At the Frontiers of Science: The NAS Throws a Symposium

Peter L. Renz

Blackboard presentations with a few slides have given way to vue-graphs and computer images. The machines range from modest work stations to super computers. This was the style at the National Academy of Science's (NAS) second annual "Frontiers of Science Symposium," held at the Arnold and Mabel Beckman Center in Irvine, California, 1–3 November 1990. Mathematics was in evidence, not only in the dynamical systems sessions organized by William P. Thurston, but in most of the other nine sessions as well.

Roughly 50 out of 100 scientists attending had obvious mathematical sides to their professional work—the exceptions being in biology or chemistry. But Eric Lander of the Whitehead Institute for Biomedical Research, mathematician and organizer of the session on gene regulation, said that mathematics and computers are essential in these areas for sequencing and pattern recognition.

To attend was to think about fundamentals of one's own field and of the fields of others. Why? Ask yourself how you would explain some piece of mathematics to molecular geneticists. You get the idea. Imagine listening to a like explanation by an organic chemist. Concentrate this into twenty hours of scientific sessions with seventeen hours scheduled for coffee breaks, meals, and informal com-

Students Welcome at the New Orono Mathfest

National meetings can make a difference in the lives of students. In a letter that Diane L. Herrmann, now a member of the Department of Mathematics at the University of Chicago, wrote to MAA representatives before the January 1991 Annual Meeting in San Francisco, she explained:

"When I was in college, we piled as many of us as would fit in a van or two and drove across Pennsylvania in January to go to the MAA meeting in Washington. We shared gas money, slept as many as possible to a hotel room, and ate at cheap restaurants. We went to a few talks, when we understood words in the titles. We spent time off our campus with faculty members who shared with us stories of their own student days. We even went to the business meeting for a while. For a few days we found ourselves in the company of all these hundreds of mathematicians. It was an amazing time."

Now the MAA Committee on Student Chapters and Pi Mu Epsilon (PME) are rolling out the red carpet once again to welcome students to the Summer Meeting that takes place from 8–10 August 1991, in Orono, Maine. To bring students together during the meetings, PME and the MAA will host a reception for students on Friday evening. Throughout the meeting, the Student Hospitality Center will provide a place where students can get acquainted with each other and where they can obtain meeting information from members

Photograph courtesy of Peter L. Renz

Mathematician Jean E. Taylor of Rutgers University and physicist Michael Widom of Carnegie-Mellon University discuss the x-ray spectra of aperiodic arrangements of atoms during the National Academy of Science's *Frontiers of Science Symposium.*

*(**Frontiers** continued from front page.)*
munication over two and one-half days and the picture is complete. The spirit was open; areas of ignorance were discussed frankly, and detailed, recent knowledge was evident.

In order of presentation the sessions were: atmospheric science and air pollution, dynamical systems, gene regulation and transcription, magnetic resonance imaging, galaxies and the distribution of matter in the universe, the physics of quasicrystals and high temperature superconductors, how the earth works, unexpected scientific computing, neural networks, and photosynthesis.

I will sketch the earth science session, which was typical, and cover other areas as space allows, emphasizing mathematical problems and methods.

Danger, Earth at Work   David Stevenson of Caltech began his talk, "How the Earth Works," remarking, "Ignorance is more interesting than knowledge." He discussed problems of plate tectonics (plates aren't completely rigid), mantle convection (difficult to measure or model, unknowns include the importance of vulcanism and melting, just one of the complexities of the mantle interacting with crustal plates), and geomagnetism (a dynamic phenomenon).

The search for understanding gives life to our subjects. Hence Stevenson's interest in ignorance.   General mechanisms are known. The earth is a heat engine: heat from the core drives mantle convection which in turn drives the crustal plates. Some details are known: the variations of the earth's magnetic field over several hundred years, the movements of the crustal plates, and activity of volcanic hot spots over hundreds of millions of years. Yet full understanding remains elusive.

Jeremy Bloxham of Harvard University described his analysis of changes in the earth's magnetic field based on magnetic navigational surveys extending back over 300 years. The changes arise

Photograph courtesy of Peter L. Renz

Starting from a decapod seed and adding only those tiles forced by their local rules, Paul Steinhardt and Kevin Ingersent, his student, generated this rapidly growing Penrose tiling of the plane. The five-fold rotational symmetry about the decapod imperfection is evident. Steinhardt and Ingersent conjecture that these rapidly growing patterns model the actual growth of quasicrystals.

from dynamo action in three convection rolls in the Earth's core oriented in the direction of the earth's axis and tangent to the inner core. Fluid velocities are a surprising 20 kilometers per year.

What we know about the movement of crustal plates above hot spots in the mantle comes from analysis of the rocks and corals of islands and submerged sea mounts in the Pacific. The coral reefs, which can only grow at certain depths, tell a good deal. Marcia McNutt of MIT spoke of this work.

Michael Gurnis of the University of Michigan showed how advances and retreats of continental coastlines can be simulated by treating the continents as an isostatic "scum" floating on the mantle. The model was simplified, the details were suppressed, but the video was convincing—suggestive of the evolution of real continents.

The mathematical tools used included analysis of fields by spherical harmonics, partial differential equations and their numerical solutions, and visual representation of the results.
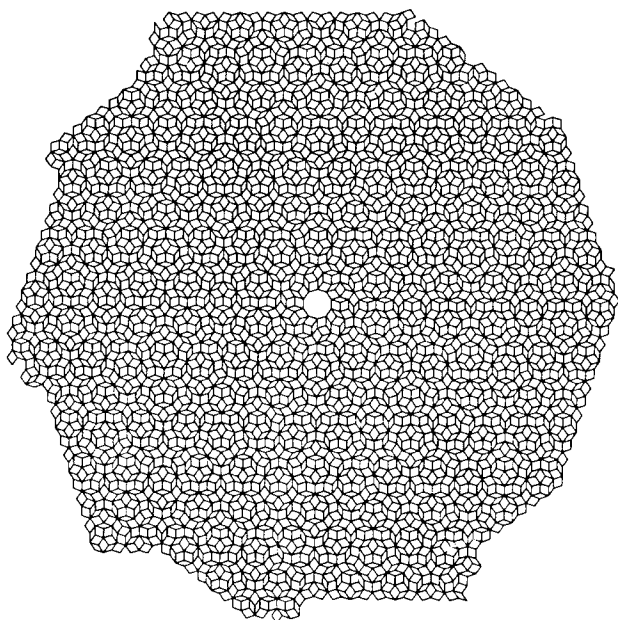
Chaos at Work?   John Hamel Hubbard of Cornell University led off on dynamical systems. He raised philosophical and mathematical questions. Is the "butterfly effect" real? Is the weather in New York significantly affected by minor disturbances such as a butterfly flapping its wings in Japan six months earlier? Is the quantum uncertainty of Heisenberg magnified by the expansive dynamics of an unstable system (a pencil balanced on its tip) to make the eventual outcome totally unpredictable? Is the unrolling of events deterministic but governed by a script that we cannot read in infinite detail (because of quantum limitations on measurement) or is it nondeterministic with some random element (free will)?

How to address such questions? We find models in the chaotic dynamics of simple systems that can be exquisitely sensitive to both initial conditions and parameters. These systems can show exponential divergence under perturbation. For the weather models used by the French Atmospheric Sciences Institute, Hubbard gave an estimate of two to three days for the doubling time of perturbations, about right to make the butterfly effect real. Roughly the same number of doublings would make the "balanced" quantum pencil fall in a few seconds. But a physicist in the audience pointed out that, for the pencil, perturbations from photons will "collapse the wave packet" and settle the fate of the pencil before the blow up of Heisenberg uncertainty did the job. Audience involvement here was a sign of a successful speaker.

Hubbard's related mathematical question arises from looking at the dynamics of a system like $x_{n+1} = 10x_n \pmod 1$, where x_0 is a real number between 0 and 1. This drops the leading digit of x_n and shifts the other digits one place left. A random choice for x_0 should give random leading digits for the x_k. Think of these leading digits as the observables of the process, the rest of x_k being beyond our quantum limit of observation. Easily written down seeds, x_0, give nonrandom sequences of observables, these being of little interest. Hubbard suggests that for reasonable seeds, x_0, looking at $x_{n+1} = 2x_n^2 - 1$ will yield as random a string of observables as you might wish. This makes $x_k = cos(2^k x_0)$, and for most rational choices for x_0 the angles $2^k x_0$ should fall randomly around the circle. Is this a short program capable of generating pseudorandom digits or numbers as random as one might wish? To prove or refute this assertion, one must deal with problems of machine precision and reasonable definitions of pseudorandomness. Note that 1/2 is not a good choice for x_0.

Hubbard suggested that interesting things (Julia sets, the Mandelbrot set, living things) are specified by exceptionally short programs (quadratic formulas, genetic codes). He pointed out that the roughly
*(**Frontiers** continues on next page.)*

(Frontiers continued from previous page.)
100 trillion cells in our bodies are coded by roughly 4 billion bits in our DNA. "All interesting strings have low information content," said Hubbard. The study of information content of strings and sequences from an algorithmic point of view goes back to Kolmogorov and has been exploited by Gregory Chaitin more recently. Does all this have significant implications for biology? It is not clear how to start on such a question, but many interesting questions about dynamics can be pursued theoretically and experimentally, including the behavior of $x_{n+1} = 2x_n^2 - 1$.

"Chaos" and "fractals" are hot, and speaker Steven G. Krantz of Washington University added heat to the debate about the merits of fractal geometry at this meeting and elsewhere. (See *The Mathematical Intelligencer*, [3(4), 1989] for some of the controversy.) The question is partly what is legitimate science. John Hubbard reported a recent conversation with Mitchell Feigenbaum: "He [Feigenbaum] said that when he understood what was going on his work was done. I feel that is where my work begins." This shows one physicist's emphasis on discovery and one mathematician's emphasis on proof within a standard mathematical field. Full proofs of the universal path to chaotic behavior through period doubling that Feigenbaum discovered came later in papers of Oscar Lanford III, Jean-Pierre Eckmann, and Pierre Collet. Who gets the glory? When a broader public is involved, the mathematical community is not the sole arbiter. This loss of control heats the debate.

Bob Devaney of Boston University and Curt McMullen of Berkeley also spoke in this session. Devaney saying that chaos was oversold as a revolution comparable to relativity theory and quantum mechanics. He noted that Steve Smale and his coworkers analyzed chaotic dynamics in the 60's. The publicity and glitzy pictures have good and bad effects, he said. His hope is that one long-lasting good effect will be to get students and teachers fired up about mathematics, and, though he did not mention it, he has written two texts on the subject, one aimed at the seniors to graduates and the other for secondary schoolers. The audience saw the good side, with comments including: "Hype is probably good because it works" and "Computers are wonderful...they make it clear that mathematics does not exist simply in the imaginations of a few mathematicians."

A questioner asked what use could be made of chaos. William Thurston answered quickly that the sensitivity of orbits in the solar system to perturbations allows us to sling satellites into far flung orbits with small course corrections. Chaotic dynamics to the rescue. Sweet are the uses of adversity.

McMullen spoke for the field, giving a short sketch of quadratic dynamics in the complex plane: Julia sets, attractors, period doublings, the Mandelbrot set, bifurcations leading to chaotic behavior. I found McMullen a welcome change of tone.

Physicist Michael Widom of Carnegie-Mellon remarked at lunch that the mathematics session was more about the sociology of science than about science itself, but was interesting in any case. Astronomer Edmund Bertschinger of MIT later commented that the mathematics sessions were interesting and enlightening. He enjoyed seeing how mathematicians dealt with the unaccustomed problems of the glare of publicity, a problem more common in astronomy where discoveries like quasars and distant objects regularly stir public interest.

Unexpected Galaxies, Dark Matter, and Clumping   Anthony Tyson of AT&T Bell Labs was the lead speaker on astrophysics. Using a charge coupled device 100 times more sensitive than the fastest photographic emulsions, he surveyed a portion of the southern sky, discovering an unexpected dense background of faint
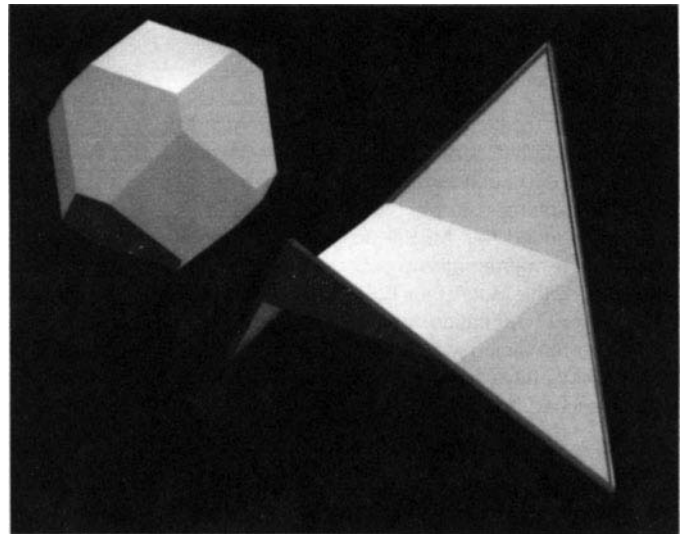
Jean E. Taylor's anisotropic soap films in which the surface energy depends on the area and direction of the surface element. At the top left is the resulting polyhedral soap bubble and, to the right, the corresponding minimal energy surface spanning a bent wire frame. © *Copyright Geometry Supercomputer Project 1988.*

bluish galaxies. With magnitudes of 24 to 30, these are roughly 10^{-10} as bright as the faintest objects visible to the naked eye. They are too faint to allow precise observations of their redshifts, but indirect methods put these in the range from 1 to 3. There are 200,000 of these galaxies per square degree throughout the sky.

From distortions of the images of these galaxies, Tyson and others calculate the gravitational lensing by dark matter in intervening galactic clusters. Computer modeling of these effects was displayed on video. It showed that dark matter is diffused through these clusters, not concentrated in the galaxies themselves. The lensing patterns were very distinct, and Tyson's images corresponded to the diffuse case. Measurements of dynamics of nearby galaxies and of gravitational lensing indicate that well over ninety percent of the matter in the universe is dark. The nature of this dark matter is controversial, but it clearly dominates the gravitational picture of the universe. Tyson's faint galaxies give us a way to track this elusive stuff.

Computation and computer generated videos were also used by Edmund Bertschinger, who spoke on the emergence of galaxies and larger structures in the universe through gravitational instabilities. His calculations done with James Gelb on a supercomputer followed 16 million particles coalescing to strings, sheets, and lumps in a cube roughly 160 million light years on a side over a 15-billion-year period. These computations show clumping consistent with present observations arising from early states consistent with the smoothness of the 3K background radiation.

Quasicrystals, Logic, and a Need for New Ideas   High school geometry shows that a crystal lattice can't have five-fold rotational symmetry. Hence the surprise when solids, now called quasicrystals, with such symmetries were discovered. More fantastic yet, the aperiodic tiles invented by Roger Penrose can be used to analyze these solids. The whole aperiodic tiling business began at AT&T Bell Labs with Hao Wang's attack on an esoteric decision-theoretic problem in logic. It would be difficult to imagine a more improbable link: decision theory to aperiodic tilings to a new form of matter. Peter Bancel of the Centre National de Recherches Scientifiques

State Mathematics Coalitions

John D. Neff

The Mathematical Sciences Education Board (MSEB) of the National Research Council (NRC) has awarded grants of approximately $10,000 each to organizations in forty-eight states and the District of Columbia to plan state mathematics coalitions. Several sponsors funded this MSEB program to establish a national network of state mathematics coalitions, including the Exxon Education Foundation, the MacArthur Foundation, the Carnegie Corporation, and the Ford Foundation. In addition, coalitions have been initiated in the two remaining states with funds from other sources. Half of the coalitions have been operating for at least a year; the other half were launched in 1991.

The project was initiated in 1989 and is engaged in establishing alliances of state leaders from the education, public policy, and corporate sectors to promote state policies and local actions that are based on national standards for excellence, such as those set forth in the reports: *Everybody Counts: A Report to the Nation on the Future of Mathematics Education* (National Research Council) and *Curriculum and Evaluation Standards for School Mathematics* (National Council of Teachers of Mathematics). In their February 1990 proposal towards six national goals for education, President Bush and the nation's governors cited these standards.

The national goal of mathematical literacy encompasses analysis and communication as well as computation. It views mathematics as a science and language of patterns with and about which students must be able to read, write, speak, think, and continue to learn. It is the task of these state mathematics coalitions to aid schools and districts in developing programs that meet these higher expectations for mathematics instruction.

Possible Coalition Initiatives

- alternative certification of teachers (Georgia and others)

- use of "loaned" teachers from business and industry (Idaho and others)

- push for a four-year (or at least a three-year) minimum mathematics requirement in the high schools (Kansas and others)

- impacting textbook selection (Kentucky and others)

- publishing a survey of mathematics education (Minnesota, New Mexico, Utah, West Virginia, and others)

- promoting the use of video technology for small rural schools (Nebraska and others)

- encouraging the use of e-mail for mathematics teachers (Wyoming and others)

Each coalition operates at the highest level of statewide leadership in mathematics education reform. Viewed collectively, they offer promise of a coherent national approach to policy revision and systemic change in the mathematical sciences. The MSEB is now completing plans for a computer network that will link the state coalition directors with each other and with key state, regional, and national leaders in a Mathematics Education Leadership Network.

It is difficult to summarize briefly the activities of the twenty-seven coalitions that have been operating for at least a year, much less to anticipate the direction that the twenty-four newly formed state partnerships will take. A very broad overview shows that the kinds of persons who have agreed to serve on the coalition boards of directors include governors, former governors, state superintendents of education, university presidents, mathematicians, scientists, corporate executives, legislators, state university system chancellors, and members of the state board of education. This indicates the importance of the coalitions at the state level.

Speaking as a member of the Georgia Coalition, I can report the following specifics about this one state partnership. The Board currently includes the current and former chancellors of the state university system, the presidents of Georgia Institute of Technology and Kennesaw State College, the state superintendent of education, the governor, the chairman of the Senate Appropriations Committee, the director of the US Education Operations of IBM, the executive vice-presidents of Georgia Power Company and Southern Bell, a senior executive of Chick-fil-A, a Georgia-based, national, fast-food company, and a research communications specialist who, for many years, coanchored a local television news program. Other corporate people are currently being identified and approached at this writing. The response to date has been remarkable in that the person at the top has always accepted, instead of delegating the responsibility to some staff person to serve as contact. One positive result so far has been the rewriting of the certification requirements for secondary mathematics teachers, which is partially due to the existence of the coalition. This has been extremely encouraging for all of us. For further information on the coalition in your state, contact: Robert J. Kansky, Mathematical Sciences Education Board, 818 Connecticut Avenue Northwest, Suite 500, Washington, DC 20006, (202) 334-1486.   ■

John D. Neff is Professor of Mathematics at Georgia Institute of Technology in Atlanta, Georgia.

Supporting Standards for Teaching Mathematics

James R. C. Leitzel

Increasing levels of mathematical literacy placed on our society require corresponding change in the teaching of mathematics and in the preparation of teachers of mathematics. Speaking to the changes needed in the preparation of teachers of mathematics, the Mathematical Association of America (MAA), together with the National Council of Teachers of Mathematics (NCTM), and the Mathematical Sciences Education Board (MSEB), participated in a joint media event on 12 March 1991. The event, held at the National Press Club in Washington, DC, heralded the release of three major documents addressing both new standards for the preparation of teachers of mathematics and the support that concerned communities need to provide for teachers to effect change in the classroom.
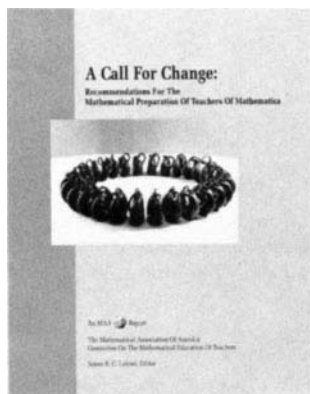
A Call for Change: Recommendations for the Mathematical Preparation of Teachers of Mathematics, prepared by the MAA's Committee on the Mathematical Education of Teachers (COMET), was endorsed by the MAA Board of Governors at its January 1991 meeting in San Francisco. The document, rather than presenting a list of courses, speaks to the experiences needed by prospective and practicing teachers as they study mathematical topics in college and university classrooms. *A Call for Change* discusses standards common to the preparation of mathematics teachers at all levels, in addition to giving specific recommendations for the elementary (K–4), middle (5–8), and secondary (9–12) school levels. It describes the preparation teachers need so that they come to view mathematics as a system of interrelated principles, communicate mathematics orally and in writing, understand the elements of mathematics modeling, understand and use calculators and computers in the teaching and learning of mathematics, and appreciate the development of mathematics

historically and culturally. The document calls for significant change in the way that the teaching and learning of mathematics is currently taking place in many collegiate classrooms.

The NCTM's *Professional Standards for Teaching Mathematics* is a complementary document to its *Curriculum and Evaluation Standards for School Mathematics.* These two sets of standards are part of the NCTM's commitment to provide direction for the reform of school mathematics. The kind of classroom teaching envisioned in the *Professional Standards for Teaching Mathematics* differs significantly from what many teachers have experienced as students in mathematics classes. The document also emphasizes that teachers are key figures in changing how mathematics is taught and learned in schools.

Recognizing that teachers are key figures in the reform of school mathematics and that long-term support and adequate resources are essential to achieve that reform, the MSEB's *Counting on You: Actions Supporting Mathematics Teaching Standards* addresses the broader community. It details the important supportive roles various concerned constituencies must play if the standards for mathematics teaching are to be attained.

Mathematics continues to be a dynamic, changing discipline. Current mathematical topics should find their way into classrooms. Technology provides new approaches for teachers to engage their students in the teaching and learning of mathematics. The preparation of teachers of mathematics must adapt to these changing realities. These documents just issued by three major professional organizations present a consensus on what that preparation and continuing professional development must include. To answer this strong "call for change" requires action on everyone's part. You can begin by getting copies of these documents and discussing their contents with colleagues and administrators. However, for college and university faculty, the most important contribution to the revitalization of undergraduate mathematics is careful, thoughtful reflection on issues of teaching and learning.   ∎

James R. C. Leitzel of the Ohio State University chairs the MAA's Committee on the Mathematical Education of Teachers (COMET). He is serving this year as a Visiting Mathematician at MAA Headquarters in Washington, DC.

Visiting Mathematicians Sought for MAA's Washington, DC Headquarters

Marcia P. Sward, Executive Director

The MAA's Washington, DC office is a busy and exciting place these days. Education is high on the national agenda, and the MAA has more good things to do than staff to do them. If you have a sabbatical coming up or if you are about to retire, and if you are interested in national mathematics issues, think about spending a semester or a year at MAA Headquarters as a *Visiting Mathematician.* A summer in Washington is also possible. The MAA cannot pay full salary for Visiting Mathematicians but we can provide a modest housing allowance in case of need.

Andrew Sterrett, recently retired from Denison University, has been at the MAA for over a year, initially serving as the first Visiting Mathematician and then, after the departure of Peter L. Renz, as Interim Associate Director for Publications and Programs. In addition to supervising the Publications Department, Andy developed attractive career materials and helped launch our Student Chapters. In April, Andy and his wife Betts will return to Ohio with memories of an interesting and fruitful year.

James R. C. Leitzel came on board as the second Visiting Mathematician last September, with 50% time support from the Department of Mathematics at Ohio State University. Jim's primary responsibilities so far have been completion and release of the new MAA report, *A Call for Change: Recommendations for the Mathematical Preparation of Teachers of Mathematics,* management of the Curriculum Action Project, and development of proposals for two new projects—one on collegiate mathematics education and the other on Section workshops on NSF funding.

If you think you might be interested, please call me at (202) 387-5200 or write and tell me about your background and interests: The Mathematical Association of America, 1529 Eighteenth Street Northwest, Washington, DC 20036-1385. The MAA Staff and Services Committee will review all applications and make appointments on the basis of (1) the needs of the office, and (2) the interests and skills of the applicant.

1990 Meritorious Service Awards

EASTERN PENNSYLVANIA AND DELAWARE SECTION

Doris J. Schattschneider
Moravian College
Bethlehem, Pennsylvania

IOWA SECTION

Arlington M. Fink
Iowa State University
Ames, Iowa

METROPOLITAN NEW YORK SECTION

Harry D. Ruderman
Hunter College High School
New York, New York

PACIFIC NORTHWEST SECTION

Calvin T. Long
Washington State University
Pullman, Washington

Doris J. Schattschneider received her doctorate from Yale University in 1966 and, in 1968, joined the faculty of Moravian College. She has earned international recognition for her work with tessallations of the plane, as well as for her exposition of the mathematical nature of M. C. Escher's art.

Professor Schattschneider has devoted years to the mathematical community. She has served the Eastern Pennsylvania-Delaware Section as both its Vice-Chair and Chair and, from 1986 through 1989, as its Governor. At the national level, she has served as both Associate Editor (1976–1980) and Editor (1980–1985) of *Mathematics Magazine*. Professor Schattschneider currently participates in the "Visual Geometry Project" funded by the National Science Foundation and based at Swarthmore College.

Before joining the faculty at Iowa State University, where he received his PhD in 1960, Arlington M. Fink taught at the University of Nebraska. He served as both Chair and Governor of the Iowa Section and, since 1987, has been a Section Lecturer. During his term as Chair, Professor Fink initiated the tradition of joining his Section's meeting with the Iowa sections of the Society for Industrial and Applied Mathematics (SIAM) and the American Statistical Association (ASA). He also played a seminal role in developing student paper sessions.

Professor Fink has published sixty-nine research papers as well as a textbook. He remains active in several areas including differential equations, optimization, and control theory. In addition, he has supervised nine PhD students who regard their work with Professor Fink a challenging and rewarding experience.

Since 1933, Harry D. Ruderman has actively participated in numerous Association endeavors. Indeed, he has served his Section in virtually every way possible. He served as Vice-Chair for High Schools (1948, 1952, 1975–1976, and 1979–1980); as regional coordinator of the MAA's American High School Mathematics Examination (AHSME), and as a member of the Mathematics Speakers Bureau since its inception in 1958. Dr. Ruderman was the first Chair of the Greater Metropolitan Math Fair and has contributed to its planning for more than twenty years.

Dr. Ruderman has dedicated his life to inspiring and developing mathematicians and mathematics teachers. For more than fifty years, he has taught mathematics, delivered talks, conducted workshops, written intriguing contest questions, contributed to journals, and judged mathematics contests and fairs. Although Dr. Ruderman has "officially" retired from teaching, he continues to exemplify all the qualities we seek in a master teacher.

In 1955, after studying with Ivan Niven, Calvin T. Long received his PhD from the University of Oregon. The following year he joined the faculty at Washington State University where he continues to teach with distinction. He served as Chair of his Section (1967–1968) and as Governor (1982–1985). In addition, he has served on several committees and panels for the Section and has advised the Washington state government on mathematics education. Moreover, he has led many projects for the improvement of mathematics education, including securing grants for inservice training of mathematics teachers.

For more than thirty years, Professor Long has delivered lectures and colloquia at colleges and high schools, stimulating the imagination and curiosity of both students and teachers.

of the MAA's Committee on Student Chapters. The Hospitality Center will be located in the Coe Lounge of the Memorial Union and will be open from 8:00 am to 5:00 pm, Thursday through Saturday.

Carl L. Leinbach of Gettysburg College and Marvin L. Brubaker of Messiah College will conduct a workshop entitled *Using the DE-RIVE Computer Algebra System to Generate Conjectures.* It is open only to students. The workshop will include an introduction to **DERIVE** and will illustrate the system's many capabilities for doing mathematics at the algebra, calculus, and linear algebra levels. There is no charge for the workshop, but students should preregister for it when they register for the meeting. (See the Minicourse Registration Form on page thirty-one of this issue.)

This year, Henry O. Pollak will deliver the Pi Mu Epsilon sponsored Frame Lecture—always a high point of the Summer Meetings. Dr. Pollak will discuss a subject which has fascinated him for many years—*Some Mathematics of Baseball.* In addition, both the MAA and PME will sponsor sessions of student papers, including reports from the winning teams of the 1990 Mathematical Contest in Modeling (MCM). The contributed papers session, *Relating mathematics to the real world: Applications of mathematics for classroom use,* will interest both students and faculty members who are on the look-out for real world applications. James R. C. Leitzel of Ohio State University and Rogers Newman of Southern University have organized this session.

On Friday, 9 August 1991, at 7:00 am, MAA Student Chapter Advisors and Coordinators may enjoy a Breakfast in the West Wind Dining Room of Wells Common.

Moreover, the Orono Mathfest will offer several entertaining activities, including a Lobster Cookout, a Moose Watch, a Whale Watch, and an old-time New England contradance. The music is the traditional music of New England, French Canada, Appalachia, and the British Isles, and it features reels, jigs, polkas, and waltzes.

Faculty members, bring your students. Students, bring your faculty members. Don't miss the first Mathfest!!

SOUTHERN CALIFORNIA SECTION

Alice King
California State
Polytechnic University
Pomona, California

Alice King received her bachelor's and master's degrees from the University of California at Riverside and her doctorate from the Claremont Graduate School. She spent most of her teaching career at the California State Polytechnic University. In addition to teaching and serving on other "normal" faculty committees, Dr. King has contributed to the Mathematics Liaison Committee of the statewide Articulation Conference for nine years; indeed, for two years, she served as its Chair. She has also served both as Secretary of the Southern California Section of the California Mathematics Council and as the Council's statewide Secretary. Furthermore, Dr. King has coauthored five textbooks in high school mathematics. The California State University system selected her to direct its Entry Level Mathematics Program.

For the past seven years, Dr. King has contributed to the American High School Mathematics Examination (AHSME) for Southern California as its Regional Examination Coordinator. Most recently, she earned a doctor of jurisprudence degree from the School of Law of the University of California at Los Angeles.
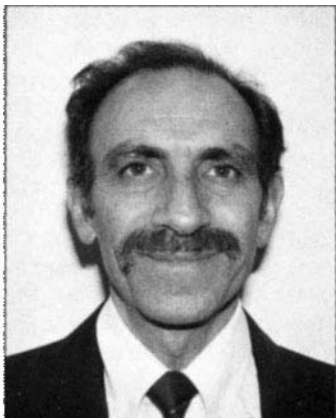
SOUTHWESTERN SECTION

Alvin Swimmer
Arizona State University
Las Cruces, New Mexico

Alvin Swimmer earned his bachelor's degree from Pennsylvania State University, his master's from New York University, and his doctorate from the University of California. In 1963 he joined the faculty of Arizona State University. Dr. Swimmer's primary mathematical interest is in Grassman algebra and its applications, but in recent years, he has become involved with teaching arithmetic to prospective elementary teachers and adults who never learned it. He has written *The Key to Arithmetic,* in which he discusses the subject from a structural viewpoint.

Professor Swimmer joined the Association in 1960 and, in 1963, became a member of the Southwestern Section. Since then, he has supported his Section faithfully and substantially. He has served three terms as Secretary-Treasurer (1972–1981); two terms as Vice Chair (1983–1984 and 1989–1990); two terms as Chair (1982–1983 and 1988–1989). Professor Swimmer is currently Governor of his Section. In addition, since 1972 he has delivered thirteen talks during his Section's meetings.

Ancient Greek Mathematics

6–27 July 1991: Study ancient Greek mathematics in Greece! Lectures will cover the development of mathematics from its legendary beginnings with Thales and Pythagoras through the work of Euclid, Archimedes, and Diophantus—all viewed in the context of Greek culture and history. Professor Paul Wolfson of West Chester University will deliver these lectures in Athens and on the island of Samos, with excursions to Miletus and some other important, early Greek cities in Asia Minor. You may earn three graduate or undergraduate credits for completing this three-week course. Professionals who complete the course may find their expenses are deductible or that their employers will defray their costs.

The program costs approximately $2,000, including round-trip airfare from New York, lodging, transportation within Europe, and several tours. Most meals are not included, nor is tuition. For further information, contact: Paul Wolfson, Department of Mathematics and Computer Science, West Chester University, West Chester, Pennsylvania 19383, (215) 436-1081.

Summer Course Offered in Greece

Mathematical Center Building Fund

About $410,000 has been received or pledged from 420 donors to the MAA Mathematical Center Building Fund. Our goal is $600,000. The Mathematical Center is now home to the MAA, the Conference Board of the Mathematical Sciences (CBMS), the Office of Governmental and Public Affairs (OGPA) of the Joint Policy Board for Mathematics (JPBM), and some offices of the Mathematical Sciences Education Board (MSEB).

Currently, four rooms have been named in the George Pólya Building. These include rooms for Ralph P. Boas, Viola and Bernard Hank, Rodney T. Hood, and Charles W. Trigg. Campaigns are now actively underway for rooms to be named after Howard Eves, Neal H. McCoy, Albert W. Tucker, and Alfred B. Willcox. Several other campaigns for named rooms are in preliminary planning stages.

There are still eighteen rooms in both the George Pólya Building and the Edgar H. Vaughn Building available for naming in honor or memory of colleagues, mentors, family members, or friends. These memorial or commemorative opportunities range from $5,000 to $30,000. Plaques bearing the name of the honoree are placed at the entrance to each room. Names of donors at the *Hexahedra* level of giving ($300) or above will appear on the Mathematical Center Fund Contributor's Plaque as well as in the book register of all donors.

The campaign will continue through December 1992. If you would like to contribute to any of the active room campaigns, or if you would like to name a room in perpetuity for someone, please contact: Dr. Marcia P. Sward, Executive Director, The Mathematical Association of America, 1529 Eighteenth Street Northwest, Washington, DC 20036-1385.

*(**Frontiers** continued from page three.)*

(CNRS), Paris, and Paul Steinhardt of the University of Pennsylvania spoke about quasicrystals. Several others present were active in the field, mathematician Jean Taylor of Rutgers and physicist Michael Widom among them.

Steinhardt says new ideas are needed to attack the geometric problems of such arrangements. He wants to know how local rules can guide the assembly of quasicrystals. This is partly pure mathematics, and Steinhardt says he knows of no general tools to attack this. He asks geometers to join the fray. Two good background articles are found in *American Scientist*, volume 74, 1986, p. 586, and *Endeavor*, volume 14, 1990, p. 112—both by Steinhardt.

Surprises in Computation "Unexpected Scientific Computing" was a fresh look at a subject seemingly dominated by supercomputer types. William Press, who chaired this session, has helped give power to the (scientific) masses as lead author of *Numerical Recipies.* He spoke on wavelets, a new orthonormal basis for functions that offers significant advantages over Fourier series. Jean Taylor showed how anisotropic surface energy functions lead to polyhedral soap bubbles and to surprising analogs of usual minimal surfaces. The applications are to crystal grain boundaries. Taylor uses microcomputers in her work, although she has access to larger machines as well.

Stephen Wolfram of Wolfram Research spoke about high-level computer languages. As the developer of *Mathematica* his authority and his biases are clear. He believes that we will soon come to think of models in terms of algorithms—high-level language statements. I have enough trouble understanding differential equations, I wonder how well I will do at understanding more general algorithms. This is a philosophical and pedagogical question, not simply personal uncertainty.

The computing session was rounded out by Alan Huang of AT&T Bell Laboratories in Holmdel, New Jersey, speaking on optical computers. His pictures and words tell a tale of microminiaturization and speed-up that suggest the computer revolution has barely started. Huang writes of "searching for the simplest 'atom' of computation," a fascinating idea. A substantial integrated optical chip might fit in an area the size of a pin from a semiconductor chip, so you can imagine the densities to be achieved. Cooling will be a problem. Huang compared this technology to that of advanced racing cars. Experimental engineering today, but tomorrow it will start to show up in street models.

The Point is at the End of Your Pencil The frontiers of science are where you find them. I hope that you will follow up on some of these ideas, and be alert for new phenomena that may show up at the end of your pencil (quantum or otherwise) or on the screen of your nearby microcomputer. Scientists, engineers, and public policy makers all know that mathematics makes vital contributions to their fields, but like the air we breathe, it is so much a part of their environments that it goes unnoticed. Mathematicians should listen to others and enjoy thinking about their science and the exchange of ideas that enriches all science. This symposium, which astronomer Edmund Bertschinger described simply as "the best scientific meeting I have ever attended," was an occasion to reflect on just how pervasive mathematics is in science and to recapture the excitement of discovery in science and mathematics. ∎

Peter Renz is a Visiting Scholar at Massachusetts Institute of Technology. From 1986–1990, he served as Associate Director of the MAA and as Editor of FOCUS. He has taught at Reed, Wellesley, and Bard Colleges, and continues to do mathematical research as well as expository writing.

"Lean and Lively." These are the characteristics of the program and social events planned for the 70th Summer Meeting (and the first annual Mathfest) of the MAA. The length of the meeting has been trimmed to three days, but the members of the Program Committee have managed to arrange an unusually interesting program that touches upon many contemporary topics and concerns. The three Hedrick Lectures will be given by John Horton Conway of Princeton University, who will discuss *The Sensual (Quadratic) Form.* Additional expository presentations will be given in three AMS-MAA Invited Addresses: *On the Maximal Principle,* by Louis Nirenberg of the Courant Institute of Mathematical Sciences at New York University; *Mathematics under Hardship Conditions in the Third World,* by Neal I. Koblitz of the University of Washington; and a topic to be announced, by Fan R. K. Chung of Bell Communications Research.

We will have ample opportunities to hear panel discussions on several important contemporary reports:

MS 2000—Issues and Needed Actions, a panel cosponsored by the MAA Science Policy Committee (John A. Thorpe, the State University of New York at Buffalo, chair), and the AMS Science Policy Committee (Michael C. Reed, Duke University, chair); *Report on the Undergraduate Major,* sponsored by the CUPM Subcommittee on the Undergraduate Major (Bettye Anne Case, Florida State University, organizer); and *Mathematics Assessment: A National Perspective,* sponsored by the MAA Committee on Assessment (Billy E. Rhoades, Indiana University, organizer).

No instructor who attends these meetings should come away without dozens of examples and ideas for enhancing his or her teaching. A panel discussion organized by Phoebe T. Judson of Trinity University entitled *Uses of Computers in NSF Calculus Projects* and sponsored by the Commit-

The Orono Mathfest: Exposition, Explanation, and Examples

tee on Computers in Mathematics Education (CCIME), (Eugene A. Herman, Grinnell College, chair), and the CUPM Subcommittee on Symbolic Computer Systems (Zaven A. Karian, Denison University, chair), is sure to contribute to the on going discussions on how to use computers effectively in teaching mathematics. A contributed paper session, *Relating Mathematics to the Real World: Applications of Mathematics for Classroom Use,* (Rogers J. Newman, Southern University and James R. C. Leitzel, Ohio State University), is expected to supply the audience with many useful examples. Another contributed paper session, *Using Student Projects in the First Two Years of the Curriculum* (John Charles Maceli and Eric E. Robinson, both of Ithaca College, organizers) will supply us with examples of another vexing pedagogical problem.

Epicurean Delights and Eye Openers   But there's more—the Opening Banquet, the Lobster Cookout, the MAA Banquet for 25-Year Members, the Whale Watch, the Moose Watch, and an old-time New England contradance! Cheers to both the Local Arrangements Committee and the Program Committee.

8-10 August 1991

Photograph courtesy of the Maine Office of Tourism

MAA PROGRAM

Wednesday, August 7

morning

8:00–4:00 **Board of Governors' Meeting**

afternoon

4:00–6:00 **Section Officers' Meeting**

6:30–10:00 **Children's Reception**

6:30–7:30 **President's Reception**

7:30–10:00 **Opening Banquet**

Thursday, August 8

morning

8:30–9:20 **AMS-MAA Invited Address:** *On the maximal principle,* Louis Nirenberg, Courant Institute of Mathematical Sciences, New York University

9:35–10:25 **Hedrick Lecture I:** *The sensual (quadratic) form. Can you see the values of $3x^2 + 6xy - 5y^2$?,* John Horton Conway, Princeton University

10:40–12:10 **AMS Progress in Mathematics Lecture:** *Algorithms in algebraic number theory,* H. W. Lenstra, Institute for Advanced Study and the University of California, Berkeley

afternoon

12:25–12:55 **AMS Business Meeting**

1:40–2:30 **MAA-Mu Alpha Theta Lecture:** *title to be announced,* Paul A. Foerster, Alamo Heights High School, San Antonio, Texas

1:40–6:40 **AMS Special Sessions and Sessions for Contributed Papers**

1:40–6:40 **MAA and Pi Mu Epsilon Student Papers**

1:40–6:40 **Contributed Paper Session:** *Using student projects in the first two years of the curriculum,* John Maceli and Eric Robinson, Ithaca College

1:45–3:45 **Minicourse #1 (Part A):** *Julia sets and the Mandelbrot set,* Robert L. Devaney, Boston University

1:45–3:45 **Minicourse #2 (Part A):** *Integrating calculus and physics for freshmen,* Joan R. Hundhausen and F. Richard Yeatts, Colorado School of Mines

1:45–3:45 **Minicourse #3 (Part A):** *Making mathematics more concrete,* Agnes Azzolino, Mathematical Concepts, Keyport, New Jersey

4:00–6:00 **Minicourse #4 (Part A):** *Teaching mathematical modeling,* Frank R. Giordano, U.S. Military Academy, and Maurice Weir, Naval Postgraduate School

4:00–6:00 **Minicourse #5 (Part A):** *Conceptualizing, organizing, and seeking funding for teacher education projects,* sponsored by the MAA Science Policy Committee; Joan Ferrini-Mundy, University of New Hampshire, and Carole Lacampagne, National Science Foundation

4:00–6:00 **Minicourse #6 (Part A):** *Symmetry and analysis of repeated patterns,* Donald Crowe, University of Wisconsin, Madison

4:00–6:00 **Minicourse #7 (Part A):** *Great theorems from mathematical analysis: 1689-1881,* William Dunham, Hanover College, Indiana

4:15–6:15 **Panel Discussion:** *Uses of computers in NSF calculus projects,* co-sponsored by CCIME, the Committee on Computers in Mathematics Education (Eugene A. Herman, chair) and the CUPM subcommittee on Symbolic Computer Systems (Zaven A. Karian, chair); organized by Phoebe Judson, Trinity University

5:30–6:30 **Donors Reception**

6:00–8:30 **Lobster Cookout**

Friday, August 9

morning

8:30–9:20 **AMS-MAA Invited Address:** *Mathematics under hardship conditions in the Third World,* Neal I. Koblitz, University of Washington

9:35–10:25 **Hedrick Lecture II:** *The sensual (quadratic) form. Can you hear the shape of a lattice?,* John Horton Conway, Princeton University

10:40–11:30 **AMS History of Mathematics Lecture:** *The interaction between mathematics and physics with emphasis on the nineteenth century (tentative),* George W. Mackey, Harvard University

afternoon

1:00–6:00 **AMS Special Sessions and Sessions for Contributed Papers**

1:00–6:00 **MAA/PME Sessions of Student Papers**

1:00–2:30 **Panel Discussion:** *The major in the mathematical sciences – Looking forward,* sponsored by the CUPM subcommittee on the undergraduate major (Bettye Anne Case, chair)

1:00–6:00 **Contributed Paper Session:** *Relating mathematics to the real world: Applications of mathematics for classroom use,* Rogers Newman, Southern University and James R.C. Leitzel, Ohio State University, currently visiting the Mathematical Association headquarters in Washington

1:00–3:00 **Minicourse #4 (Part B, optional):** *Teaching mathematical modeling,* Frank R. Giordano, U.S. Military Academy, and Maurice Weir, Naval Postgraduate School

1:00–3:00 **Minicourse #8 (Part A):** *Knot theory for undergraduates,* Stefanos Gialamas, Columbia College, Chicago

1:00–3:00 **Minicourse #9 (Part A):** *Unifying themes for discrete mathematics,* Ralph Grimaldi, Rose-Hulman Institute of Technology

1:00–3:00 **Minicourse #10 (Part A):** *Mathematical computer graphics on the HP-28C&S and HP-48SX: A means to arouse students' interest in mathematics,* Yves Nievergelt, Eastern Washington University

2:45–4:30 **AMS-MAA Panel Discussion:** *MS 2000 Report – Issues and needed actions,* cosponsored by the MAA Science Policy Committee (John A. Thorpe, chair) and AMS Committee on Science Policy (Michael C. Reed, chair)

4:00–6:00 **SUMMA Intervention Workshop:** *Intervention programs,* William A. Hawkins, Director of Strenghtening

Underrepresented Minorities Mathematics Achievement (SUMMA)

4:00–6:00   **Minicourse #1 (Part B):** *Julia sets and the Mandelbrot set,* Robert L. Devaney, Boston University

4:00–6:00   **Minicourse #2 (Part B):** *Integrating calculus and physics for freshmen,* Joan R. Hundhausen and F. Richard Yeatts, Colorado School of Mines

4:00–6:00   **Minicourse #3 (Part B):** *Making mathematics more concrete,* Agnes Azzolino, Mathematical Concepts, Keyport, New Jersey

4:30–5:30   **Presentation:** *1991 Mathematical contest in modeling,* B. A. Fusaro, Salisbury State University

5:45–6:45   **MAA-Pi Mu Epsilon Reception**

7:00–8:30   **Presentation:** *Changing the climate – Repeat of 1990 skits,* sponsored by Committee on the Participation of Women (Patricia C. Kenschaft, chair)

8:30–9:30   **Pi Mu Epsilon Frame Lecture:** *Some mathematics of baseball,* Henry O. Pollak, Bell Communications Research (retired) and Visiting Professor, Teacher's College, Columbia University

Delays are dangerous.

Be in time.

morning

8:30–9:20   **AMS-MAA Invited Address:** *title to be announced,* Fan R.K. Chung, Bell Communications Research

9:35–10:25   **Hedrick Lecture III:** *The sensual (quadratic) form. Can you speak its soul?,* John Horton Conway, Princeton University

10:40–12:10   **AMS Progress in Mathematics Lecture:** *The theory and applications of harmonic mappings between Riemannian manifolds,* Richard M. Schoen, Stanford University

afternoon

12:25–12:55   **MAA Business Meeting**

1:40–6:40   **AMS Special Sessions and Sessions for Contributed Papers**

1:40–4:40   **MAA Student Workshop:** *Using the DERIVE computer algebra system to generate conjectures,* Marvin L. Brubaker, Messiah College, and Carl L. Leinbach, Gettysburg College

1:40–6:40   **Contributed Paper Sessions:** *Computer software for classroom use,* Clayton Dodge and Charles Slavin, University of Maine, Orono

1:40–3:00   **Informal Discussion:** *Quantitative literacy,* members of the CUPM subcommittee on Quantitative Literacy will be available for discussion (Linda R. Sons, chair)

1:45–3:45   **Minicourse #4 (Part C):** *Teaching mathematical modeling,* Frank R. Giordano, U.S. Military Academy, and Maurice Weir, Naval Postgraduate School

1:45–3:45   **Minicourse #5 (Part B):** *Conceptualizing, organizing, and seeking funding for teacher education projects,* sponsored by the MAA Science Policy Committee; Joan Ferrini-Mundy, University of New Hampshire, and Carole Lacampagne, National Science Foundation

1:45–3:45   **Minicourse #6 (Part B):** *Symmetry and analysis of repeated patterns,* Donald Crowe, University of Wisconsin, Madison

1:45–3:45   **Minicourse #7 (Part B):** *Great theorems from mathematical analysis: 1689-1881,* William Dunham, Hanover College, Indiana

4:00–6:00   **Minicourse #8 (Part B):** *Knot theory for undergraduates,* Stefanos Gialamas, Columbia College, Chicago

4:00–6:00   **Minicourse #9 (Part B):** *Unifying themes for discrete mathematics,* Ralph Grimaldi, Rose-Hulman Institute of Technology

4:00–6:00   **Minicourse #10 (Part B):** *Mathematical computer graphics on the HP-28C&S and HP-48SX: A means to arouse students' interest in mathematics,* Yves Nievergelt, Eastern Washington University

5:45–6:30   **Reception for MAA Banquet for 25-Year Members**

6:30–10:00   **MAA Banquet for 25-Year Members**

MAA PROGRAM

Don't Be Left Out – Mark Your Calendar Now!!!

The AMS-MAA Joint Meetings Committee is offering an experimental, all-new format August 8-10. This *NEW LOOK* in summer mathematics meetings is an effort to make them even more attractive to participants and their families. For example, you may notice that the mornings are devoted to 50-minute talks only, while the afternoons offer a large number of choices to appeal to a wide range of interests. Maine is known as America's Vacationland, and a number of exciting and interesting activities for participants and their families are being offered. Where else would you have the chance to go on a Moosewatch, or visit a 19th century logging camp? Reactions of participants will be greatly appreciated, and will be used to help determine the form of future Mathfests. A short questionnaire will be included in the mailing to preregistrants containing their badge and program. It is hoped that participants will take a few minutes to complete this form and drop it off at the Transparencies section of the Mathfest registration desk while in Orono.

Opening Banquet and President's Reception

On Wednesday evening, the President of the University of Maine will host a complimentary reception open to all participants. The reception will be followed by a special banquet to officially open the first Mathfest and welcome everyone to the University of Maine. All participants are encouraged to attend this festive event, which will feature the awarding of the AMS and MAA prizes and a Welcome Address by the university's President. Details on the banquet, including how to purchase tickets, can be found in the section on Social Events.

The Scientific Program

The August 1991 Mathfest, including the 70th Summer Meeting of the Mathematical Association of America, the 94th Summer Meeting of the AMS, and the 1991 summer meetings of the Association for Women in Mathematics and Pi Mu Epsilon, will be held August 8-10 (Thursday-Saturday), 1991, at the University of Maine, Orono. Sessions will take place on the campus of the university.

AMS-MAA Invited Addresses

By invitation of the AMS-MAA Joint Program Committee (Peter Gilkey, Gerald J. Porter, Jean E. Taylor, and Audrey A. Terras, Chair), three speakers will address the AMS and MAA on the history and development of mathematics. The names of the speakers, their affiliations, the titles (where available), dates, and times of their talks follow:

Fan R.K. Chung, Bell Communications Research, title to be announced, 8:30 a.m. Saturday

Neal I. Koblitz, University of Washington, Seattle, *Mathematics under hardship conditions in the Third World*, 8:30 a.m. Friday

Louis Nirenberg, Courant Institute of Mathematical Sciences, New York University, *On the maximal principle*, 8:30 a.m. Thursday

70th Summer Meeting of the MAA
August 8 – 10, 1991

Hedrick Lectures: The 39th Earle Raymond Hedrick Lectures will be given by **John Horton Conway** of Princeton University. These lectures are scheduled at 9:35 a.m. on Thursday, Friday, and Saturday, August 8-10. The title of the lecture series is *The sensual (quadratic) form*. The three lectures are titled as follows: Lecture I: *Can you see the values of $3x^2 + 6xy - 5y^2$?*; Lecture II: *Can you hear the shape of a lattice?*; and Lecture III: *Can you speak its soul?* The members of the Committee on Earle Raymond Hedrick Lecutres who arranged for this series of lectures include Richard K. Guy, Andrew M. Gleason, and William P. Thurston, chair.

MAA-Mu Alpha Theta Lecture: The Board of Governors has approved a new series of summer lectures sponsored jointly by the MAA and the high school honorary Mu Alpha Theta. The first lecture in this new series will be given by **Paul A. Foerster**, Alamo Heights High School, San Antonio, Texas, on Thursday, August 8, at 1:40 p.m.

Minicourses: Ten Minicourses are being offered by the MAA. The names and affiliations of the organizers, the topics, the dates and times of their meetings, and the enrollment limitations of each are as follows:

Minicourse #1: *Julia sets and the Mandelbrot set* is being organized by **Robert L. Devaney**, Boston University. Part A is scheduled from 1:45 p.m. to 3:45 p.m. on Thursday, August 8, and Part B from 4:00 p.m. to 6:00 p.m. on Friday, August 9. Enrollment is limited to 85.

Many mathematicians and students have seen the gorgeous computer graphics images associated with Julia sets and the Mandelbrot set, but few know the equally beautiful and accessible mathematics behind these sets. The goal of the course will be to explain what these images mean mathematically, how they are generated, and how such topics can be included in the undergraduate

curriculum. Specifically, we will present the mathematics and the computer experiments done by students in a sophomore-junior level dynamical systems course. These topics may also be incorporated into an undergraduate complex analysis course or into a special topics course.

Minicourse #2: *Integrating calculus and physics for freshmen* is being organized by *Joan R. Hundhausen* and *F. Richard Yeatts*, Colorado School of Mines. Part A is scheduled from 1:45 p.m. to 3:45 p.m. on Thursday, August 8, and Part B from 4:00 p.m. to 6:00 p.m. on Friday, August 9. Enrollment is limited to 35.

This Minicourse will be based on the organizers' experiences in developing and teaching an integrated course in calculus and physics, but the presentation will also be addressed to those who are particularly interested in emphasizing applications in a traditional calculus course. The first session will feature discussion of physical applications in motivating and illustrating calculus concepts; modeling, geometry, use of parameters, and problem-solving will also be stressed. The role of the laboratory/workshop and the use of symbolic/graphical calculators will be discussed. Participants will practice selected laboratory/workshop exercises and be offered guidance on the design and implementation of new exercises. These activities will continue into the second session, which will conclude with some practical considerations such as student preparation and motivation, textbooks, sequencing and reinforcement of topics, and testing.

Minicourse #3: *Making mathematics more concrete* is being organized by *Agnes Azzolino*, Mathematical Concepts. Part A is scheduled from 1:45 p.m. to 3:45 p.m. on Thursday, August 8, and Part B from 4:00 p.m. to 6:00 p.m. on Friday, August 9. Enrollment is limited to 40.

For many, early work with concrete materials facilitates later work with abstract ideas. In lab and lecture format, participants in this Minicourse will make and use manipulatives and models and consider the following questions. What manipulatives are appropriate for use by adult learners in basic arithmetic, algebra, trigonometry, and calculus? What strategies make manipulative use successful? How does work with manipulatives mesh with mental, manual, and mechanical computation?

Minicourse #4: *Teaching mathematical modeling* is being organized by *Frank Giordano*, U.S. Military Academy, and *Maurice Weir*, Naval Postgraduate School. Part A is scheduled from 4:00 p.m. to 6:00 p.m. on Thursday, August 8, Part B, which is optional, from 1:00 p.m. to 3:00 p.m. on Friday, August 9, and Part C from 1:45 p.m. to 3:45 p.m. on Saturday, August 10. Enrollment is limited to 40.

In 1981 the MAA Committee on the Undergraduate Program in Mathematics recommended that "Students should have an opportunity to undertake 'real world' mathematical modeling projects..." as part of the common core curriculum for all mathematical science majors. This is because many applications of problems in science, industry and government are best approached using mathematical modeling techniques. This Minicourse provides an introduction to the modeling process and to several topics underlying the construction of mathematical models, as well as addresses issues related to the design of an undergraduate course in modeling. The optional third session will consist of demonstrations and "hands-on" running of models on microcomputers.

Minicourse #5: *Conceptualizing, organizing, and seeking funding for teacher education projects* is being organized by *Joan Ferrini-Mundy*, University of New Hampshire, and *Carole Lacampagne*, National Science Foundation. This Minicourse is sponsored by the MAA Science Policy Committee. Part A is scheduled from 4:00 p.m. to 6:00 p.m. on Thursday, August 8, and Part B from 1:45 p.m. to 3:45 p.m. on Saturday, August 10. Enrollment is limited to 50.

The role for mathematicians in national reform activities in pre-college education is of critical importance. In the areas of preservice and inservice teacher education, collaborations among mathematicians, mathematics educators, and school personnel have great promise for improving the teaching and learning of mathematics, by helping teachers become change agents and professional leaders. Federal funding is available to support many such programs. This Minicourse will focus on questions such as: What are important elements of mathematics teacher education projects? How do we develop collaborations and work realistically with schools? What expectations for mathematical emphasis and instructional strategies are appropriate for teachers at various levels? What new curriculum materials are available for teachers to use? What funding sources are available, and what are the processes for obtaining funds? What are the elements of a successful proposal? Participants will hear presentations by experienced mathematics teacher education project directors and by current and former funding agency program staff members. Some hands-on activities in the art of proposal preparation will be included.

Minicourse #6: *Symmetry analysis of repeated patterns* is being organized by *Donald Crowe*, University of Wisconsin, Madison. Part A is scheduled from 4:00 p.m. to 6:00 p.m. on Thursday, August 8, and Part B from 1:45 p.m. to 3:45 p.m. on Saturday, August 10. Enrollment is limited to 50.

Patterned art appears in many industrial and pre-industrial artifacts. Pattern analysis, using the classification by isometries developed for crystallography, has archaeological and anthropological applications. The course mentions such applications, but emphasizes proofs of basic properties of isometries; the classification of the 7 + 17 one- and two-dimensional patterns, and the 17 + 46 two-color versions of these patterns; and hands-on identification of real-world patterns. Useful flowcharts from Washburn-Crowe "Symmetries of Culture: Theory and Practice of Plane Pattern Analysis" (1988) will be provided. Preferably, each participant should have a copy of that book. The material requires no special knowledge beyond high school geometry.

Minicourse #7: *Great theorems from mathematical analysis: 1689-1881* is being organized by *William Dunham*, Hanover College. Part A is scheduled from 4:00 p.m. to 6:00 p.m. on Thursday, August 8, and Part B from 1:45 p.m. to 3:45 p.m. on Saturday, August 10. Enrollment is limited to 80.

We examine original proofs of four historically significant theorems: the Bernoulli brothers' proofs of the divergence of the harmonic series (1689); Euler's summation of $1 + 1/4 + 1/9 + ... + 1/n^2 + ...$ and related series (1734); Weierstrass' everywhere continuous, nowhere differentiable function (1872); and Volterra's proof of the non-existence of a function continuous precisely on the rationals (1881). Each theorem is accompanied by brief biographies of key individuals and placed in appropriate historical context.

Minicourse #8: *Knot theory for undergraduates* is being organized by *Stefanos Gialamas*, Columbia College, Chicago. Part A is scheduled from 1:00 p.m. to 3:00 p.m. on Friday, August 9, and Part B from 4:00 p.m. to 6:00 p.m. on Saturday, August 10. Enrollment is limited to 80.

Knots are encountered almost daily in our lives. They are used by children when tying their shoes, by surgeons, sailors, bakers, and biologists in their work. Mathematicians are fascinated by the contrast between the banality of knots and the difficulty of establishing how many categories of knots exist. This Minicourse will familiarize participants with new fascinating concepts in knot theory; knot equivalence, linking numbers of links with two components, and other invariants. We will study knots and links using traditional mathematical concepts such as polynomials, functions, groups and Fox derivatives, and new invariants such as Conway polynomial, Bracket polynomial, Kauffman polynomial, Jones polynomial, and generalized polynomial. Applications of the theory of knots in DNA research, chemistry, and statistical mechanics will be discussed. The integration of the concept of knots with art will be presented using slides, drawings, sculptures, lasers, and video tapes.

Minicourse #9: *Unifying themes for discrete mathematics* is being organized by *Ralph Grimaldi*, Rose-Hulman Institute of Technology. Part A is scheduled from 1:00 p.m. to 3:00 p.m. on Friday,

August 9, and Part B from 4:00 p.m. to 6:00 p.m. on Saturday, August 10. Enrollment is limited to 80.

As discrete mathematics courses impact the college curricula, some students express concern about the apparent fragmented nature of the concepts. To dispel this feeling of fragmentation, certain unifying themes can serve to interrelate different concepts. Among such themes are:

(i.) the function–with its role in enumeration, the analysis of algorithms, finite state machines, and the preservation of discrete structures.

(ii.) enumeration–as it reinforces the study of partial orders, equivalence relations, graph theory, and summation formulas.

Minicourse #10: *Mathematical computer graphics on the HP-28C&S and HP-48SX: A means to arouse students' interest in mathematics* is being organized by **Yves Nievergelt**, Eastern Washington University. Part A is scheduled from 1:00 p.m. to 3:00 p.m. on Friday, August 9, and Part B from 4:00 p.m. to 6:00 p.m. on Saturday, August 10. Enrollment is limited to 80.

At the third Computers & Mathematics Conference, in June 1989 at MIT, speakers emphasized the importance of multidimensional visualization in mathematics and in the natural sciences. Meanwhile, students in calculus and linear algebra encounter inordinate difficulties visualizing just planes in space. As a remedy, the presentation will demonstrate the classroom use of such topics as an automated curve sketcher, 3D graphics, splines, and fractals, first to draw students' attention to mathematics, then to convince them of the need for visual intuition and theory (but not rote exercises) in designing programs for the HP-28S, HP-48SX, or CRAY. Participants will receive a copy of the author's book, which also contains genuine research projects for students. Participants who own HP-28 (C or S) or HP-48SX supercalculators may want to bring them to the course.

Participants interested in attending any of the MAA Minicourses should complete the MAA Minicourse Preregistration Form found at the back of this issue *and send it directly to the MAA office at the address given on the form so as to arrive prior to the June 6 deadline. DO NOT SEND THIS FORM TO PROVIDENCE. Please note that these MAA Minicourses are NOT the AMS Short Course.* After the deadline, potential participants are encouraged to call the MAA headquarters at 800-331-1622.

Please note that prepayment is required. Payment can be made by check payable to MAA (Canadian checks must be marked "in U.S. funds") or Visa or MasterCard credit cards.

The MAA Minicourses are open only to persons who register for the Mathfest and pay the Mathfest registration fee. *If the only reason for registering for the Mathfest is to gain admission to a MAA Minicourse, this should be indicated by checking the appropriate box on the MAA Minicourse Preregistration Form. Then, if the Minicourse is fully subscribed, full refund can be made of the Mathfest preregistration fee. Otherwise, the Mathfest preregistration will be processed, and then be subject to the 50% refund rule. Participants should take care when cancelling Minicourse preregistration to make clear their intention as to their Mathfest preregistration, since if no instruction is given, the Mathfest registration will also be cancelled. PREREGISTRATION FORMS FOR THE MATHFEST SHOULD BE MAILED TO PROVIDENCE PRIOR TO THE DEADLINE OF JUNE 6.*

The registration fee for MAA Minicourses is $36 each.

Contributed Papers: Contributed papers are being accepted on three topics for presentation at the meeting. The topics, organizers, their affiliations, and the probable afternoon they will meet are:

- *Computer software for classroom use*, **Clayton Dodge** and **Charles Slavin**, University of Maine, Orono. Saturday afternoon. Presentations are invited that include demonstrations of software actually used in a classroom for instruction. Equipment available is Zenith 386 computer with VGA and with 27" monitors for viewing by the audience. It takes both 5 1/4 and 3 1/2 inch disks.

- *Relating mathematics to the real world: Applications of mathematics for classroom use*, **Rogers Newman**, Southern University and **James R. C. Leitzel**, Ohio State University. Friday afternoon. Presentations are invited that illustrate applications of mathematics that are suitable for classroom use, especially by those who have solved problems arising in industry, business or government, problems whose resolutions made extensive use of mathematics. Talks should not be highly theoretical, but should be of such a nature that teachers can make use of them in their classes.

- *Using student projects in the first two years of the curriculum*, **John Maceli** and **Eric Robinson**, Ithaca College. Thursday afternoon. Student projects are used in many places in the undergraduate curriculum in courses ranging from liberal arts courses for the non-science major to required courses for the mathematics major. Projects can be used to introduce or enhance material and can range from individual to group work. Papers are invited that discuss actual projects considering such aspects as their design, purpose and/or results from use.

Presentations are normally limited to ten minutes, although selected contributors may be given up to twenty minutes. Individuals wishing to submit papers for any of these sessions should send the following information to the MAA Washington office at 1529 Eighteenth Street, NW, Washington, DC 20036 *by May 8*:

1. One page giving the author's name, author's address, the intended session, and a one-paragraph 16-line abstract (for distribution at the meeting);

2. A one-page outline of the presentation.

Other MAA Sessions

Uses of Computers in NSF Calculus Projects: The Committee on Computers in Mathematics Education (Eugene A. Herman, Chair) and the CUPM Subcommittee on Symbolic Computer Systems (Zaven A. Karian, Chair) are cosponsoring a panel discussion on the *Uses of computers in NSF calculus projects*. This panel will be organized by **Phoebe Judson**, Trinity University, and is scheduled from 4:15 p.m. to 6:15 p.m. on Thursday. Panelists include **William H. Barker**, Bowdoin College; **Joan R. Hundhausen**, Colorado School of Mines; **David O. Lomen**, University of Arizona, Tucson; and **Dennis M. Schneider**, Knox College.

Report on the Undergraduate Major: A panel discussion on *The major in the mathematical sciences – Looking forward*, will take place from 1:00 p.m. to 2:30 p.m. on Friday. This panel is sponsored by the CUPM subcommittee on the Undergraduate Major and will be organized by the committee chair, **Bettye Anne Case**. In January 1991 the CUPM endorsed this committee's report titled *The major in the mathematical sciences*. Committee members will present the recommendations about the philosophy, structure and tracks of the major. Audience input is encouraged.

SUMMA Intervention Workshop: A workshop on *Intervention programs* is scheduled for Friday from 4:00 p.m. to 6:00 p.m. This workshop is being organized by **William A. Hawkins**, Director of Strengthening Underrepresented Minorities Mathematics Achievement (SUMMA).

1991 Mathematical Contest in Modeling: Several teams of undergraduate participants will present their winning papers at this session scheduled from 4:30 p.m. to 5:30 p.m. on Friday. The Organizer is B. A. Fusaro, Salisbury State University.

Mathematics Assessment: A national perspective: This panel, scheduled for 4:45 p.m. to 6:00 p.m. on Friday, is sponsored by the Committee on Assessment (Bernard Madison, Chair) and is organized by **Billy E. Rhoades**, Indiana University, Bloomington. The panelists will be the Organizer, **Bernard Madison**, University of Arkansas, and **Raymond Shiflett**, Mathematical Sciences Education Board.

Changing the Climate – Repeat of 1990 skits: This presentation, sponsored by the Committee on the Participation of Women (Patricia C. Kenschaft, Chair), will be held from 7:00 p.m. to 8:30 p.m. on Friday. For those who missed the presentation in San Francisco, mathematicians dramatize micro-inequities that actually happened to women mathematicians in 1990. Micro-inequities are small slights that individually are not of great consequence but cumulatively wear down a person's ability to pursue a serious career. Many are funny in retrospect. After laughing at ourselves, we will have small group discussions about day-to-day professional interactions and ways that we can change our own behavior and the patterns of our community so that we may all be more comfortable and our community more welcoming.

Quantitative Literacy: Members of the CUPM subcommittee on Quantitative Literacy will be available for an informal discussion on this subject and on the activities of this committee. This informal discussion is scheduled from 1:40 p.m. to 3:00 p.m. on Saturday and will be moderated by the committee Chair, *Linda R. Sons*.

Prize Session: The MAA Prize Session will be held jointly with the AMS Prize Session at the Opening Banquet on Wednesday, August 7. The Merten M. Hasse Prize and the Allendoerfer, Ford and Pólya Prizes will be presented.

Business Meeting: The MAA Business Meeting is scheduled from 12:25 p.m. to 12:55 p.m. on Saturday, August 10. This meeting is open to all members of the Association.

Board of Governors: The MAA Board of Governors will meet from 8:00 a.m. to 4:00 p.m. on Wednesday, August 7. This meeting is open to all members of the Association.

Section Officers: There will be a Section Officers' meeting from 4:00 p.m. to 6:00 p.m. on Wednesday, August 7.

94th Summer Meeting of the AMS
August 8 – 10, 1991

History of Mathematics Lecture: The AMS History of Mathematics Editorial Committee (Richard A. Askey, Peter L. Duren (Chair), and Harold M. Edwards) announces the debut of an important new lecture series in Orono. The first History of Mathematics Lecture will be given by *George W. Mackey*, Harvard University, on Friday, August 9, at 10:40 a.m. The tentative title of this lecture is *The interaction between mathematics and physics with emphasis on the nineteenth century*. This series of lectures permits serious historians of mathematics to report on research in the subject to the mathematics community.

Progress in Mathematics Lectures: This series of lectures provides a forum for the exposition of mathematical topics that have come into prominence in the past five years. The members of the Progress in Mathematics Selection Committee for these lectures are Hyman Bass, Armand Borel (Chair), Paul H. Rabinowitz, Hugo Rossi, and Alan D. Weinstein.

The names and affiliations of the speakers and their titles, are as follows:

H. W. Lenstra, Jr., Institute for Advanced Study and the University of California, Berkeley, *Algorithms in algebraic number theory*, Thursday 10:40 a.m.

Richard M. Schoen, Stanford University, *The theory and applications of harmonic mappings between Riemannian manifolds*, Saturday 10:40 a.m.

Special Sessions: By invitation of the AMS Program Committee for National Meetings, there will be eight special sessions of selected twenty-minute papers. The topics of these special sessions and the names and affiliations of the mathematicians arranging them are:

Problems in number theory, *Joseph Arkin*, U.S. Military Academy at West Point.

Symmetry and differential analysis, *Edward Bierstone*, University of Toronto and *Gerald W. Schwarz*, Brandeis University.

Commutative Noetherian rings with applications in algebraic geometry, *Frank Curtis*, University of Maine, Orono, and *Andrew R. Kustin*, University of South Carolina.

Continuum theory and dynamical systems, *John C. Mayer*, University of Alabama.

Analytic number theory, *Ali E. Ozluk* and *William M. Snyder*, University of Maine, Orono.

Geometric inequalities for polytopes, *Stanley Rabinowitz*, Math Pro.

Variational methods and symmetry, *Chuu-Lian Terng*, Northeastern University, and *Karen Uhlenbeck*, University of Texas, Austin.

Function algebras and function spaces, *Toma V. Tonev*, University of Toledo and *I. Keith Yale*, University of Montana, Missoula.

Most of the papers to be presented at these special sessions will be by invitation; however, anyone contributing an abstract for the meeting who feels that his or her paper would be particularly appropriate for one of these sessions should indicate this clearly on the abstract, *and should submit it by May 1, 1991, three weeks earlier than the normal deadline for contributed papers,* in order that it be considered for inclusion.

Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in departments of mathematics, and should be sent to Abstracts, Editorial Department, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940. A charge of $16 is imposed for retyping abstracts that are not in camera-ready form.

Contributed Papers: There will be sessions for contributed papers Thursday, Friday, and Saturday afternoon.

Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in departments of mathematics, and should be sent to Abstracts, Editorial Department, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940, *so as to arrive by the abstract deadline of May 22, 1991*. A charge of $16 is imposed for retyping abstracts that are not in camera-ready form.

Late papers will not be accepted.

Electronic Submission of Abstracts: This service is available to those who use the T_EX typesetting system and can be used for abstracts of papers to be presented at this meeting. Requests to obtain the package of files may be sent by electronic mail on the Internet to *abs-request@math.ams.com*. Requesting the files electronically will likely be the fastest and most convenient way, but users may also obtain the package on IBM or Macintosh diskettes, available free of charge by writing to: Secretary to Director of Publication, American Mathematical Society, Publications Division, P.O. Box 6248, Providence, RI 02940. When requesting the Abstracts package, users should be sure to specify whether they want the plain T_EX, $\mathcal{A}_{\mathcal{M}}S$-$T_EX$, or the L^AT_EX package. Again, late papers will not be accepted.

Other AMS Sessions

AMS Committee on Science Policy: A panel discussion sponsored by the AMS Committee on Science Policy is scheduled for Friday, August 9, at 4:00 p.m.

Other AMS Events

Council Meeting: The Council of the Society will meet at 2:00 p.m. on Wednesday, August 7.

Business Meeting: The Business Meeting of the Society will take place at 12:25 p.m. on Thursday, August 8. 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.*

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 M. Salah Baouendi, Robert M. Fossum (chairman), and Carol L. Walker.

In order that a motion for the Business Meeting of August 8, 1991, receive the service offered by the committee in the most effective manner, it should have been in the hands of the secretary by July 8, 1991.

AMS Short Course on
The Unreasonable Effectiveness
of Number Theory

A two day Short Course on *The unreasonable effectiveness of number theory* will be held on Tuesday and Wednesday, August 6-7, 1991. The program is under the direction of Stefan A. Burr, City College, CUNY.

Thirty, and even twenty, years ago, number theory seemed to be very "pure" mathematics, with only a handful of applications to the real world at best. Now, almost everyone knows of the revolution in cryptography, and the central role of number theory in that revolution. It is less generally known that in recent years number theory has found important applications in many areas, such as theoretical physics, dynamical systems, numerical analysis, coding theory, and computer graphics. In this Short Course we will consider such non-cryptographic applications. The speakers and topics are:

George E. Andrews, Pennsylvania State University, *Number theory and statistical mechanics*

Jeffrey C. Lagarias, AT&T Bell Laboratories, *Number theory and dynamical systems*

George Marsaglia, Florida State University, *The mathematics of random number generators*

M. Douglas McIlroy, AT&T Bell Laboratories, *Number theory in computer graphics*

Vera S. Pless, University of Illinois at Chicago, *Cyclotomy and cyclic codes*

Manfred R. Schroeder, University of Göttingen, *The unreasonable effectiveness of number theory in physics, communication, and music*

Please note that this is *NOT* an MAA Minicourse. See the section on *How to Register* for more information.

Other AMS – MAA Joint Sessions

MS 2000 Report – Issues and Needed Actions: The MAA Science Policy Committee and AMS Committee on Science Policy are cosponsoring a panel discussion on the Report on MS 2000, to be held from 2:45 p.m. to 4:30 p.m. on Friday. The organizer and moderator is the MAA committee chair, *John A. Thorpe*. The Mathematical Sciences in the Year 2000 (MS 2000 for short) is a three-year project of the Mathematical Sciences Education Board and the Board on Mathematical Sciences of the National Research Council. The final report of this project, released this spring, details serious problems in collegiate mathematics education that need attention if the U.S. is to have the mathematically sophisticated workforce that will be needed in the 21st century. This session will summarize the findings and recommendations of the report and discuss the implications for the mathematics community. The principal speaker will be *William E. Kirwan*, President of the University of Maryland and Chair of the MS 2000 committee. Respondents include *Lida K. Barrett* and *Ivar Stakgold*.

Activities of Other Organizations

The *Association for Women in Mathematics* (AWM) is sponsoring a panel discussion on Thursday, August 8, at 3:00 p.m.

The Second Annual Alice T. Schafer Mathematics Prize for excellence in undergraduate mathematics will be presented at the AWM Membership Meeting which will be held at 4:30 p.m. on Thursday, August 8.

An open reception is planned for Thursday evening, August 8, at 8:30 p.m.

The *Joint Policy Board for Mathematics* and the *Office of Governmental and Public Affairs* (JPBM/OGPA) will sponsor a session on Friday, August 9, at 7:00 p.m.

The *National Science Foundation* (NSF) invites participants at the Orono Mathfest to meet informally with staff members from 1:00 p.m. to 2:00 p.m. daily, Thursday – Saturday, August 8-10.

The *Pi Mu Epsilon* ($\pi\mu\epsilon$) J. Sutherland Frame Lecture will be delivered on Friday, August 9, at 8:30 p.m. by *Henry O. Pollak*, Bell Communications Research (retired) and Visiting Professor, Teacher's College, Columbia University, on *Some mathematics of baseball*.

$\pi\mu\epsilon$ will hold sessions for contributed papers on Thursday, Friday, and Saturday afternoon.

The $\pi\mu\epsilon$ Council will meet from noon to 1:00 p.m. on Friday, August 9.

Information on the $\pi\mu\epsilon$ banquet can be found in the *Social Events* section of this announcement.

A reception for students will be cosponsored by $\pi\mu\epsilon$ and MAA on Thursday, August 8, at 5:30 p.m. on the Patio of the Memorial Union.

Pi Mu Epsilon prepares their own program for their sessions. These programs are available at the registration desk.

Other Events of Interest

AMS Information Booth: All meeting participants are invited to visit the AMS Information Booth during the meetings. Coffee will be available at 9:00 a.m. and 1:00 p.m. The Membership Manager of the Society, will be at the booth to answer questions about membership in the Society.

Book Sales: Books published by the AMS and MAA will be sold at discounted prices somewhat below the cost for the same books purchased by mail. *These discounts will be available only to registered participants wearing the official meetings badge.* Visa and MasterCard credit cards will be accepted for book sale purchases at the meetings. The book sales will be open 9:00 a.m. to 5:00 p.m., Thursday – Saturday.

Joint Books, Journals and Promotional Materials Exhibit: This exhibit will be open the same hours as the book sales, and affords participants the opportunity to order publications from various commerical publishers.

Social Events

It is strongly recommended that tickets for these events be purchased through preregistration, since only a very limited number of tickets will be available for sale on-site. Tickets purchased through preregistration will be mailed with the badge and program unless

the participant instructs otherwise on the Preregistration/Housing Form. In that case, participants can pick up their ticket(s) at the meeting at the same time as their badge and program. To get a 50% refund, *returned tickets must be received by the Mathematics Meetings Service Bureau by July 9.* After that date no refunds can be made. Special meals are available at all banquets, upon request, including vegetarian, but this must be indicated on the Preregistration/Housing Form in advance. We regret that no kosher meals will be available.

Opening Banquet and President's Reception: This special feature of the Mathfest is scheduled on Wednesday evening, August 7 at 7:30 p.m. It will be preceded by a complimentary reception sponsored by the President of the University of Maine at 6:30 p.m. in Wells Commons Lounge. The AMS will award three Steele Prizes, one for writing a truly seminal paper, one for a work or sequence of works that has been shown to be of lasting value, and one for an outstanding career. The MAA will award the Merten M. Hasse Prize and various awards for outstanding journal articles, namely the Allendoerfer, Ford and Pólya Awards. A welcome address will be given by the President of the University of Maine.

Dinner will be served at 7:30 p.m. in the Wells Commons Dining Room. The menu consists of Filet Mignon with bearnaise sauce, baked potato, peas and pearl onions, spinach salad, dinner rolls and butter, ice cream pie and beverages. Tickets are $15 per person for those not on the university meal plan and $9 for those who are. These prices include tax and gratuity. Since this event occurs the evening prior to the first day of the meetings, no tickets can be available for purchase onsite, so be sure to purchase your ticket when you preregister.

Children's Reception: A complimentary reception for children of participants will be held concurrently with the Opening Banquet in the West Winds Dining Room in the Wells Commons at 6:30 p.m. Snoodles the Clown will greet the children as they arrive and do a magic show. Pam Flood, an experienced educator/musician, will entertain the children with a variety of songs ranging from old to traditional to children's standards and newer favorites. She will bring along various rhythm instruments for the children to play, and her sing-along style should provide a real opportunity for fun. Some cartoons will be shown, and light healthful snacks and beverages will be served. Children must be over three years of age.

MAA 25-Year Member Banquet: The MAA is planning its fifteenth annual banquet for those individuals who have been members of the Association for twenty-five years or more. The banquet will be held on Saturday, August 10, in the Dining Room of Wells Commons. A reception with cash bar will take place from 5:45 p.m. to 6:30 p.m. in the Lounge of Wells Commons. Dinner will be served at 6:30 p.m. The menu includes stuffed Filet of Sole, wild rice pilaf, herbed green beans, green tossed salad, dinner rolls and butter, and beverages. Chicken is available upon request as an alternative entree. Tickets are $20 each for those not on the university meal plan and $14 for those who are; the price includes tax and gratuity.

Pi Mu Epsilon Banquet: This banquet will take place on Friday, August 9, at 6:45 p.m., in the Damn Yankee in the Memorial Union. The menu includes Chicken Dijoinaise, baked potato, sauteed spring vegetables, tossed salad, dinner rolls and butter, lemon mousse, beverages. Tickets are $8 for those not on the university meal plan and $2 for those who are; the price includes tax and gratuity.

Lobster Cookout: Participants will have an opportunity to taste world famous Maine lobster at the Lobster Cookout to be held on Thursday, August 8, 6:00 p.m.–8:30 p.m. The evening will begin with a cash bar at 6:00 p.m. where participants can relax and mingle with their colleagues and others. Entertainment for the cookout will be provided by the Marsh Island Band whose country music tunes will entice the entire family to line dance all night long. They will be set up in the Wells Complex Area.

The cookout will take place in the Wells Complex Area. The menu includes steamed lobster, steamed clams, corn on the cob,

cole slaw, hard rolls with butter, sour cream blueberry pie, coffee, tea, or punch, all for a low price of $23 for those not on the university meal plan and $17 for those who are. For meat lovers, the two entrees can be replaced by steak and broiled chicken. For vegetarians, the two entrees can be replaced by a Veggie Kabob for the same price. For children (12 years and younger), the two entrees can be replaced by hamburger and hot dogs for a low price of $8 for those not on the university meal plan and $3 for those who are. Participants may indicate their meal preference on the Preregistration/Housing Form. The usual selection of alcoholic beverages may be purchased at the bar.

Tours: The following tours are being offered to participants and their families. Preregistration is necessary as places on the tours are limited. Please indicate prereference for tour(s) on the Preregistration/Housing Form and include applicable payments. NOTE: Should these tours not meet the minimum they will be cancelled and full refunds issued.

Best of Bangor, Old Town, and the Penobscot Indian Reservation – Thursday, August 8.

In the first half of the 19th century, with the increase in timber production, Bangor became a boomtown. Millions of logs came down the Penobscott to Bangor lumber mills and were then loaded into the holds of vessels sailing the world over.

Reminders of the heyday remain. During your guided tour you will see the displays at the Thomas A. Hill house, home of the Bangor Historical Society. You will see the residence of lumber baron Isaac Ferrar, a greek revival mansion, and a statue memorializing Maine's River Drivers. View the 31 foot high Paul Bunyan statue, and drive by the restored Victorian home of best selling novelist Stephen King.

Continue on to the Penobscott Indian Reservation for a tour of the Indian Museum and St. Ann's Church, the home of a beautiful painting done with natural pigments and coveted by the Smithsonian. Take a break for box lunches and then on to a tour of the Old Town Historial Museum where you will see wonderful exhibits reflecting the history of Old Town and the surrounding area. Return to campus by 2:15 p.m.

The cost is $21 per person for those on the university meal plan and $26 for those not on the university meal plan (minimum of 35 persons).

Living History Day at Leonard's Mills – Saturday, August 10

Depart campus at 9:00 a.m. and visit the Maine Forest and Logging Museum where folks in period costume reinact life in a logging village in the 1800's. Activities include candle dipping, spinning and dyeing, bateau rides on the river, walks on nature trails, pit sawing demonstrations, and maybe even horse drawn wagon rides! This tour is great for kids, of all ages! Return to campus after a box lunch at about 2:00 p.m.

The cost is $10 per person for those on the university meal plan and $15 for those not on the university meal plan (minimum of 45 persons).

Moosewatch – Friday, August 9

Friday morning depart campus at 5:00 a.m. (coffee served on the bus). Travel to Rockwood, Maine and Moosehead lake. After a ride through the woodlands at daybreak, enjoy a delightful cruise on crystal-clear Moosehead lake. Forty-two miles long and 22 miles wide, the lake boasts secluded beaches, coves and a variety of wildlife. Enjoy the thrill of seeing deer, beaver, and, most likely moose! Then breakfast at The Birches, well known for their "feed", and back to campus along the same senic route arriving at about 11:30 a.m.

The cost is $36 per person for adults and $33 for children under twelve (limited to 18 persons).

Bar Harbor Whale Watch – Sunday, August 11

Depart campus at 6:15 a.m. and travel to Bar Harbor via motorcoach. Juice, milk and Danish pastries will be served enroute. Upon arrival in Bar Harbor, "all aboard!" for a four-and-one-half-hour Whale Watch Cruise. You may see humpback, finback, or minke

whales, plus dolphins, porpoises, seals and many varieties of sea birds. On your own for lunch (food can be purchased on the boat) and some shopping time in bustling downtown Bar Harbor, including mill outlets, antique shops, and craft shops with Maine hand-crafted items. Return to campus approximately 6:00 p.m.

The cost is $46 for adults and $40 for children under 12 (minimum 35 persons).

Whitewater Rafting on the Kennebec River – Sunday, August 11 (rain or shine)

Depart campus at 6:00 a.m. Milk, juice and Danish pastries will be served enroute to the "Forks" of the Kennebec River for a day of miles and miles of whitewater. The Kennebec flows from Moosehead lake, crosses Indian Pond and crashes through Kennebec Gorge. Six to eight foot waves promise intimate familiarity with some of the most challenging and beautiful rapids in the east. Below the rapids, the river is soft, allowing more adventurous paddlers to get out of the raft and swim or float through some mellow whitewater. The trip ends with a hearty riverside steak cookout (chicken or vegetarian arranged with advance notice) and a video presentation starring YOU! Note: This river is a Class 4 (moderate). A brief orientation precedes rafting and wet suits will be available for rent ($15 per person). Rafters are assigned with guides six to seven per raft. Children 11 years and under (excluding infants) may ride only half the river. Rafting company staff will then transport these children to a meeting point. Day care will be provided for them, as well as for any children not participating in the rafting. Pregnant women should not participate.

The cost is $89 for adults and $43 for children under 11 (minimum 35 persons).

Summer List of Applicants

At the direction of the AMS-MAA-SIAM Committee on Employment Opportunities, which is charged with operation of the Employment Register and with the publication of *Employment Information in the Mathematical Sciences*, the Society will publish a Summer List of mathematical scientists seeking employment for distribution at the Orono Mathfest.

Copies of the 1991 Summer List of Applicants will be available at the Transparencies section of the Mathfest registration desk for $8. Following the Mathfest, they may be purchased from the AMS office in Providence for $10. This list should prove useful to employers who have last-minute openings in the latter part of the summer or in the fall.

The deadline for receipt of applicant forms to appear in this Summer List is June 6.

The applicant preregistration résumé and instructions on its completion can be found in this issue.

Instead of an Employment Register at the Mathfest in Orono, there will be an opportunity for posting of both applicant résumé forms and employers' announcements of open positions in or near the Mathfest registration area. There will be no special room set aside for interviews. No provisions will be made for interviews; arrangements will be the responsibility of each employer and applicant. Messages may be left on the message board located in the registration area.

Special applicant and employer forms will be available at the Transparencies section of the Mathfest registration desk both for applicants to post résumés and for employers to post forms announcing positions.

Applicants who submit an applicant form, but do not plan to attend the Mathfest, will appear on the printed list only. There is no provision made for posting résumés for participants who do not attend the Mathfest. No printed lists of employers or applicants who register at the Mathfest will be available afterward.

How to Preregister and Get a Room

How to Preregister

The importance of preregistration cannot be overemphasized. Those who preregister pay fees considerably lower than the fees that will be charged for registration at the Mathfest and will receive typeset badges instead of typewritten ones. Participants who preregister by the ORDINARY deadline of June 6 may utilize the housing services offered by the Mathematics Meetings Service Bureau.

Preregistration fees: The AMS-MAA Joint Meetings Committee is responsible for maintaining a sound fiscal position for these meetings and keeping the deficits at a reasonable level, while still providing the very best meeting facilities and services to the participants. The committee has had to raise meeting registration fees, effective with the January 1991 meeting. A discourse on the new fees appeared in the *Inside the AMS* section of the October 1990 issue of *Notices* and in *Focus*. The registration fees at the Mathfest will be 30% higher than the preregistration fees listed below.

Orono Mathfest

Member of AMS, Canadian Mathematical Society, MAA, $\pi\mu\epsilon$	$ 85
Emeritus Member of AMS, MAA	$ 26
Nonmember	$132
Student/Unemployed	$ 26

AMS Short Course

Student/Unemployed	$ 25
All Other Participants	$ 55
Emeritus Member of AMS, MAA	$ 25

MAA Minicourses

(if openings available)

Minicourses #1-10	$ 36

Preregistration and registration fees only partially cover expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register and should be prepared to show their badge, if so requested. Badges are required to obtain discounts at the AMS and MAA Book Sales and to cash a check with the Mathfest cashier. If a preregistrant should arrive too late in the day to pick up his/her badge, he/she may show the acknowledgment of preregistration received from the Mathematics Meetings Service Bureau as proof of registration.

A $5 charge will be imposed for all invoices prepared when preregistration forms are submitted without accompanying check(s) for the preregistration fee(s) or are accompanied by an amount insufficient to cover the total payments due. We are sorry, but it is not possible for the Mathematics Meetings Service Bureau to refund amounts less than $2. Preregistration forms received well before the deadline of July 11 which are not accompanied by correct payment will be returned to the participant with a request for resubmission with full payment. This will, of course, delay the processing of any housing request.

An income tax deduction is allowed for education expenses, including registration fees, cost of travel, meals and lodging incurred to (i) maintain or improve skills in one's employment or trade or business or (ii) meet express requirements of an employer or a law imposed as a condition to retention of employment, job status, or rate of compensation. This is true even for education that leads to a degree. However, the Tax Reform Act of 1986 has introduced significant changes to this area. In general, the deduction for meals is limited to 80% of the cost. Unreimbursed employee educational expenses are subject to a 2% of adjusted gross income floor. There are exceptions to these rules; therefore, one should contact one's tax advisor to determine the applicability of these provisions.

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

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

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

Persons who qualify for emeritus membership in either the Society or the Association may register at the emeritus member rate. The emeritus status refers to any person who has been a member of the AMS or MAA for twenty years or more, and is retired on account of age or on account of long term disability from his or her latest position.

Nonmembers who preregister or register at the Mathfest and pay the nonmember fee will receive mailings from AMS and MAA, after the Mathfest is over, containing information about a special membership offer.

Preregistration deadlines: There are two separate preregistration deadlines, each with its own advantages and benefits.

ORDINARY Preregistration
(and Housing)   June 6
FINAL Preregistration
(no Housing)   July 11

ORDINARY Preregistration: Those who preregister by the *ORDINARY* deadline of June 6 may utilize the housing services offered by the Mathematics Meetings Service Bureau.

FINAL Preregistration: Those who preregister by the *FINAL* deadline of July 11 must pick up their badge and program at the Mathfest. Unfortunately, it is not possible to provide *FINAL* preregistrants with housing or tickets to special events in advance. *Please note that the July 11 deadline is firm and any forms received after that date must be returned and full refunds issued.*

ELECTRONIC Preregistration: Preregistration through electronic mail is also available. Anyone wishing to preregister through this method should send a message to MEET@MATH.AMS.COM requesting this service. A message will be sent back within 24 hours with instructions on how to complete the format required. *Credit card is the ONLY method of payment which can be accepted for electronic preregistration.* Forms received through this method will be treated in the same manner as forms received through U.S. mail. Receipt of the Preregistration/Housing Form and payment will be acknowledged by the Mathematics Meetings Service Bureau. Participants are advised to bring a copy of this acknowledgement with them to Orono. The same deadlines apply as for preregistration by mail.

All *ORDINARY* preregistrants will receive formal acknowledgements prior to the meetings. *FINAL* preregistrants will receive instead a letter from the Mathematics Meetings Service Bureau (including receipt of payment) prior to the meetings.

ORDINARY preregistrants will receive their badge, program, and prepurchased tickets by mail two to three weeks before the Mathfest, unless they check the appropriate box to the contrary on the Preregistration/Housing Form. So, it is extremely important that the mailing address given on the Preregistration/Housing Form be one at which the participant can receive this mailing. Due to the delays that occur in the U.S. mail to Canada, it is strongly suggested that preregistrants from Canada choose to pick up their preregistration material at the meeting as opposed to having it mailed. There will be a special Registration Assistance desk at the Mathfest to assist individuals who either do not receive this mailing or who have a problem with their registration. Please note that a $2 replacement fee will be charged for programs and badges that are mailed but not taken to Orono. Unfortunately, it will not be possible

to make changes in Orono to badges received through the mail before the meetings.

Please note that requests for housing through the Mathematics Meetings Service Bureau must be received by the ORDINARY deadline of June 6.

It is essential that the Preregistration/Housing Form (found at the back of this issue) be completed fully and clearly. In the case of several preregistrations from the same family, *each* family member who is preregistering should complete a separate copy of the Preregistration/Housing Form, but all preregistrations from one family may be covered by one payment. Please print or type the information requested and be sure to complete all sections. Absence of information (missing credit card numbers, incomplete addresses, etc.) causes a delay in the processing of preregistration for that person.

It is planned to make available in Orono a list of preregistrants by area of interest. If you wish to be included in this list, please provide the *Mathematical Reviews* classification number of your major area of interest on the Preregistration/Housing Form. (A list of these numbers appears on the back of the AMS abstract form.) The master copy of this list will be available for review by participants at the Directory of Registrants located near the registration area.

How to Obtain Residence Hall Accommodations

Use of the services offered by the Mathematics Meetings Service Bureau requires preregistration for the Mathfest. All reservation requests for university accommodations must be received in writing and be processed through the Service Bureau. Telephone requests cannot be accepted. *Please do not contact the university directly, since they will only refer callers back to the Service Bureau.*

Participants desiring confirmed reservations in the University of Maine, Orono, residence halls should read carefully the section on *University Housing* and then choose preferred accommodations. This information should be indicated clearly in the Housing Section of the Preregistration/Housing Form, and the form submitted with the appropriate payment in full *so as to arrive no later than June 6, 1991.*

Participants who are able to do so are urged to share a room whenever possible. Sharing can be economically beneficial. It is regretted that the Mathematics Meetings Service Bureau is unable to provide a matching service for roommates. Participants planning to share accommodations should provide the name of the person with whom they plan to occupy a room and the Housing Section should be fully completed to ensure proper assignment of rooms. Each participant should, however, complete a separate Preregistration/Housing Form. Parties planning to share rooms should send their forms together in the same envelope, if possible. *If two participants arriving on different days plan to share a double room, each participant must submit the per person amount due applicable to his or her particular choice.*

Housing payments for residence hall accommodations will be forwarded to the University of Maine, Orono, on your behalf.

University Housing: Participants in the Mathfest may occupy residence hall rooms at the University of Maine during the period August 7 to August 10; however, if a participant is arriving prior to August 7 (no earlier than August 5) or is departing after August 10 (no later than August 16), he or she may be assigned to a resident hall for transients that may not be used for housing during the meeting. All rooms on campus are offered through a room/board package ONLY. A very limited number of rooms on campus will be available for those participants who do not preregister but plan on attending the meetings and registering on-site.

All check-ins and room assignments will be done at the reception desk, located in the lobby of Wells Commons. The university will not accept any payments for housing assigned both during preregistration and on-site. *ALL* advance payments for housing and meals must be sent to the Service Bureau in Providence. (See

Preregistration/Housing Form.) *ALL* balances due on preregistration and/or housing assigned during preregistration must be paid to the Mathfest Cashier at the registration desk in Orono during the hours registration is open. Payments for rooms assigned on-site and payments for changes made on-site to room assignments are due during the week of the Mathfest. These payments must be paid at the Registration Assistance Section of the Mathfest registration desk during the hours registration is open. Refunds for changes made on-site to room assignments obtained during preregistration will be sent from the Providence office after the meeting. A $5 charge will be imposed for all invoices prepared when payments for on-site room assignments and/or changes are not made during the week of the Mathfest.

Participants requesting housing on the University of Maine campus will be assigned a room in the Wells Complex (see map). The Service Bureau will forward all requests for housing to the university, who will assign all rooms. Special housing needs should be communicated to the Service Bureau via the Preregistration/Housing Form. *The Service Bureau is not responsible for room assignments in the residence halls.*

Families with children will be permitted to stay in the dormitories. There will be reduced single and double (per person) rates for youths younger than 19 years of age and older than 10 years of age residing in a room. A child 10 years and younger cannot stay in a room without an adult. There is a special rollaway fee for youths (under 19 years of age) staying in a single room with an adult or staying in a double room with two adults. Youths cannot pay a rollaway fee if there is a vacant bed in the room. There are no cribs available and sleeping bags are not allowed. In addition, there are no rollaways available for adults. The maximum number of adults allowed in one room is two. If there is a youth present, the maximum number is three. (See page on *Hotel/Motel Accommodations* for alternate housing for families.) *Please note that participants residing in hotels or motels MUST have a car since public transportation is infrequent or nonexistent.*

The average number of floors in the residence halls in the Wells Complex is four. Hancock Hall and Hart Hall have elevators. In addition, Hancock Hall is equipped for the handicapped. None of the residence halls are air-conditioned. Alcoholic beverages and smoking are permitted in the sleeping rooms only. Lounges are considered to be public areas and thus no smoking is allowed in them. There are no nonsmoking rooms. Most rooms are arranged for double occupancy and contain dressers, closets, desks, chairs, and an overhead light. Participants are advised to bring their own alarm clocks, clothes hangers, and reading lamps in addition to other essential items such as soap, toothpaste, etc. At check-in participants will be given one towel, one washcloth, and a bar of soap. In addition, they will find their beds made with clean linen. For adults, linen service will be provided every fourth day except Sunday (provided the next day) and towels can be exchanged daily at the reception desk of the residence hall. For youths, linen service and clean towels are provided upon check-in only and they can exchange their towels daily. Light maid service is provided daily in all residence halls.

Each residence hall contains laundry facilities (washers $.75 and dryers $.50). Local telephones are located on every wing and floor with one pay telephone located on each floor. There are ice machines ($1 per bag), and a small kitchenette either in the basement or in some other location of each building. Smoke detectors are located in the hallways, positioned 20 feet apart.

Check-In/Check-Out Locations and Times: All check-ins and room assignments will be done in the lobby of Wells Commons. The office is open 8:00 a.m. to 6:00 p.m., seven days a week. It is located 40-60 feet from the residence halls. Temporary parking will be available in the athletic parking lot, located in front of Wells Commons. After check-in, participants can park in the parking lot of their assigned residence hall at no charge. After 6:00 p.m.,

participants are urged to go to the main lobby of Hancock Hall for assistance. Receptionist hours in the residence halls are 8:00 a.m. to midnight, seven days a week. *Check-out time is noon.*

Driving directions from the Bangor International Airport to the Wells Commons are as follows: Take I-95 North to exit 51. Bear right on Stillwater Avenue. Take a right on College Avenue. Take a left on Squa Pan Road (Hockey arena will be on the left) leading into the parking lot. Wells Commons is to the right of the parking lot.

At the time of check-in, participants assigned rooms through the Mathematics Meetings Service Bureau will be checked against a master list (Service Bureau acknowledgment may prove useful) and asked to sign a statement to be used solely for the purpose of verifying the university's billing to the Service Bureau. Each person will receive his or her residence hall room assignment, university information, meal tickets, parking instructions, and directions to the assigned residence hall. Those participants being assigned a room on-site by the university will be required to fill out a housing form and to sign a form to be given to the Mathfest Housing Coordinator, to whom payment should be given at the Registration Assistance Section of the Mathfest registration desk. Spouses desiring a room key must follow this procedure also. Each person will receive his or her key at the assigned residence hall. This key will unlock his or her room and the outside door of the building. *Please note that currently there is no deposit required for keys nor will there be a penalty imposed for a lost key; however, it is advised that proper caution be used to insure the continued security of the campus.* At check-out, all keys must be returned to the reception desk of the assigned residence hall. Should the clerk not be present, please ensure that your name is left at the desk with the key.

Room and Board Rates: The rates found in the chart which follows apply for residence hall accommodations at the University of Maine.

Please note that a minimum room-and-board package would be one night's lodging, one breakfast, one lunch, and one dinner. Participants residing on campus can purchase tickets for a social event (see section on Social Events) for a reduced price that will be a supplement to the cost of a dinner meal in the dining hall. The Mathematics Meetings Service Bureau will accept changes to packages reserved up until July 26. After that, all changes will have to be made directly with the university. The university will accept changes in packages reserved up until five days prior to check-in. Any requests for exceptions to this policy should be addressed to Bruce Stinson, Director of Conferences and Institutes, 207-581-4092. All daily room-and-board packages include dinner on the night of arrival, and breakfast and lunch the next day. The last meal of a package will be lunch on the day of check-out. *There can be no exceptions to meal plans offered, nor can any refunds be issued for meals missed. Meal tickets are nonrefundable.*

Food Services: Residence hall guests will dine in the Wells Commons. It is equipped with ramps for the handicapped. Serving hours for breakfast are 7:00 a.m.–8:00 a.m., for lunch noon–1:30 p.m., and for dinner 5:00 p.m.–6:30 p.m. Meal tickets must be presented at each meal for admission to the dining area. Lost meal tickets can be replaced at no charge if reported to their dormitory receptionist desk during the meeting. There will be a reduced rate for meals purchased during preregistration for children 10 years of age and younger. (See chart on Room and Board Rates.) A typical breakfast includes two hot entrees, cereals, juices, hot beverages, toast, bagels, and fruit. Typical lunch and dinner includes two hot entrees, salad bar, soups, bread and butter, beverages, and desserts. Entrees, soups, vegetables, breads and desserts are served from a cafeteria line; a self-service salad bar and beverage stations are in the dining area. Servings are generous; unlimited seconds are allowed. It is regretted that there are no Kosher meals available.

A limited number of meals is available in the dining room on a cash basis for guests not staying in the residence halls. The cash price for breakfast is $4.30, for lunch $5.40, and for dinner $7.50.

These prices will apply for all ages. There will be a separate cash station set up for cash sales. Participants not residing on campus but planning to eat in the dining room are urged to check the appropriate box on the housing side of the Preregistration/Housing Form.

Besides Wells Commons, there are two other eating establishments on campus. The Bear's Den, located on the ground floor in the Memorial Union, is open from 8:00 a.m. to 4:00 p.m. daily serving cafeteria-style fast food such as pizza, sandwiches, burgers, etc. The Damn Yankee, located on the second floor of the Memorial Union, will be open for lunch only. Cafeteria-style meals include two hot entrees, soups, salads, desserts, and beverages.

The number of off-campus restaurants in Orono is extremely limited and most are approximately three miles from campus. There are many off-campus restaurants in Bangor, but most are over five miles from campus.

Miscellaneous Information

Audio-Visual Equipment: Standard equipment in all session rooms is one overhead projector and screen. (Invited 50-minute speakers are automatically provided with two overhead projectors.) *Blackboards are available only in rooms where they currently exist and cannot be produced upon request.*

MAA speakers requiring additional equipment may make written request for one additional overhead projector/screen, 35mm carousel slide projector, or VHS video cassette recorder with one color monitor. Such requests should be addressed to the MAA Associate Secretary (Kenneth A. Ross, Department of Mathematics,

University of Oregon, Eugene, OR 97403). These requests should be received *by June 1*.

All other speakers requiring additional equipment should contact the Audio-Visual Coordinator for the meetings at the AMS office in Providence at 401-455-4140, or electronic mail WSD@MATH.AMS.COM *by June 1*.

Because of the remote location, participants are urged to arrange for more sophisticated audio-visual equipment in advance, especially computer equipment. In addition, requests for equipment made at the meeting most likely will not be able to be satisfied because of budgetary restrictions.

Camping and RV Facilities: There are several campgrounds, most with RV facilities, from 7 to 25 miles from the university. Rates range from $10 per day for a tent site to about $17 for RV space with water, electricity and sewer hookups.

Villa-Vaughn Campgrounds, Pushaw Lake, Orono, ME 04473, 207-945-6769. 7 miles, tenting, RV's, lake beach, recreation hall, boat rentals.

Pleasant Hill Campground, RFD #3, Box 180, Bangor, ME 04401, 207-848-5127. 12 miles, tenting, RV's, swimming pool, games.

Red Barn RV Park, Bar Harbor Road, Holden, ME 04429, 207-843-6011. 12 miles, tenting, RV's, swimming pool, playground.

Big Hammond Street Campground, Outer Hammond Street, Bangor, ME 04401, 207-848-3455. 17 miles.

Balsam Cove Campground, Toddy Pond, East Orland, ME 04431, 207-469-7771. 25 miles, lake swimming.

University of Maine
Room and Board Rates

	Adults* (per person)	Youths* 11–18 yrs. (per person)	1 Adult + 1 Youth 11–18 yrs.	1 Adult + 1 Youth 10 yrs. & younger	2 Adults + 1 Youth 11–18 yrs. in rollaway	2 Adults + 1 Youth 10 yrs. & younger in rollaway
8/5	$41 single $37 double	$33 single $31 double	$63	$60	$91	$89
8/6	$41 single $37 double	$33 single $31 double	$63	$60	$91	$89
8/7	$41 single $37 double	$33 single $31 double	$63	$60	$91	$89
8/8	$41 single $37 double	$33 single $31 double	$63	$60	$91	$89
8/9	$41 single $37 double	$33 single $31 double	$63	$60	$91	$89
8/10	$41 single $37 double	$33 single $31 double	$63	$60	$91	$89
8/11	$41 single $37 double	$33 single $31 double	$63	$60	$91	$89

There is no room and board charge for infants in arms.
* There can be a maximum of two adults in a room. There can be a maximum of three people in a room if one of them is a youth.

RESIDENCE HALL ACCOMODATIONS

Green Lake Tenting Area, Green Lake, ME 04440, 207-843-5789. 20 miles, lake swimming.

There are two campgrounds in Acadia National Park, and many others in the vicinity, about an hour-and-one-half from Orono. For the Park campgrounds, you must have advance reservations. Write directly to Acadia National Park, Bar Harbor, ME 04609.

Car Rental: Because the University of Maine campus is between three to five miles from all of the hotels listed, the Joint Meetings Committee has designated Hertz as the official car rental company for the Mathfest in Orono. Hertz has a desk at the Bangor International Airport. To rent a car at the special rates for this meeting, call 1-800-654-2240 and use the meeting number 6308. These rates are applicable one week prior to and one week after the Mathfest and include unlimited mileage.

Car Class	Daily 1-4 days	Weekly 5-7 days
A Subcompact	$36.80	$125.80
B Compact	$40.80	$135.80
C Midsize	$43.80	$138.80
D Fullsize 2-door	$52.80	$168.80
C Fullsize 4-door	$54.80	$189.80

Applicable charges for taxes, optional refueling service, PAI (Personal Accident Insurance) PEC (Personal Effects Coverage), and LIS (Liability Insurance protection for third party) are extra. Optional LDW (Liability Damage Waiver) may be purchased at $13 per day or less. Rates are nondiscountable. Rentals are subject to Hertz age, driver's license and credit requirements as well as car availability at the time of rental. Weekend rentals are available for pickup between noon Thursday and noon Sunday and must be returned no later than 11:59 p.m. Monday. Weekend minimum rental periods: Thursday pickups – three days; Friday pickups – two days; Saturday and Sunday pickups – one day.

Children's Activities:

Art Class: On Friday, August 9, from 2:00 p.m. to 5:00 p.m., local artist Margaret Skalski will hold an art class for children ages five to 15. Mrs. Skalski has been a professional artist in Maine for ten years, is a state certified art educator, and has been instructing children in the Maine school system for five years. In her class each child will construct a three-dimensional sculpture of high tech camp living quarters in the '90's. There will be a $10 materials fee payable to Mrs. Skalski at the class. If you would like your child/children to participate in this function, please check the appropriate box on the Preregistration/Housing Form and note their ages. The program will announce the location of this class.

Parent-Child Lounge: This room will be furnished with casual furniture, a crib, a changing area, and a VCR and monitor for viewing videotapes. The tapes, appropriate for children, can be checked out at the Telephone Message section of the registration desk.

Please refer to the section on ***Social Events*** for information on the Children's Reception on Wednesday evening and for tour information pertaining to participation by children.

Information Distribution: A table is set up in the registration area for dissemination of information of possible interest to the members.

If a person or group wishes to display information of a mathematical nature promoting a product or program for sale, they may do so in the book sale area at the Joint Books, Journals and Promotional Materials exhibit for a fee of $30 per item.

If a person or group would like to display material in the book sale area separate from the Joint Books table, the proponent must reimburse the AMS and MAA for any extra furnishings requested (tables, chairs, easels, etc.) in addition to payment of the $30 per item fee. (This latter display is also subject to space availability.)

The administration of these tables is in the hands of the AMS-MAA Joint Meetings Committee, as are all arrangements for Mathfests. The following rules and procedures apply.

1. Announcements submitted by participants should ordinarily be limited to a single sheet no more than 8½" × 14".
2. A copy of any announcement proposed for either table is to be sent to the Director of Meetings, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940 to arrive at least one week before the first day of the scientific sessions.
3. The judgment on the suitability of an announcement for display rests with the Joint Meetings Committee. It will make its judgments on a case-by-case basis to establish precedents.
4. Announcements of events competing in time or place with the scheduled scientific program will not be accepted.
5. Copies of an accepted announcement for either table are to be provided by the proponent. Announcements are not to be distributed in any other way at the meetings (for example, not by posting or personal distribution of handbills).
6. It may be necessary to limit the number of events or the quantity of announcements distributed at a meetings.
7. At the close of registration, both tables will be swept clean. Therefore, a proponent who wishes the return of extra copies should remove them before the close of registration.

Mail: All mail and telegrams for persons attending the Mathfest should be addressed as follows: Name of Participant, Mathfest, c/o Department of Mathematics, 333 Neville Hall, University of Maine, Orono, ME 04469. Mail and telegrams so addressed may be picked up at the mailbox outside the Mathfest registration area. U.S. mail not picked up will be forwarded after the meeting to the mailing address given on the participant's registration record.

Telephone Messages: A telephone message center is located in the registration area to receive incoming calls for participants. ***The center is open from August 7 through August 10 during the hours that the Mathfest registration desk is open.*** Messages will be taken and the name of any individual for whom a message has been received will be posted until the message has been picked up at the message center. Once the Mathfest registration desk has closed for the day there is no mechanism for contacting participants other than calling them directly at their hotel or residence hall. The telephone number of the message center is 207-581-1730.

Travel: Bangor International Airport is 12 miles from the University of Maine and is served by Delta, United, Northwest, and Continental Airlines. The flight time to Bangor is approximately 45 minutes from Boston and two hours from New York or Montreal. Hertz, Dollar, Avis and National car rental agencies are represented at the airport, and taxi service is available for approximately $16 one way.

University of Maine buses will provide shuttle service from the airport and campus as follows:

From the airport to Wells Commons on campus:

Wednesday, August 7 – meet all incoming flights arriving at noon and after.

Thursday, August 8 – meet all incoming flights arriving at noon and after.

From Wells Commons on campus to the airport:

Saturday, August 10 – buses will leave at 3:00 p.m. and 6:00 p.m. only; reservations are not necessary

Sunday, August 11 – must sign up at the Mathfest registration desk in advance to reserve a seat and check back at the registration desk on Saturday for exact departure times.

Greyhound Bus Lines accommodates Bangor daily with frequent northbound and southbound trips. From Bangor, taxi service or The Bus (the city bus system) offers transportation to the university.

By car, take I-95 north to Exit 51 and follow signs to the University of Maine. The driving time from Boston to Bangor is approximately five hours.

For some years now, the AMS-MAA Joint Meetings Committee has engaged a travel agent for the January and August meetings in an effort to ensure that everyone attending these meetings is able to obtain the best possible airfare. This service is being performed

by TRAVCON; their advertisement can be found elsewhere in this meeting announcement. Although any travel agent can obtain Supersaver or other such published promotional fares, only TRAVCON can obtain the special additional 5% discount over and above these fares, and the 45% off regular coach fare. The latter, of course, is financially beneficial only when one does not qualify for one of the promotional fares. Participants should pay particular attention to the policies stated in the ad.

Weather: Orono is pleasant in August, with daytime highs generally in the 70's and nighttime lows in the 50's, so bring a sweater. An occasional shower or thunderstorm is possible. A jacket is appropriate for those planning to visit the coast or the mountains, where temperatures tend to be about ten degrees cooler.

Local Arrangements Committee
The members of the Local Arrangements Committee are Joseph A. Cima (ex-officio), Clayton W. Dodge, Pao Sheng Hsu, William H. Jaco (ex-officio), Philip M. Locke, John C. Mairhuber, Grattan P. Murphy (chair), Kenneth A. Ross (ex-officio), Charles P. Slavin, Donald B. Small, and William L. Soule, Jr., and Marcia P. Sward (ex-officio).

Petition Table
At the request of the AMS Committee on Human Rights of Mathematicians, a table will be made available in the meetings registration area at which petitions on behalf of named individual mathematicians suffering from human rights violations may be displayed and signed by meetings participants acting in their individual capacities.

Signs of moderate size may be displayed at the table, but must not represent that the case of the individual in question is backed by the Committee on Human Rights unless it has, in fact, so voted. Volunteers may be present at the table to provide information on individual cases, but notice must be sent at least seven (7) days in advance of the meetings to the Director of Meetings in Providence (telephone 401-455-4137). Since space is limited, it may also be necessary to limit the number of volunteers present at the table at any one time. The Committee on Human Rights may delegate a person to be present at the table at any or all times, taking precedence over other volunteers.

Any material which is not a petition (e.g., advertisements, résumés) will be removed by the staff. *When registration closes, any material on the table will be discarded, so individuals placing petitions on the table should be sure to remove them prior to the close of registration.*

(Calendar continued from back cover.)
analysis especially appropriate to the exploratory phase. Results are often displayed graphically. For further information, contact: Clayton Dodge, Department of Mathematics, University of Maine, Orono, Maine 04469; (207) 581-3908.

17–21 June 1991   NSF funded workshop on *Computer Algebra Systems* (CAS), West Valley College, Saratoga, California 95070. Designed to prepare persons to use a CAS as a teaching tool in calculus. The program contains three parts: "hands-on" experience using one or two CASs; pedagogical issues; and participant involvement in developing a CAS-based curriculum topic. The instructors, Wade Ellis, Jr. of West Valley College and Joseph R. Fiedler of the University of California at Bakersfield, will focus on **Derive** and **Maple.** Participants should possess some experience with a CAS. The National Science Foundation will fund all expenses *except* travel. For further information, contact: Denny K. Burzynski at West Valley College.

20–23 June 1991   *Fourth Boston Workshop for Mathematics Faculty,* Wellesley College, Massachusetts. Workshop dedicated to strengthening undergraduate teaching. For further information, contact: Gilbert Strang, Department of Mathematics, MIT, Cambridge, Massachusetts 02139, (617) 253-4383.

30 June–3 July 1991   NSF funded *Regional Institute in Dynamical Systems,* Boston University. Topic: "Chaos and Catastrophes." Principal lecturer: E. Christopher Zeeman of Oxford University. The NSF will offer full or partial support for room, board, and travel expenses to some participants. For further information, contact: Dynamical Systems Institute, Department of Mathematics, Boston University, 111 Cummington Street, Boston, Massachusetts 02215.

7–11 July 1991   NSF funded *Regional Institute in Dynamical Systems,* Boston University. Topic: "Fractal Geometry." Principal lecturer: Jenny Harrison of the Mathematical Sciences Research Institute. (See 30 June–3 July 1991 above for complete institute announcement.)

14–18 July 1991   NSF funded *Regional Institute in Dynamical Systems,* Boston University. Topic: "Complex Analytic Dynamics." Principal lecturers: Bodil Branner of the Technical University of Denmark and John Milnor of the State University of New York at Stony Brook. (See 30 June–3 July 1991 above for complete institute announcement.)

14–19 July 1991   NSF funded workshop on *Computer Algebra Systems* (CAS), Colby College, Waterville, Maine 04901. The instructor, James Douglas Child of Rollins College, will focus on **Calculus T/L, Derive** and **Maple.** *(See 17–20 June 1991 above for complete workshop announcement.)* For further information, contact Donald B. Small at Colby College.

15 July–2 August 1991   NSF sponsored conference: *Recent Developments in Differential Equations with Applications to Modeling in Population Ecology.* Focus on both content and applicability to the undergraduate curriculum. Speakers include: Herbert I. Freedman of the University of Alberta and Paul Waltman of Emory University. Some support available to selected participants. For further information and application forms, contact: A. Duane Porter, Department of Mathematics, University of Wyoming, Laramie, Wyoming 82071. E-mail: adporter@uwyo.bitnet.

17–19 July 1991   Ohio Section Short Course on *Problem Solving: How to Teach It,* John Carroll University, University Heights, Ohio 44118. Edward J. Barbeau, Jr. of the University of Toronto, coeditor, with W. O. J. Moser, of the Canadian Mathematics Olympiads from 1968–1978, and coeditor, with Murray Klamkin and Moser, of the five-volume *1001 Problems in High School Mathematics* will conduct this short course. For further information, contact: D. J. Horwarth of the Department of Mathematics and Computer Science at John Carroll University, (216) 397-4685. E-mail: BITNET: DJH@JCUVAX.

21–25 July 1991   NSF funded *Regional Institute in Dynamical Systems,* Boston University. Topic: "Renormalization and Rigidity." Principal lecturers: Curt McMullen of the University of California at Berkeley and Dennis Sullivan of the Graduate Center of the City University of New York and of IHES. (See 30 June–3 July 1991 above for complete institute announcement.)

21–26 July 1991   NSF funded workshop on *Computer Algebra Systems* (CAS), St. Olaf College, Northfield, Minnesota 55057. The instructors, Paul Zorn of St. Olaf College and Michael G. Henle of Oberlin College, will focus on **Maple** and **Mathematica.** *(See 17–20 June 1991 above for complete workshop announcement.)* For further information, contact Arnold M. Ostebee at St. Olaf College.

21–26 July 1991   NSF funded workshop on *Computer Algebra Systems* (CAS), Clemson University, Clemson, South Carolina 29634. The instructors, Donald R. LaTorre and Thomas G. Proctor both of Clemson University, will focus on the HP 48S calculator. *(See 17–21 June 1991 above for complete workshop announcement.)* For further information, contact: John W. Kenelly of Clemson University.

Summer List of Applicants

Instructions for Applicant Form on facing page

The form. Forms submitted by job applicants who attend the Mathfest in Orono will be posted. The first impression a prospective employer has of an applicant may be based on the appearance of this form.

The forms should be carefully typed using a fresh black ribbon. The best results are obtained with a carbon-coated polyethylene film ribbon, but satisfactory results may be obtained using a ribbon made of nylon or other woven fabric if suitable care is exercised. It is important that the keys be clean and make a sharp, clear impression. Use a correcting typewriter or correction tape or fluid if necessary. Submit the original typed version only. Hand lettered forms are acceptable if prepared carefully.

The summary strip. Information provided here will be used to prepare a printed list of applicants for distribution to employers. Please supply all information requested, and **confine your characters to the boxes provided**. Use the codes below. Circled letters identify corresponding items on the form and the strip.

Address forms to the Mathematics Meetings Service Bureau (MMSB), P. O. Box 6887, Providence, RI 02940. The deadline for receipt is **June 6, 1991**.

(A) Specialties

AL = Algebra	AN = Analysis
BI = Biomathematics	BS = Biostatistics
CB = Combinatorics	CM = Communication
CN = Control	CS = Computer Science
CT = Circuits	DE = Differential Equations
EC = Economics	ED = Mathematical Education
FA = Functional Analysis	FI = Financial Mathematics
FL = Fluid Mechanics	GE = Geometry
HM = History of Math	LO = Logic
MB = Mathematical Biology	ME = Mechanics
MO = Modelling	MP = Mathematical Physics
MS = Management Science	NA = Numerical Analysis
NT = Number Theory	OR = Operations Research
PR = Probability	SA = Systems Analysis
ST = Statistics	TO = Topology

(B) Career Objectives

AR = Academic Research	AT = Academic Teaching
NR = Nonacademic R&D	NC = Nonacad. Consulting
NS = Nonacademic Supervision	

(H) (I) Duties

T = Teaching	U = Undergraduate
G = Graduate	R = Research
C = Consulting	A = Administration
S = Supervision	IND = Industry
GOV = Government	DP = Data Processing

Location

E = East		S = South
C = Central		M = Mountain
W = West	O = Outside U.S.	I = Indifferent

Summer List of Applicants

1. **This form CANNOT be submitted by electronic mail.**
2. **Please type. See instructions on facing page. Do not type beyond the box.**
3. **Deadline for receipt of form is June 6, 1991.**
4. **Return form to: MMSB, P.O. Box 6887, Providence, RI 02940.**

APPLICANT: Name_____

Mailing address (include zip code) _____

_____

(A) Specialties_____

(B) Career objectives and accomplishments

ACADEMIC: ☐ Research, ☐ Teaching

NON-ACADEMIC: ☐ Research and Development, ☐ Consulting, ☐ Supervision

Near-term career goals_____

Significant achievements or projects, including role_____

Honors and offices_____

Other (e.g., paper to be presented at THIS meeting)_____

Selected titles of papers, reports, books, patents_____

(C) Degree   Year   Institution

_____ _____ _____ (D) No. of abstracts, internal reports_____

_____ _____ _____ (E) No. of papers accepted_____

_____ _____ _____ (F) No. of books and patents_____

EMPLOYMENT HISTORY:

	Present	Previous	Previous
(G) Employer			
Position			
(H) Duties			
Years	___to___	___to___	___to___

DESIRED POSITION:_____

(I) Duties_____

(J) Available mo.____/yr.____ Location_____

(K) References   (Name and Institution)

_____

_____

_____

(L) Citizenship: (check one) ☐ U.S. Citizen ☐ Non-U.S. Citizen, Permanent Resident
                                            ☐ Non-U.S. Citizen, Temporary Resident

(M) I plan to attend the Summer Meeting   yes ☐   no ☐

SUMMARY STRIP

Family Name First Name Mailing Address

Address (cont'd.) Address (cont'd.) State & Zip Code (A) Specialties

(B) Career objectives (C) Highest Degree (C) Yr. (C) Institution (D) (E) (F) (G) Most recent employer

(H) Present duties (I) Desired duties (J) Available mo./yr.

SUMMER LIST OF APPLICANTS FORM

BANGOR-ORONO AREA MAP

BANGOR / ORONO AREA
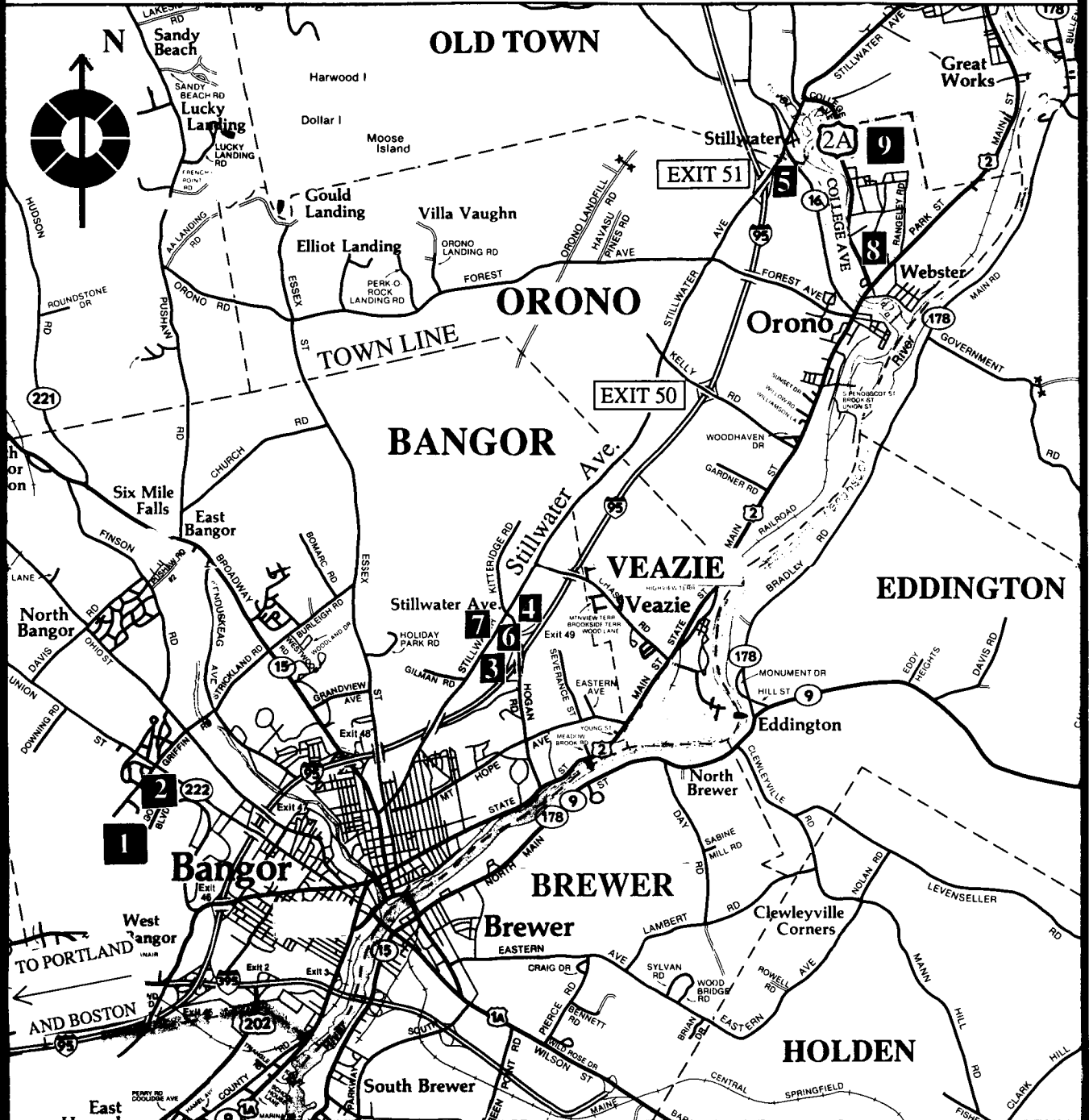
Legend

1 - Bangor International Airport

2 - Bangor Hilton

3 - Bangor Mall

4 - Bangor Motor Inn

5 - Black Bear Inn

6 - Comfort Inn

7 - Country Inn

8 - University Motor Inn

9 - University of Maine

0   2.4miles

1 inch = 2.4 miles

UNIVERSITY OF MAINE

OLD TOWN

U.S. ROUTE 2

PARK ST.

RANGELEY RD.

WOODLAND PRESERVE

TALMAR WOOD

WOODLAND PRESERVE

RANGELEY RD.

MAINE CENTER FOR THE ARTS

LIBRARY

ATHLETIC FIELD

PUBLIC SAFETY

CAMPUS INFORMATION

TO MAIN STREET

COLLEGE AVE.

U.S. ROUTE 2A

U.S. ROUTE 2A

MEMORIAL GYM

ALFOND ARENA

COLLEGE AVE.

STILLWATER RIVER

TO AIRPORT AND BANGOR

N
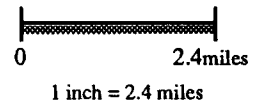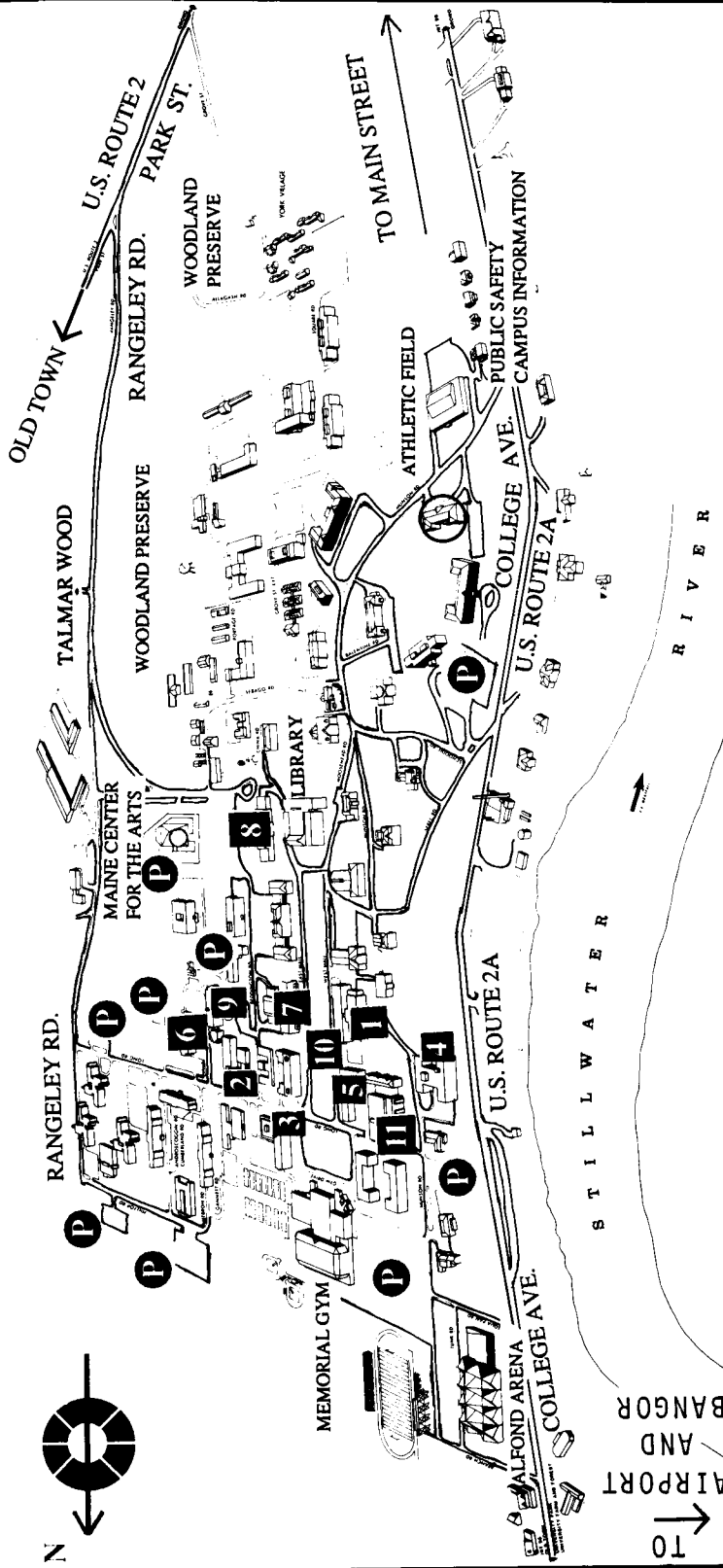
Legend

1 - Aubert Hall

2 - Barrows Hall

3 - Bennett Hall

4 - Hancock Hall

5 - Hart Hall

6 - Jenness Hall

7 - Little Hall

8 - Memoral Union
   Hauck Auditiorum
   Bookstore

9 - Neville Hall & Computer Center

10 - The Mall Area

11 - Wells Commons

P - Parking Lots

0   1/2 mile

1 inch = 1/2 mile

UNIVERSITY OF MAINE MAP
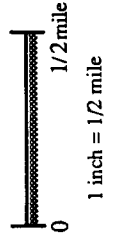
HOTEL DESCRIPTIONS AND RATES

Orono/Bangor Hotels/Motels

As an alternative to university housing, the Service Bureau lists the following hotels/motels with group rates. They are all located within 1–13 miles of the university and are listed below in order of distance from campus. **There is no public tranportation from these hotels to the university. Participants residing in hotels/motels must have a car.** Rates are subject to a 7 percent sales tax. Checkin time is noon. The Bangor Motor Inn and the Comfort Inn offer a free shuttle to and from the airport. The Bangor Hilton is located across the street from the airport. All hotels/motels offer free parking, a very limited number of nonsmoking rooms, and, with the exception of the Bangor Hilton, a limited amount of sleeping rooms equipped for the handicapped. The sleeping rooms in the Bangor Hilton are not equipped for the handicapped. Not all properties listed below have restaurants. **This means leaving the premises to dine. Participants should consider this carefully when choosing one of the hotels/motels listed below.**

Participants should make their own reservations directly with the following hotels/motels. All rooms and rates listed **are based on availability ONLY.** Participants making reservations should be prepared to remit a one night's deposit to the hotel or motel or give a major credit card number in order to guarantee their room reservation.

	Location	Location to University	Description	Single	Double 1 beds	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot
University Motor Inn	5 College Avenue Orono, ME 04473 207-866-4921	1.2 miles	Restaurant, Lounge Outdoor Pool	$48	N/A	$58	$64	N/A	$70	N/A
Bangor Motor Inn	Hogan Road Bangor, ME 04401 207-947-0355	9.5 miles	NO Restaurant Lounge Free Continental Breakfast	$56	$64	$64	$72	$80	N/A	N/A
Comfort Inn	750 Hogan Road Bangor, ME 04401 207-942-7899 1-800-228-5150	9.5 miles	Restaurant Lounge Outdoor Pool # rooms on 8/10 and 8/11 very limited	$59	$69	$69	$75	$81	$81	$87
Country Inn	936 Stillwater Ave. Bangor, ME 04401 207-941-0200	9.5 miles	NO Restaurant Free Continental Breakfast # of rooms very limited	$57	$57	$57	$62	$62	$72	$72
Bangor Hilton Airport (Headquarters)	303 Godfrey Boulevard Bangor, ME 207-947-6721 1-800-227-4609	13 miles (Across street from Airport)	Restaurant, Lounge Free Parking	$85	$85	$85	$85	N/A	$85	N/A

N.B.: IF YOU PLAN ON STAYING IN ONE OF THESE HOTELS/MOTELS, YOU MUST BE PREPARED TO PROVIDE YOUR OWN TRANPORTATION TO AND FROM CAMPUS.

Preregistration/Housing Form, Orono, Maine
August 8–10, 1991
Must Be Received in Providence No Later Than June 6, 1991

Please complete this form and return it with your payment to
Mathematics Meetings Service Bureau
P.O. Box 6887, Providence, Rhode Island 02940 – Telephone: (401) 455-4143-Telex: 797192

DEADLINES:

Preregistration/Residence Hall Reservations	June 6, 1991
Final Preregistration (no housing)	July 11, 1991
90% Refund on Residence Hall Package	July 26, 1991 (no refunds after this date)
50% Refund on Tours/Banquets/Cookout	July 9, 1991 (no refunds after this date)
50% Refund Preregistration Cancellation	August 2, 1991 (no refunds after this date)

REGISTRATION FEES

	Preregistration by mail by July 11, 1991	At Meeting
MATHFEST		
Member of AMS, CMS, MAA, PME	$ 85	$ 111
Nonmember	132	172
* Student, Unemployed, or Emeritus	25	33
AMS SHORT COURSE		
Member/Nonmember	55	70
* Student, Unemployed, Emeritus	25	30

* See section on "How to Preregister" in the *Notices* or *Focus* for definition of "student", "unemployed", or "emeritus" status.

PREREGISTRATION SECTION: Please check the function(s) for which you are preregistering:

Mathfest ☐   AMS Short Course (August 6–7) ☐   (A separate form for MAA Minicourses appears in this issue)

1) _____ Telephone: _____
   (Please print) Surname   First   Middle

2) _____
   (Mailing address)   (E-mail address)
   I do not wish my badge and program to be mailed; however, the mailing address for my acknowledgement is given above. ☐

3) Badge information: Affiliation _____ 4) I am a student at _____

5) Emeritus member ☐   Unemployed ☐   MR Classification # _____

6) Member of AMS ☐ CMS ☐ MAA ☐ PME ☐ Nonmember ☐   Member of other organizations: AWM ☐ NAM ☐

7) Mathfest fee $ _____   8) AMS Short Course fee $ _____   9) Residence Hall payment $ _____

10) Opening Banquet: ____ tkt(s) @ $15 each = $ _____   ____ (staying on campus) tkt(s) @ $9 each = $ _____

11) MAA 25-Yr Member Banquet: ____ tkt(s) @ $20 each = $ _____   ____ (staying on campus) tkt(s) @ $14 each = $ _____

12) PME Banquet: ____ tkt(s) @ $8 each = $ _____   ____ (staying on campus) tkt(s) @ $2 each = $ _____

13) Lobster Cookout: ____ Lobster tkt(s) @ $23 each = $ _____   ____ (staying on campus) tkt(s) @ $17 each = $ _____
                       ____ Steak tkt(s) @ $23 each = $ _____   ____ (staying on campus) tkt(s) @ $17 each = $ _____
                       ____ Vegetarian tkt(s) @ $23 each = $ _____   ____ (staying on campus) tkt(s) @ $17 each = $ _____
                       ____ Child (10 & under) tkt(s) @ $8 each = $ _____   ____ (staying on campus) tkt(s) @ $3 each = $ _____

14) Tours: ____ Bangor tkt(s) @ $26 each = $ _____   ____ (staying on campus) tkt(s) @ $21 each = $ _____
                       ____ Leonard's Mills tkt(s) @ $15 each = $ _____   ____ (staying on campus) tkt(s) @ $10 each = $ _____
                       ____ Moose Watch tkt(s) @ $36 each = $ _____   ____ Child (under 12) tkt(s) @ $33 each = $ _____
                       ____ Whale Watch tkt(s) @ $46 each = $ _____   ____ Child (under 12) tkt(s) @ $40 each = $ _____
                       ____ White Water Rafting tkt(s) @ $89 each = $ _____ ____ Child (under 11) tkt(s) @ $43 each = $ _____

15) TOTAL AMOUNT ENCLOSED FOR 7 through 14 $_____ NOTE: May be paid by check payable to AMS (Canadian checks must be marked "U.S. Funds") or VISA or MasterCard credit cards.

Credit card type: _____ Card number: _____ Expiration date: _____
If this is your credit card, please print your name as it appears on the credit card on the line below as well as sign your name.
If this is not your credit card, please print card holder's name as it appears on the credit card on the line below, and have the card holder sign:

_____   _____
         (Printed name)   (Signature)

Please complete the appropriate sections on the reverse.

For office use only:

Codes:	Options:	Hotel:	Dorm:	Room type:
Dates:	Hotel Deposit	Room/Board Pmt	Total Amt. Paid:	

Special Remarks:

$ _____ room/board paid; $ _____ room/board due

HOUSING SECTION:

☐   Please check here if you will **not** be staying in one of the hotels, motels, or residence halls being offered through the Service Bureau.

☐   Please check here if you will be staying in one of the hotels/motels being offered through the Service Bureau.

UNIVERSITY HOUSING SECTION:

NOTE: Full prepayment for room and board is required. Please make checks payable to AMS. Canadian checks must be marked "In U.S. Funds", VISA and MasterCard credit cards will also be accepted. Acknowledgements of your residence hall reservations will be sent to address indicated on reverse. **The University will assign ALL rooms. Purchase of room and board package is mandatory, and the price of meals is included in the rates below. Please see items #10–14 for purchasing tickets with special prices for participants residing on campus.**

Please circle applicable rates listed below for each day and enter totals in column at far right. Please notice per person rates vs. family package rates.

	Adults* (per person)	Youths* 11–18 yrs. (per person)	1 Adult + 1 Youth 11–18 yrs.	1 Adult + 1 Youth 10 yrs. & younger	2 Adults+ 1 Youth 11–18 yrs. in rollaway	2 Adults+ 1 Youth 10 yrs. & younger in rollaway	Enter total rate per day
8/5	$41.00 single $37.00 double	$33.00 single $31.00 double	$63.00	$60.00	$91.00	$89.00	
8/6	$41.00 single $37.00 double	$33.00 single $31.00 double	$63.00	$60.00	$91.00	$89.00	
8/7	$41.00 single $37.00 double	$33.00 single $31.00 double	$63.00	$60.00	$91.00	$89.00	
8/8	$41.00 single $37.00 double	$33.00 single $31.00 double	$63.00	$60.00	$91.00	$89.00	
8/9	$41.00 single $37.00 double	$33.00 single $31.00 double	$63.00	$60.00	$91.00	$89.00	
8/10	$41.00 single $37.00 double	$33.00 single $31.00 double	$63.00	$60.00	$91.00	$89.00	
8/11	$41.00 single $37.00 double	$33.00 single $31.00 double	$63.00	$60.00	$91.00	$89.00	
Total for Residence Hall Package = (Please insert this amount in #9 on the reverse)							$

There is no room and board charge for infants in arms.

*There can be a maximum of two adults in a room. There can be a maximum of three people in a room if one of them is a youth.

Special housing requests, handicapped needs, etc.: _____

I will arrive on (date) _____ at _____ a.m./p.m., and depart on (date) _____ at _____ a.m./p.m.

Please list other room occupants, indicating ages of children.   Please check here if one of the occupants is your spouse ☐

FULL NAME	ARRIVAL DATE	DEPARTURE DATE

☐   I am not staying in the residence halls but plan to purchase meals in the Wells Commons Dining Hall.

☐   My child/children will attend the Children's Reception on Wednesday, August 7. Ages: _____

☐   My child/children will attend the Art Class on Friday, August 9. Ages: _____

MAA Minicourse Preregistration Form, Orono, Maine
August 8–10, 1991

NOTE: This is not an AMS Short Course Form. Please use the Orono, Maine Pregistration/Housing Form to preregister for the AMS Short Course.

To preregister for MAA Minicourse(s), please complete THIS form and return it with your payment to:

Linda Heineman
Mathematical Association of America
1529 Eighteenth Street, N.W.
Washington, DC 20036
Telephone: 202-387-5200

_____ Telephone: _____

(Please print)   Surname   First   Middle

_____

Street address   City   State   Zip

- Deadline for MAA Minicourse preregistration: June 6, 1991 (After this date, potential participants are encouraged to call the MAA headquarters at 800-331-1622.)
- Deadline for cancellation in order to receive a 50% refund: August 2, 1991
- Each participant must fill out a separate Minicourse Preregistration form.
- Enrollment is limited to two Minicourses, subject to availability.
- Please complete the following and send both form and payment to Linda Heineman at the above address:

    I would like to attend ☐ 1 Minicourse   ☐ 2 Minicourses

    Please enroll me in MAA Minicourse(s):   #_____ and #_____

    In order of preference, my alternatives are: #_____ and #_____

- PAYMENT

    Check enclosed: $ _____

    Credit card type: ☐ MasterCard ☐ Visa

    Credit card # _____ Expiration date: _____

_____   _____
Your Employing Institution   Signature (as it appears on credit card)

Minicourse Number and Name	Organized by	Fee
1. Julia Sets and the Mandelbrot Set	Robert L. Devaney	$36
2. Integrating Calculus and Physics for Freshmen	Joan R. Hundhausen & F. Richard Yeatts	$36
3. Making Mathematics More Concrete	Agnes Azzolino	$36
4. Teaching Mathematical Modeling	Frank Giordano & Maurice Weir	$36
5. Conceptualizing, Organizing, and Seeking Funding for Teacher Education Projects	Joan Ferrini-Mundy & Carole Lacampagne	$36
6. Symmetry Analysis of Repeated Patterns	Donald Crowe	$36
7. Great Theorems from Mathematical Analysis: 1689–1881	William Dunham	$36
8. Knot Theory for Undergraduates	Stefanos Gialamas	$36
9. Unifying Themes for Discrete Mathematics	Ralph Grimaldi	$36
10. Mathematical Computer Graphics on the HP-28C&S and HP-48SX: A Means to Arouse Students' Interest in Mathematics ~~CANCELLED~~	Yves Nievergelt	$36

☐ I plan on preregistering for the Orono Mathfest ONLY in order to attend the MAA Minicourse(s) indicated above. It is my understanding that, should the course(s) of my choice be filled, full refund of the Mathfest preregistration fee will be made.

☐ I would like to preregister for the free Student Workshop organized by the MAA Committee on Student Chapters.

MAA MINICOURSE REGISTRATION FORM   SEND TO THE MAA IN WASHINGTON, DC

Board Actions in San Francisco

Gerald L. Alexanderson, Secretary

At its San Francisco meeting on 15 January 1991, the Board of Governors elected two new governors-at-large to represent mathematicians in teacher education and mathematicians outside academia. Elected to the first position, replacing John A. Dossey, is Shirley A. Hill of the University of Missouri at Kansas City; elected to the second position, replacing Marjorie L. Stein, is S. Brent Morris of the National Security Agency. The Board also elected a new chair of the Committee on Sections: Barbara Trader Faires of Westminster College; she replaces David W. Ballew.

The *ad hoc* Committee on Awards recommended to the Board a new series of teaching awards to be given at the Sectional and national levels. The proposal was approved. A committee is being appointed to determine guidelines for selecting awardees in the Sections. This committee will also recommend to the Board of Governors candidates for the national awards.

The Board approved a report of the Committee on the Mathematical Education of Teachers (COMET), *A Call for Change: Recommendations for the Mathematical Preparation of Teachers of Mathematics*. This wide-ranging statement on teacher education was published and distributed on 12 March 1991. (For further details on this timely report, see page five of this issue of FOCUS.)

A restructuring of Association committees into six areas, each with a Coordinating Council, was approved by the Board. These six areas—Awards, Competitions, Education, Human Resources, Meetings, and Publications—will include almost all of the Association's committees. (A few committees, e.g., the Executive and Finance Committees, the Committee on Sections, and the Investment Committee, do not fall easily within any of these categories.) The grouping of committees should increase communication between committees working in related areas and also provide the opportunity for new vision in these important general areas of MAA activity. President Deborah Tepper Haimo is now proceeding with the appointment of members of the Coordinating Councils. Chairs for the Councils have already been appointed: Henry L. Alder of the University of California at Davis (Awards); Thomas W. Tucker of Colgate University (Competitions); Alan C. Tucker of the State University of New York at Stony Brook (Education); Eileen L. Poiani of St. Peter's College (Human Resources); David W. Ballew of Western Illinois University (Meetings); and Donald J. Albers of Menlo College (Publications).

The Board approved Denver, Colorado as the meeting site for the joint meetings in January 1995. There has been continuing discussion of summer meetings. Attendance at summer meetings has been disappointing in recent years, often ranging between 600 and 700. It reached 1,300 in Columbus last summer but only because of the special nature of the meeting—the 75th anniversary of the Association. In order to reduce the deficit that results from low attendance at summer meetings and to make them more attractive to people who want to combine meetings with a vacation, a revised format will be used this summer in Orono, Maine. Because of the 1992 International Congress on Mathematics Education (ICME) in Québec, there will be no joint AMS-MAA scientific meetings during that summer; the Board of Governors and a few committees, however, will hold meetings there to conduct essential business. This practice follows the precedent set in 1986 when the International Congress of Mathematicians (ICM) was held in Berkeley, California. The following summer (1993), the Association will hold joint meetings in Vancouver, British Columbia with the American Mathematical Society (AMS) and the Canadian Mathematical Society (CMS). Orono and Vancouver are both attractive sites for summer meetings and, of course, many members of the Association will want to attend ICME in Québec in 1992.

The Board passed a resolution thanking retiring President Lida K. Barrett for her outstanding contributions to the Association. It also passed a resolution congratulating the Women and Mathematics Program (WAM) on its fifteen years of contributions to the mathematical community.

The next meeting of the Board will take place in Orono, Maine on Wednesday, 7 August 1991.   ∎

Gerald L. Alexanderson is Professor of Mathematics at Santa Clara University in Santa Clara, California. From 1986–1990, he edited the Association's MATHEMATICS MAGAZINE.

Small Grants for Development of Mathematics Intervention Projects

The Mathematical Association of America (MAA) expects to receive a grant in April 1991 to fund **Small Grants for Development of Mathematics Intervention Projects.** In anticipation of this grant, SUMMA is soliciting mathematicians and their department and institutions to submit proposals for the advance work necessary to host precollege mathematics intervention projects targeting underrepresented minority students. These projects may replicate already existing, successful projects, adapt components of such projects, or be innovative. The primary objective of the SUMMA **Small Grants Program** is to encourage mathematicians to develop projects to increase minority participation in mathematics.

Grants are expected to average $5,000 and will be made to the institution of the project director to be spent within the year. An institution is encouraged to supply matching funds as an indication of commitment to that project's development. Grants will be made to faculty at minority institutions; they will also be made to colleges and universities which have student bodies with a high percentage of underrepresented minorities (at least twenty percent) and a track record of success in developing minority students interest in mathematics and science. In addition, grants will be made to colleges and universities in which the institution or department has demonstrated that the faculty have the willingness and capacity to replicate or adapt successful projects.

Potential participants should submit proposals as soon as possible, but no later than **30 April 1991.** SUMMA will notify all applicants by **15 May 1991.** Your (maximum) three-page proposal should include a brief narrative on how a successful existing project can be expected to be adapted to local conditions (or need for innovation), potential for long-term commitment of host institution, and likelihood of institutionalization through local or state funding (perhaps after start-up federal funding from a variety of programs). For more detailed information on these grants, contact: Dr. William A. Hawkins, Jr., Director, The Mathematical Association of America-SUMMA, 1529 Eighteenth Street Northwest, Washington, DC 20036-1385. Telephone: (202) 387-5200. FAX: (202) 265-2384. E-mail: maa@athena.umd.edu.

FOCUS Employment Advertisements

The Mathematical Association of America's more than 30,000 members all receive FOCUS and its "Employment Advertisements" as a standard membership benefit. FOCUS readers describe themselves as mathematicians teaching in secondary schools, colleges and universities, or working in business, industry, and government.

Rates for both classified and display FOCUS Employment Advertisements:

■ Fifty (50) words or less: $50.00

■ More than fifty (50) words:
   $55.00 per column inch

Each advertising column measures 14.33 picas or 2⁷⁄₁₆ inches wide. Advertisements spanning two columns measure 29.66 picas or 4¹⁵⁄₁₆ inches wide. Advertisements spanning three columns measure 45 picas or 7½ inches wide.

FOCUS offers a 15% discount for the same advertisement in three or more consecutive issues.

The MAA will invoice advertisers after the *first* occurrence specified in insertion orders. All invoices include a tear sheet.

ADVERTISING COPY DEADLINES

The Association publishes FOCUS six times per year. Advertisement copy deadlines include:

■ June 1991 issue
   Friday, 19 April 1991

■ September 1991 issue
   Monday, 8 July 1991

After these deadlines, we advise potential advertisers to telephone MAA headquarters to inquire about advertising space availability in these issues. *The Association will accept postdeadline advertisements on a discretionary basis only.*

Anyone wishing to place an employment advertisement in FOCUS should contact:

Siobhán B. Chamberlin
FOCUS Employment Advertisements
The Mathematical Association of America
1529 Eighteenth Street Northwest
Washington, DC 20036-1385
Telephone: (202) 387-5200
FAX: (202) 265-2384
e-mail: maa@athena.umd.edu

NORTHWESTERN COLLEGE (IOWA)

NORTHWESTERN COLLEGE (Iowa) seeks candidates for a one or two-year leave replacement beginning in fall 1991. Teaching assignments for 1991–92 include statistics, business calculus, and math service courses. Candidates must have a master's degree in math or math education, teaching experience, and commitment to a Reformed expression of evangelical Christian faith. Send materials to: Dr. Robert Zwier, Vice-President for Academic Affairs, Northwestern College, Orange City, IA 50141. NORTHWESTERN COLLEGE COMPLIES WITH FEDERAL AND STATE REQUIREMENTS FOR NONDISCRIMINATION IN EMPLOYMENT. WOMEN AND MINORITIES ARE ENCOURAGED TO APPLY.

WESTERN WYOMING COMMUNITY COLLEGE

Western Wyoming Community College invites applications for the position of instructor of mathematics. This is a full-time, 9-month per year appointment with duties to commence late August 1991. Successful candidate will be committed to providing quality instruction and participating in other college and departmental activities. A master's degree in mathematics is required. Salary is commensurate with education and qualifications. Closing date for receipt of completed WWCC application form is April 1, 1991. Also, please submit resumé, letter of application, and academic transcripts. For further information, WWCC application form, and detailed job description, please contact: Personnel Office, Western Wyoming Community College, PO Box 428, Rock Springs, Wyoming 82902-0428; or call (307) 382-1610.

WWCC IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.

CHRISTIAN BROTHERS UNIVERSITY

Department of Mathematics and Computer Science

Tenure-track position in mathematics and/or computer science beginning in 8/91. An applicant should possess a doctorate in mathematics or computer science or have multiple master's degrees, one of which must be in mathematics or computer science. ABDs will be considered if completion of the dissertation is assured. CBU is a Catholic, primarily undergraduate institution with an enrollment of about 1,600 students and offers degrees in arts, business, engineering, and science. Successful teaching experience at the undergraduate level is desirable. Rank and salary depend on experience and credentials.

Qualified candidates may apply by submitting a letter of application and resumé with names and addresses of at least three references to:

Dr. Arthur Yanushka, Head
Department of Mathematics/Computer Science
Christian Brothers University
Memphis, TX 38104

AA/EOE

WIDENER UNIVERSITY

Applications are invited for a position as visiting assistant professor, renewable annually for up to 3 years, beginning September 1991. PhD required. Teaching load: 12 hours/semester. Strong interest in teaching undergraduates essential. Some experience desirable.

Send letter of application, resumé, and three letters of reference (at least one of which should concern teaching) to: Dr. Richard C. Pappas, Department of Mathematics, Widener University, Chester, PA 19013.

An Equal Opportunity/Affirmative Action Employer.

TEMPORARY POSITIONS 1991–1992

Department of Mathematics
Southern Illinois University At Carbondale

Temporary positions are anticipated starting on 16 August 1991 as Lecturer. Master's degree in mathematics or admission to candidacy required; PhD preferred. Applicants should provide evidence of excellence of teaching and foreign applicants *must* provide evidence of ability to teach in English effectively. Preference given to applicants with research interests compatible with those of the faculty. The duties will consist of 12 hours of undergraduate mathematics instruction each semester. Closing date: 15 May 1991 or until positions are filled. Send applications (including transcripts) to:

Temporary Positions
c/o Ronald Kirk, Chair
Department of Mathematics
Southern Illinois University at Carbondale
Carbondale, Illinois 62901

SIUC is an Equal Opportunity-Affirmative Action Employer.

STATE UNIVERSITY OF NEW YORK COLLEGE AT CORTLAND

Mathematics Department
Cortland, New York 13045

Applications are invited for a tenure-track position in mathematics at the assistant professor level beginning August 1991. Duties include teaching mathematics courses from the elementary to the upper-division level (four classes/three preparations). A doctorate in mathematics and evidence of strength in, and commitment to undergraduate education is required. An interest in the preparation of secondary mathematics teachers will be valued, as well as research potential in mathematics or mathematics education.

Please send credentials to: Professor Kenneth Wooster, Department of Mathematics, PO Box 2000, Cortland, New York 13045.

SUNY Cortland is an Equal Opportunity/Affirmative Action employer. Qualified women and minority candidates are encouraged to apply.

MATHEMATICIAN

Mount Saint Mary's College, an independent, Catholic college, has an opening in academic year 1991-1992 for an entry level assistant professor of mathematics, tenure-track. A PhD in mathematics is required by September of 1991 (preferably in hand). Candidates should possess a dedication to quality teaching at a small liberal arts college. Computer experience is desirable as is an interest in mathematical modeling and applications. Duties include teaching mathematics courses at all levels and involvement in departmental and college-wide activities and committees. Salary is competitive. Letter of application, vita, and three letters of recommendation should be sent to: Dr. John August, Search Committee, Department of Mathematics & Computer Science, Mount Saint Mary's College, Emmitsburg, MD 21727. Application review begins March 4, 1991 and continues until the position is filled.

Mount Saint Mary's College does not discriminate on the basis of sex, age, race, or national origin. Women and minorities are actively encouraged to apply.

TENURE-TRACK POSITION IN MATHEMATICS

Rank and salary depends on experience. PhD in mathematics is required. Excellence in teaching and a strong commitment to professional growth is also expected. Send vita, transcripts, and 3 letters of recommendation to: Dr. A. L. Temple, Jr., Chairman, Department of Mathematical and Physical Sciences, Northwestern State University, Natchitoches, LA 71457. AA/EOE.

EAST TEXAS STATE UNIVERSITY
Department of Mathematics

Applications are invited for a tenure-track assistant professor position starting August 1991. The position requires a PhD in mathematics. All candidates should have a strong commitment to excellence in teaching and expect to maintain an ongoing program of research. Participation in university, college, and departmental service is also expected. The teaching load is twelve hours per semester. Salary is negotiable, commensurate with qualifications and experience. Review of applications will begin March 1, 1991 and continue until the position is filled.

To apply, send vita, transcripts, and three current letters of reference to:

Stuart Anderson, Head
Department of Mathematics
East Texas State University
Commerce, TX 75429
Telephone : (903) 886-5157

Women and minorities are encouraged to apply. AA/EOE.

MEREDITH COLLEGE
Department of Mathematics and Computer Science

Applications are being accepted for a tenure-track faculty position in Computer Science beginning August 1991. To teach undergraduate computer science courses and take a leadership role in the development of the computer science and information systems curricula. PhD preferred. Salary and rank based on qualifications and experiences. Meredith is a small, liberal arts, women's college committed to excellence in teaching and located in the Research Triangle area of North Carolina.

Applicants should send a letter of application, resumé, and three letters of reference to: Dr. Virginia Knight, Head, Department of Mathematics and Computer Science, 3800 Hillsborough Street, Raleigh, NC 27607-5298. Minorities are encouraged to apply.

THE UNIVERSITY OF AKRON
Head—Department of Mathematical Sciences

The Department of Mathematical Sciences invites applications and nominations for the position of department head. A PhD in the mathematical sciences (mathematics, applied mathematics, statistics, or computer science) and a strong commitment to teaching and research are required. Some administrative and/or professional experience in a mathematical sciences PhD program is desirable. The Department consists of thirty-seven full-time faculty members and offers BS degrees in mathematics, applied mathematics, statistics, and computer science, and MS degrees in mathematics, applied mathematics, and statistics. The department has proposed graduate programs for the MS in computer science and the PhD in applied mathematics.

The University of Akron is the third largest state university in Ohio (30,000 day and evening students) and offers a multitude of associate, bachelor's, master's, and doctorate degree programs in the physical and social sciences, engineering, and education.

Review of applications will begin April 15, 1991 and continue until the position is filled. Tentative inquiries are desirable and will be treated confidentially. Please send a curriculum vitae and the names of at least three references to: Dr. Chand Midha, Chair, Search Committee, Department of Mathematical Sciences, The University of Akron, Akron, OH 44325-4002. The University of Akron is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply.

FACULTY POSITIONS
Department of Mathematical Sciences

The Department of Mathematical Sciences at the University of Akron invites applicants for a number of faculty positions. The department seeks:

1. an individual with a PhD in mathematics. An interest in freshman-sophomore curriculum development and articulation with regional secondary schools is desirable.

2. an individual with a PhD in statistics, preferably in the area of statistical computing, quality control, or applied probability.

Additional positions in mathematics, applied mathematics, statistics, and computer science are anticipated. Starting date September 3, 1991. Each response should indicate to which position the application is directed.

The department consists of thirty-seven full-time faculty members and offers BS degrees in mathematics, applied mathematics, statistics, and computer science, and MS degrees in mathematics, applied mathematics, and statistics. The department has proposed graduate programs for the MS in computer science, and the PhD in applied mathematics.

The University of Akron is the third largest state university in Ohio (30,000 day and evening students) and offers a multitude of associate, bachelors, masters, and doctorate degree programs in the physical and social sciences, engineering, and education.

Review of applications will begin April 15, 1991 and continue until the position is filled. Minorities and women are encouraged to apply.

Please send curriculum vitae, transcripts, and at least three letters of reference to:

Dr. David C. Buchthal
Acting Department Head
Department of Mathematical Sciences
The University of Akron
Akron, OH 44325-4002
e-mail: R1BUCK@AKRONVM.BITNET

The University of Akron is an Equal Education and Employment Institution.

TRANSYLVANIA UNIVERSITY
Lexington, KY 40508

COMPUTER SCIENCE: assistant/associate professor, Transylvania University. Full-time, tenure-track. PhD in computer science, or master's in computer science with PhD in a closely related field. Rank and salary dependent upon background. Exceptionally well-qualified candidates may be considered for a Bingham Award for Excellence in Teaching; smaller "start-up" grants are available for less experienced faculty. This recognition provides a supplement of up to 50% of base salary for the position. Transylvania is a private, liberal arts college with a strong commitment to excellence in undergraduate education. The program in computer science is of longstanding and is recognized for its outstanding quality. Please send letter of application, curriculum vitae, and names of three references to: Dr. Dwight W. Carpenter, Computer Science Program, Transylvania University, Lexington, KY 40508. An Equal Opportunity Employer.

TRANSYLVANIA UNIVERSITY
Lexington, KY 40508

The Mathematics Program invites applications for a tenure-track position commencing in the fall of 1991 and a possible one-year sabbatical replacement for 1991–92. Transylvania University is a private, liberal arts college with a strong commitment to academic excellence. Applicants must have a PhD in mathematics and a commitment to undergraduate teaching. Salary and rank will depend on qualifications and experience. Exceptionally well-qualified candidates may be considered for a Bingham Excellence in Teaching Award which supplements faculty member's salary by up to 50%; smaller, "start-up" grants are available for less experienced faculty. Send letter of application, resumé, undergraduate and graduate transcripts, and three letters of reference to: David L. Shannon, Mathematics Program Director, Transylvania University, Lexington, KY 40508. The search will remain open until the positions are filled. Transylvania University is an Equal Opportunity Employer.

LORAIN COUNTY COMMUNITY COLLEGE

Math position: instructor for tenure-track position needed for fall 1991. Master's in mathematics required, additional hours and/or PhD desirable; strong teaching experience in a community college preferred. Must be able to demonstrate ability to teach all areas of applied and transfer mathematics. Statistical and/or computer science expertise desirable.

Salary commensurate with qualifications and experience. The salary is enhanced by a comprehensive fringe benefits package. A job description will be forwarded to qualified candidates. Applicants should submit a letter of interest, a comprehensive resumé, and the names, addresses, and telephone numbers of 3 work-related references. Additional documentation, including a professional statement, will be required after receipt of the initial materials. Official transcripts are required prior to employment. Forward materials to:

Errol M. Browne, Director of Personnel
Lorain County Community College
1005 N. Abbe Road
Elyria, Ohio 44035

Screening process to begin in April 1991.

Minority candidates and
women are encouraged to apply

AN AFFIRMATIVE ACTION EQUAL OPPORTUNITY EMPLOYER

MATHEMATICS POSITION

One tenure-track opening exists for which expertise in computer science is preferred. A master's in the mathematical sciences is required and an appropriate doctorate is required for tenure. Appointment possible at ranks of assistant through associate ($28,686 to $46,727 per academic year). Emphasis on undergraduate teaching. Full-time load is 12 hours teaching per week. A complete application consists of a letter of application, vita, transcripts, and three letters of recommendation. Send application materials to: Search Committee, Dept. of Mathematics and Computer Science, Bloomsburg University, Bloomsburg, PA 17815. Complete applications will be reviewed beginning March 10, 1991, and we will continue accepting applications until the position is filled. Bloomsburg University is an equal opportunity and affirmative action employer. Women and all other protected class persons are encouraged to apply.

MOORHEAD STATE UNIVERSITY
Mathematics Department
Moorhead, MN 56563

One-year position as instructor or assistant professor of mathematics beginning September 1991. Master's degree in mathematics, mathematics education, or statistics required for instructor; PhD for assistant professor. College teaching experience desirable. Preference given to applicants holding the PhD degree. Duties include teaching mathematics and/or statistics and other professional activities as appropriate. The teaching load is twelve hours per quarter. First screening on April 1, 1991; applications accepted until filled. Apply to: Milton Legg, Chair, Mathematics Department, Moorhead State University, Moorhead, Minnesota 56563. Moorhead State University is an equal opportunity/affirmative action employer. Women and minority persons are encouraged to apply.

HEAD
Department of Mathematics
Texas A & M University

Applications and nominations are invited for the position of Head of the Department of Mathematics at Texas A & M University.

The Department of Mathematics resides in the College of Science and currently consists of 65 tenure-track faculty, approximately 20 visiting and nontenure-track faculty, and about 80 graduate students. Both MS and PhD degrees are offered. In addition to teaching, members of the department are actively involved in research and other professional activities. Nearly one-half of the tenure-track faculty receive outside research funding.

Candidates for the position must have an earned doctorate, a distinguished record in both teaching and research, and other professional accomplishments. Candidates should have demonstrated the ability and commitment to continue the development of all facets of a strong program in mathematics. Women and minorities are encouraged to apply.

Nominations and applications, along with resumés and names of references, will continue to be accepted until June 1, 1991 or until a suitable candidate is identified. Please send all materials to:

Professor C. J. Maxson, Chairman
Head Search Committee
Department of Mathematics
Texas A & M University
College Station, TX 77843
Phone: (409) 845-4150
FAX: (409) 845-6028
E-mail: MathDept@venus.tamu.edu

Texas A & M University is an equal opportunity affirmative action employer.

MATHEMATICS DEPARTMENT
Washburn University
Topeka, Kansas 66621

Tenure-track faculty position beginning Aug. 20, 1991. Qualifications: doctorate in mathematics or mathematics education or expect to complete all requirements by Dec. 31, 1991. The doctorate is required for rank of asst. or assoc. professor. Experience in elementary or secondary teaching is desirable, as is experience in utilizing computers in the classroom. Interest in working with elementary and secondary preservice teachers is essential. Responsibilities include teaching undergraduate mathematics for elementary and secondary majors and mathematics for liberal arts students. Scholarly activity is required for promotion and tenure. Salary is commensurate with qualifications. Send vita, transcripts, and three letters of reference to: Dr. A. Allan Riveland by April 15, 1991. Washburn University is an equal opportunity/affirmative action employer.

GANNON UNIVERSITY
Mathematics Department
University Square, Erie, PA 16541

The Department of Mathematics invites applications for a tenure-track position beginning August 1991. Applicant must possess a PhD with strength in probability and statistics, and demonstrate evidence of good undergraduate teaching with research potential. Send resumé and three letters of recommendation to: Dr. Rafal Ablamowicz, Chairman. For full consideration, please apply by March 1, 1991. Gannon University is an Equal Opportunity/Affirmative Action Employer.

BENTLEY COLLEGE
Waltham, Massachusetts

The Department of Mathematical Sciences anticipates at least one opening for a tenure-track position starting in fall 1991. A PhD in mathematics, statistics, quantitative methods, operations research, or a related field is required. Located in suburban Boston, Bentley College has long been known for its leadership in the education of business professionals. In recent years, the school has experienced dramatic growth and currently enrolls about 7,500 graduate and undergraduate students in both business and liberal arts programs. While heavy emphasis continues to be placed on quality teaching, research and other scholarly activities are also encouraged and expected. Send resumé to: Prof. Charles. R. Hadlock, Chair, Department of Mathematical Sciences, Bentley College, 175 Forest Street, Waltham, MA 02154-4705. Bentley College is an Equal Opportunity/Affirmative Action employer.

PEPPERDINE UNIVERSITY
Mathematics Faculty Position

Seaver College, the undergraduate liberal arts college of Pepperdine University, seeks applicants for a tenure-track appointment in mathematics. PhD required. Candidates should be committed to excellence in undergraduate mathematics teaching at all levels and have an interest in continuing scholarly activity. Pepperdine is an independent Christian university under the control of a self-perpetuating Board of Regents and is related to the Churches of Christ. Forward curriculum vitae, a copy of transcripts, and three letters of recommendation, at least two of which comment on teaching, to: **Dr. Ken Perrin, Natural Science Division, Pepperdine University, Malibu, California 90263.**
An Equal Opportunity Employer.

East Carolina University
Mathematics Department

East Carolina University is currently accepting applications for a tenure-track Assistant Professorship in Mathematics Education beginning August 19, 1991.

Requires a Ph.D. or Ed.D in Mathematics Education or a related area and evidence of ability to engage in research and service activities. Prefer some public school teaching experience, an interest in the areas of special education or elementary school education, and some experience in using computers in mathematics education.

ECU is a growth-oriented institution with a current enrollment of over 16,000 and offers both undergraduate and graduate degrees in mathematics. The Mathematics Department consists of 47 faculty members in the areas of Mathematics, Mathematics Education, Computer Science, and Statistics. The University is located in Greenville, NC, a city with a population of approximately 50,000. Competitive salary, commensurate with qualifications. Candidates should submit resume, official transcripts, and three letters of reference to: **Dr. Robert L. Bernhardt, Mathematics Department, East Carolina University, Greenville, NC 27858-4353.** Screening will begin on April 22, 1991, and will continue until the position is filled. An Equal Opportunity Affirmative Action Employer. Applicants must comply with the Immigration Reform and Control Act.

Calendar

National MAA Meetings

8–10 August 1991   67th Summer Meeting, Orono, Maine (Board of Governors, 7 August 1991)

8–11 January 1992   75th Annual Meeting, Baltimore, Maryland (Board of Governors, 7 January 1992)

Sectional MAA Meetings

Allegheny Mountain   West Virginia State College, Institute, West Virginia: 12 and 13 April 1991

Illinois   Eastern Illinois University, Charleston, Illinois: 26 and 27 April 1991

Indiana   Indiana-Purdue University, Fort Wayne, Indiana: 18 and 19 October 1991

Intermountain   Ricks College, Rexburg, Idaho: 12 and 13 April 1991

Maryland–District of Columbia–Virginia   Virginia Commonwealth University, Richmond, Virginia: Spring 1991

Metropolitan New York   Columbia University, New York, New York: 4 and 5 May 1991 (50th Anniversary)

Michigan   Calvin College, Grand Rapids, Michigan: 10 and 11 May 1991

Nebraska   Nebraska Wesleyan University, Lincoln, Nebraska: 26 and 27 April 1991

New Jersey   Georgian Court College, Lakewood, New Jersey: 20 April 1991

North Central   St. Olaf College, Northfield, Minnesota: 19 and 20 April 1991

Northeastern   Vermont Technical College, Randolph Center, Vermont: 7 and 8 June 1991; Providence College, Providence, Rhode Island: 22 and 23 November 1991

Pacific Northwest   Seattle Pacific University, Seattle, Washington: 20–22 June 1991

Rocky Mountain   University of Northern Colorado, Greeley, Colorado: Spring 1991

Seaway   State University of New York at Oneonta, Oneonta, New York: 19 and 20 April 1991

Southern California   University of California at Santa Barbara, Santa Barbara, California: 9 November 1991

Wisconsin   University of Wisconsin, Oshkosh, Wisconsin: 26 and 27 April 1991; joint meeting with Wisconsin Mathematics Council, University of Wisconsin–Center at Fond du Lac, Wisconsin: 5 October 1991

Other Meetings

9 April 1991   *Second Annual Dolciani Lectures,* Hunter College of the City University of New York. Program includes: Andrew M. Gleason of Harvard University on "Teaching Mathematics: What's the Problem" and Ronald L. Graham of AT&T Bell Laboratories on "Computational Barriers in Mathematics." For further information, contact: Joseph Roitberg, Department of Mathematics and Statistics, Hunter College of the City University of New York, 695 Park Avenue, New York, New York 10021, (212) 772-5300 or 4357.

11–13 April 1991   *Twenty-eighth Biennial Kappa Mu Epsilon (KME) National Convention,* University of North Alabama, Florence, Alabama. Over 100 chapters belong to this national mathematics honor society. The convention program includes fifteen student papers. For further information, contact: Harold Thomas, Pittsburg State University, Pittsburg, Kansas 66762, (316) 231-7000; or Arnold Hammel, Central Michigan University, Mt. Pleasant, Michigan 48859, (517) 774-3543.

12 and 13 April 1991   *Fifteenth Annual Meeting of the SIAM Southeastern Atlantic Section,* Western Carolina University, Cullowhee, North Carolina 28723. Invited speakers include: Fred S. Roberts, John E. Dennis, Shui-Nee Chow, and Robert J. Plemmons. For further information, contact: Shan Manickam of the Department of Mathematics and Computer Science at Western Carolina College, (704) 227-7245.

12 and 13 April 1991   *Tenth Annual Pi Mu Epsilon Regional Undergraduate Mathematics Conference,* St. John's University, Collegeville, Minnesota 56321. Open to all students, faculty, and those with a love of mathematics. Invited speaker: Raymond Smullyan of Herbert H. Lehman College of the City University of New York. For further information, contact: Shoba Gulati of the Department of Mathematics at St. John's University, (612) 363-3087.

26–28 April 1991   *1991 Annual Meeting of the New York State Mathematics Association of Two-Year Colleges (NYSMATYC),* Buffalo Hilton at the Waterfront, Buffalo, New York. For further information, contact: Leonard T. Malinowski, Department of Mathematics, Community College of the Finger Lakes, Lincoln Hill, Canandaigua, New York 14424.

17–19 May 1991   *Twentieth Annual State of Jefferson Mathematics Congress,* Whiskeytown (Redding), California. These campground conferences promote mathematics exchange in the hinterlands of southern Oregon, northern California, and northeastern Nevada. Speakers include: Eric Hayashi of San Francisco State University and Kemble Yates of Southern Oregon State College. For further information, contact: Richard Montgomery, Department of Mathematics, 1250 Siskiyou Boulevard, Ashland, Oregon 97520-5026, (503) 482-6141. FAX: (503) 482-6429.

7 and 8 June 1991   *Summer Institute of the New York State Mathematics Association of Two-Year Colleges* (NYSMATYC), Mohawk Valley Community College, Utica, New York 13501. Theme: Multisocial Mathematics Classroom. J. Arthur Jones, President of Futura Technologies, will present a workshop on "Teaching Mathematics to a Multicultural Audience." Other topics include: women and mathematics, teaching mathematics to the handicapped, and correctional facility mathematics. For further information, contact: Ted Moore of the Department of Mathematics at Mohawk Valley Community College.

17–21 June 1991   Northeastern Section Short Course on *Exploratory Data Analysis,* University of Maine. Peter Bloomfield of North Carolina State University will describe some aspects of data