*X = \cup\{\mu_w(p) \mid p \in X\}$. Numerous applications are given. (Received April 5, 1977.)

77T-G73 D.G. Paulowich, Dalhousie University, Halifax, Nova Scotia, Canada. Trees are weakly contractible. Preliminary report.

Every hereditarily unicoherent, locally connected compact connected Hausdorff space is weakly contractible (in the sense of K.H. Hofmann and P.S. Mostert, Elements of Compact Semigroups, page 53). (Received April 7, 1977.)

77T-G74 SEHIE PARK, Seoul National University, Seoul 151, KOREA. A generalization of a theorem of Janos and Edelstein. Preliminary report.

A generalization of Edelstein's version of a theorem of Janos and its converse are obtained :

THEOREM. Let X be a compact metrizable topological space, f, g be continuous self-maps of X such that $gX \subset fX$, $gf = fg$, and f be injective. Then g is injective and $\bigcap_1^\infty g^n X = \{x_0\}$, where $x_0 \in X$, iff, given λ, $0 < \lambda < 1$, a homeomorphism h of X into ℓ_2 exists such that

$$\|h(gx) - h(gy)\| = \lambda\|h(fx) - h(fy)\|$$

for all $x,y \in X$. (Received April 7, 1977.)

*77T-G75 W. H. Row, University of Tennessee, Knoxville, Tennessee 37916. An Algebraic Characterization of Connected Sum Factors of Closed 3-manifolds.

M and N will be connected, closed, possibly non-orientable, 3-manifolds. A knot group of M is the fundamental group of the complement of a tame simple closed curve in M. We denote the set of knot groups of M by $K(M)$. We call a compact, connected 3-manifold with a torus or Klein bottle boundary a toral 3-manifold. A toral group of M is the fundamental group of a toral 3-manifold contained in M. Let $T(M)$ denote the set of toral groups of M. THEOREM: $T(M)$ contains $K(N)$ iff N is a connected sum factor of M. CORCLLARY: $K(M) = K(N)$ iff M is homeomorphic to N. The method of proof involves selecting an appropriate property P knot group of N that depends only on N and the Haken number of M. Map improvement techniques of Feustal are mimicked to finish the proof. The corollary generalizes announced results of A.C. Connor and Jaco-Myers. (Received April 11, 1977.)

*77T-G76 Dix H. Pettey, University of Missouri, Columbia, Missouri 65201. Feeble compactness and regular filterbases. Preliminary report.

A topological space is said to be feebly compact iff every countable open filterbase in the space has a cluster point. It is well-known that every regular-closed space is feebly compact. THEOREM. If X and Y are topological spaces, $X \times Y$ is feebly compact, and $\mathcal{B}$ is a regular filterbase in $X \times Y$, then $\{\pi_X(B) | B \in \mathcal{B}\}$ is a regular filterbase in X. COROLLARY. If X and Y are regular-closed (minimal regular) spaces, then a necessary and sufficient condition that $X \times Y$ be regular-closed (minimal regular) is that it be feebly compact. (In [Abstract 77T-G53, these Notices 24 (1977), A-302], the author announced a proof that the product of a regular-closed (minimal regular) space and a feebly sequentially compact, regular-closed (minimal regular) space is necessarily regular-closed (minimal regular). Since the product of a feebly compact space and a feebly sequentially compact space is always feebly compact, this result follows immediately from the above corollary.) (Received April 11, 1977.)

*77T-G77 ANDREW J. CASSON, Trinity College, Cambridge University, Cambridge, England and JOHN L. HARER, University of California at Berkeley, Berkeley, California Some Brieskorn Homology 3-spheres Which Bound Contractible Manifolds. Preliminary report.

Let $\Sigma(p,q,r)$ be the Brieskorn homology 3-sphere given as $\{(x,y,z)\in\mathbb{C}^3: x^p+y^q+z^r=0, x\bar{x}+y\bar{y}+z\bar{z}=1\}$ (p,q,r pairwise relatively prime positive integers). We consider the classes $\Sigma(p,ps+1,ps+2)$, $\Sigma(p,ps-1,ps-2)$ both with p odd and s arbitrary, $\Sigma(p,ps-1,ps+1)$ with p even and s odd and the special cases $\Sigma(2,3,13)$ and $\Sigma(2,3,25)$, realizing each of these as the boundary of a contractible 4-manifold. For the infinite classes, we give two constructions of such 4-manifolds: the first as a 2-fold cover of B^4 branched along the image of a proper critical-level imbedding of a disk with two 0-handles and one 1-handle; the second as a 4-dimensional handlebody with one 0-handle and an algebraically cancelling pair of 1 and 2-handles (Mazur manifold). The second construction also works for the cases $\Sigma(2,3,13)$ and $\Sigma(2,3,25)$, although $\Sigma(2,3,25)$ requires two cancelling pairs. (Received April 11, 1977.)

77T-H2 FRANK WILLIAMSON, JR., University College, Rutgers University, Newark, New Jersey 07102.
The finite element method in the early calculus of variations.

It is shown that the variational form of the finite element method is much older than the 1943 work of R. Courant usually cited as the first appearance of the method. The procedure dates from the late 17th century and was one of a class of methods used for deriving differential equations. (Received April 4, 1977.) (Author introduced by H. Levinson.)

743RD MEETING
University of Alabama
Huntsville, Alabama
March 31–April 1, 1977

743-E14 James L. Wang, University of Alabama, University, Alabama 35486. Approximation on boundary sets. Preliminary report.

Let U be a bounded open subset of the complex plane. By a well known result of A. M. Davie, C(bU) is the uniformly-closed linear span of A(U) and the powers $(Z-Z_i)^{-n}$, $n = 1,2,3,\ldots$ with Z_i a point in each component of U. We show that if A(U) is a Direchlet algebra and bU is of infinite length, thenone power of $(Z-Z_i)$ is superfluous. This generalizes a result of Wermer (Amer. Math. Monthly, 64(1957), p. 372). (Received February 4, 1977.)

*743-E1 JOSEPH BARBACK, SUNY College at Buffalo, Buffalo, New York 14222
Regressive isols and series over their finite sums.

We would like to announce some results that involve infinite recursive series over finite sums of regressive isols. These are with respect to recursive functions in one variable. The idea for these series is based upon the infinite series of the kind introduced by J.C.E. Dekker. The work was motivated by a theorem of F. Sansone which states, when f is a recursive function having an increasing first difference function then it's extension to the isols will be order preserving on the regressive isols. We obtain a generalization of this result and also a characterization of the recursive functions whose extension will map finite sums of regressive isols to the isols. Proof of the latter result is given by E. Ellentuck. (Received February 7, 1977.)

745TH MEETING

Northwestern University
Evanston, Illinois
April 15–16, 1977

*745-A20 Jin Bai Kim, West Virginia University, Morgantown, W. Va. 26505. The tree defined by a sequence of non-negative integers.

Let (f_n) be a sequence of non-negative integers. Let f_n^2 be the binary number of f_n $(=f_n^{10})$. Let $f_n^2 = a_k a_{k-1} \cdots a_2 a_1$. For f_n^2, we define $n(f_n^2)=k$ and $m(f_n^2) = n(f_n^2)+$(the number of ones in f_n^2). For a_i, we assign $\downarrow$ when $a_i=0$ and $\swarrow$ when $a_i=1$. This rule can define a tree of the sequence f_n^2 $(n=1,2,\ldots)$. Let $T(f_n^2)$ denote the tree define by the above. The tree $T(f_n^2)$ is said to be permanent if $n(f_{n+1}^2) \leq m(f_n^2)$. $T(f_n^2)$ is permanently well growing if $n(f_{n+1}^2)=m(f_n^2)$ for all $n=1,2,\ldots$ The age of the tree $T(f_n^2)$ is defined as follow: $\text{age}(T(f_n^2)) = \min\{t: n(f_{t+1}^2) > m(f_t^2)\}$. We can extend this notion. If f_n^3 represents the ternary number of f_n, then we assign $\downarrow$ for $a_i=0$, $\swarrow$ for $a_i=1$ and $\downarrow\!\!\swarrow$ for $a_i=2$, where $f_n^3 = a_k \cdots a_2 a_1$. We discuss problems of trees $T(f_n^i)$ $(i=2,3)$ for sequences f_n. (Received February 28, 1977.)

746TH MEETING

California State University
Hayward, California
April 22–23, 1977

746-A19 Hugh M. Edgar, San Jose State University, San Jose, California, 95192. Relative integral bases for algebraic number fields. Preliminary report.

Theorem 1. Assume that $D > 0$, $D \neq 3$, and $(-D, a) \not\equiv (2,3)$ or $(3,2) \pmod 4$, where a and D are distinct square free rational integers and $D \neq a$. Let $F = Q(\sqrt{-D})$ and let $E = F(\sqrt{a})$. Then E/F has a relative integral basis iff $(a, D) = 1$. If $(-D,a) \equiv (2,3)$ or $(3,2) \pmod 4$ then E/F has no relative integral basis. Theorem 2. Assume that the algebraic number field F has class number $h(F) > 1$. Let $\mathfrak{p}$ be a non-principal prime ideal of O_F and assume that $pO_F = \mathfrak{p}^2$ where the prime p is odd. Choose $\pm p \equiv 1 \pmod 4$ and assume $\sqrt{\pm cp} \in F$ where the square-free rational integer c is relatively prime to p. Let $E = F(\sqrt{\pm p})$. Then E/F has no relative integral basis. Application of Theorem 2. Let $F = Q(\sqrt{cp})$ with c and p as in Theorem 2 and $c \equiv 2 \pmod 8$, $p \equiv 5 \pmod 8$. Let $E = F(\sqrt{p})$. Then E/F has no relative integral basis. (Received February 28, 1977.)

*746-C14 LUCY LAM KING, Montefiore Hospital Medical Center, Bronx, New York 10467, Statistical Approach to Quality Control in Clinical Chemistry Laboratories

Based on the distribution of patients' results for a given blood chemistry test, the consecutive batch means and their moving averages are used for tracking trends in the multi-channel auto-analysers. A transformation of the distribution may be necessary for a given test to approximate the resultant distribution to a

Gaussian. Constants for the moving averages are optimized via min-max methods to give the smallest batch size and detectable deviation from the norm, but the largest true positive to false positive ratio. (Received February 28, 1977.) (Author introduced by Dr. Francis G. King).

746-C15 ROBERT W. MacCORMACK, NASA Ames Research Center, Moffett Field, California 94035. An efficient numerical method for solving the time-dependent compressible Navier-Stokes equations for high Reynolds number flows past arbitrarily shaped bodies. Preliminary report.

This report describes a new numerical method that has been used to drastically reduce the computation time required to solve the Navier-Stokes equation at flight Reynolds numbers. Though flows past complete aircraft configurations are still beyond our reach, the new method makes it possible and practical to calculate many important three-dimensional, high Reynolds number flow fields on today's computers. (Received March 17, 1977.) (Author introduced by Craig Comstock).

ERRATA
Volume 24

C. J. MOZZOCHI, A remark on Goldbach's conjecture VI. Abstract 77T-A43, Page A-223.
Line 5, for "Hilbert transform" read "Hilbert transform kernel".

B. J. PEARSON, The Hahn-Mazurkiewicz theorem for hereditarily locally connected continua. Abstract 77T-G44, Page A-264.
The theorem stated holds for finitely Suslinian continua and not for hereditarily locally connected continua as claimed.

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MATHEMATICIAN. Ph.D., 1973. Specialties: Algebra and Geometry. Publications. Four years experience as Naval Officer. Desire Academic or industrial position with research duties. References and transcripts supplied upon request. Robert E. Seydel, 909 39 St. Court, Moline, Illinois 61265.

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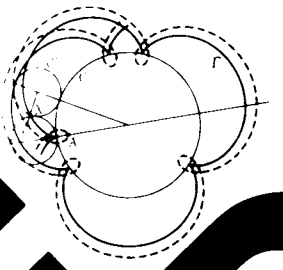

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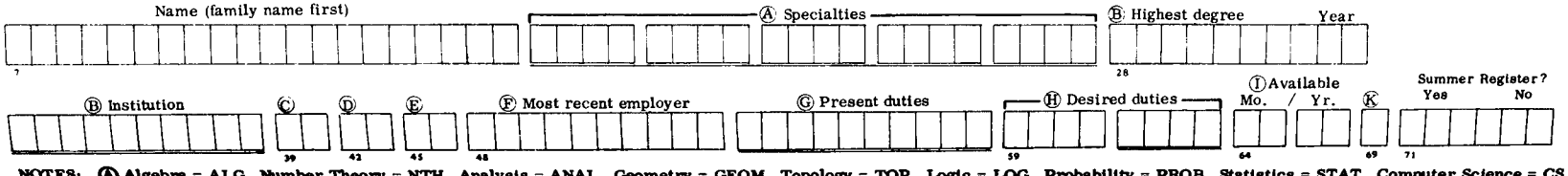

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