FOCUS

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AMS - MAA Joint Meetings

San Antonio, Texas

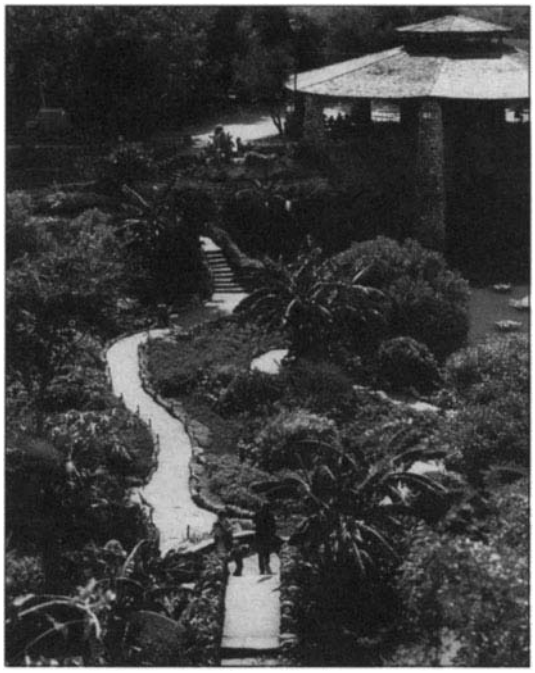
13 - 16 January 1993

Special Meetings Issue

San Antonio, Texas, is the location for the 1993 MAA-AMS Joint Mathematics Meetings, which takes place this coming 13-16 January. See inside for the full program and complete registration details.

Meetings highlights include:

- Celebrations to mark the 100th birthday of the American Mathematical Monthly
- George Andrews on the *Lost Notebook of Ramanujan*
- A special session on mathematical life outside academia
- A reception for first-time meetings attendees
- A number of events dealing with the use of computers in mathematics education



All photos courtesy of the San Antonio Convention & Visitors Bureau.

Top, The Alamo, site of the historic battle of the Alamo; middle, Japanese Tea Garden, completed in 1918, this park is noted for its giant goldfish, floral displays, and a 60 foot waterfall; left, Mission San Jose Y Miguel De Aguayo, founded in 1720, San Jose is known as the Queen in Texas Missions.

ICME-7 Meets in Québec

Donald J. Albers

More than 3500 participants from around the world assembled at Université Laval in Québec from 17-23 August 1992 to discuss mathematics education. Québec, a beautiful walled city that is nearly 400 years old, proved to be an outstanding site for ICME-7. The French-speaking Québecois were very gracious to participants, especially comforting to those of us whose French does not extend much beyond a badly accented *bon jour*. Lovely views of the old city, spectacular vistas from the bluffs overlooking the St. Lawrence, and French food combined to put participants in a good mood.

Following the opening ceremonies on Monday, 17 August, conferees got down to the serious business of ICME-7: listening to lectures, meeting with one of 23 working groups, 17 topics groups, and 3 study groups: observing projects, films, videos, educational materials, and exhibits; and participating in one of 12 special meetings. The first plenary lecture, "Teachers of Mathematics," was given by Geoffrey Howson. At the conclusion of his lecture, Henry Pollak, president of the MAA from 1975 to 1976, was awarded an honorary doctorate from Unviersité Laval for his contributions to mathematics education.

Technology and its connections with mathematics education was prominent at ICME-7. Half of the first day was given over to a miniconference on calculators and computers. Several of the groups cited earlier focused on technology issues, and it should be noted that Maria Klawe and Beniot Mandelbrot, two of the four plenary lecturers, are strongly identified with new technologies and their links to mathematics education.

Discussions, often spirited, frequently spilled over into the much appreciated happy hour sessions under the big tent, and dinners in Old Québec at the end of the day.

ICME-7 served to remind all of us of the importance of looking beyond our own borders for new ideas to improve mathematics education. The cordial atmosphere of the Congress also served to foster good relations in the mathematics education community.

ICME-7 has set a high standard for the organizers of ICME-8, which will be held in Seville, Spain in 1996.

Donald J. Albers is the MAA Associate Executive Director and Director of Publications and Progams

Impressions of ICME-7

❑ The topics of language and communication were raised frequently at ICME-7. In the working group that I attended, concern was voiced over the misconceptions that language creates for students, particularly when a mathematical term has a separate meaning in the student's conversational language, or, worse, another meaning in mathematics.

❑ In her presentation, Glenda Lappan stressed the importance of communication. One of her points was that requiring students to verbalize their understanding of mathematical concepts alerts the teacher to any misunderstandings and increases students' retention.

❑ Written language was the subject of Michael Closs' presentation, "Mathematicians and Mathematics Education in Ancient Maya Society." While historians had long recognized that the Mayans had an advanced system for reckoning time and astronomical events, they now know something about the Mayan system of education. Those charged with practicing and teaching mathematics and astronomy were separate from the scribes whose responsibilities included writing and medicine. It is also evident from the Mayan hieroglyphics that at least a few women were included in the ranks of the mathematical scribes.

Marilyn Mays, North Lake College

❑ This was the first time I had been able to attend an ICME. The most startling aspect to me was the "culture" of the event. Many different languages, many different appearances, and many different opinions were certainly in evidence.

❑ A particular highlight of the conference for me was attending sessions sponsored by the International Organization of Women and Mathematics Education (IOWME). The sense of camaraderie and acceptance, along with the enthusiasm of sharing common concerns regarding women was something special to behold.

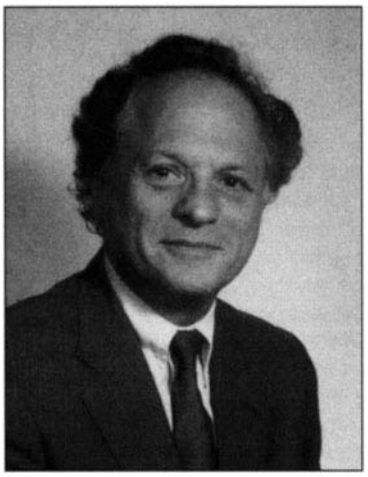
❑ The obvious highlight of each day was convening at 5:30 pm for a social hour at the "Big Tent." A cocktail hour for 3,500 persons is something to behold! The exchange of ideas, time for relaxation, and cementing of new friendships was a most important part of ICME.

Karen Sharp, Mott Community College

Porter Elected Treasurer

Gerald J. Porter has been elected Treasurer of the Association. He succeeds Donald L. Kreider, President-elect. Porter was elected to membership on the Finance Committee in 1986 and re-elected in 1990. He also serves on the Building Committee and is chair of the Investment Committee.

Professor Porter brings energy and enthusiasm to the post of Treasurer. He is optimistic about the Association's future and believes that "the MAA is well positioned through the efforts of its members to provide national leadership in the improvement of mathematics education and increasing minority access to careers in mathematics. A strong financial basis is required for these activities. It is my goal as Treasurer to work with Association leaders to provide this base."



Porter, an algebraic topologist by training, received his PhD from Cornell University. He has been a faculty member at the University of Pennsylvania since 1966. For many years, his mathematical interests have been complemented by considerable interest in the use of computing to improve undergraduate instruction. He served as Associate Dean for Computing in Penn's School of Arts and Sciences, from 1981 to 1992, and was the first chair of the Association's Committee on Computers in Mathematics Education. He currently is Director of the Interactive Mathematics Text Project, which has as its goal improvement of mathematics learning through the use of interactive, computer-based texts. He also is a principal investigator on a Fund for the Improvement of Postsecondary Education (FIPSE) funded project to create an interactive text for linear algebra.

In addition to his mathematical activities, Porter is chair-elect of the Faculty Senate at the University of Pennsylvania.

He is married to Judith Porter, Professor of Sociology at Bryn Mawr College. They are the parents of three children: Daniel (26), head of teacher recruitment for Teach for America; Rebecca (24), an MBA student at the Wharton School of the University of Pennsylvania; and Michael (21), a senior at Princeton University.

The Porters are avid travelers and in recent years have trekked in Peru, Nepal, Khirgizia, and Morocco.

MAA Members Successful in SIAM Elections

Three MAA members are among those who have recently been elected to senior positions in the Society for Industrial and Applied Mathematics (SIAM).

Peter Castro, supervisor of applied mathematics and statistics at the Eastman Kodak Company in Rochester, New York, has been elected to a two-year term as secretary of the Society. A graduate of Cornell University, Dr. Castro received a masters and a doctorate in mathematics from the Courant Institute of Mathematical Sciences in New York. He has been at Kodak since 1969. From 1970 to 1985, he was also coordinator of the Applied Mathematics and Statistics MS program at the University of Rochester.

Paul W. Davis, the John Sinclair Professor of Mathematics at Worcester Polytechnic Institute, has been re-appointed editor-in chief of *SIAM Review.* Dr. Davis received a BS, MS, and a PhD in mathematics from Rensselear Polytechnic Institute.

Mary F. Wheeler, the Noah Harding Professor of Mathematical Sciences at Rice University, has been re-elected to a second three-year term on the SIAM Board of Trustees. In addition to her position on the Board, Dr. Wheeler is also vice chair of the new SIAM Activity Group on Geosciences. She was the first woman to receive a PhD in mathematics at Rice University, the first woman to be tenured in the mathematical sciences at Rice, and the first woman to be appointed to a distinguished chair in any science at the University of Houston. She obtained a BS in social sciences and a BA and MA in mathematics from the University of Texas. She has been a member of the Rice faculty since 1971, except for 1988-90, when she was MD Anderson Professor of Mathematics at the University of Houston.

The new president-elect of SIAM is Avner Friedman, director of the Institute for Mathematics and its Applications and professor at the University of Minnesota. Born in Israel, Dr. Friedman received a PhD and an MSc in mathematics from the Hebrew University, and came to the United States, where he is now a citizen, in 1956.

MAA Strategic Planning Report

At their August meeting in Quebec, the Board of Governors was presented a draft of a report from the MAA's Strategic Planning Task Force, chaired by Tom Tucker. This report, edited by Lynn Steen and in preparation since March of this year, has been through a number of revisions including a two-day review by the task force in May. It is scheduled for final approval by the Board of Governors at the January meeting in San Antonio.

The report includes a mission statement and goals for MAA programs and operations, as well as a variety of strategic initiatives supporting those goals. This is an important document that will help guide MAA activities and policies over the next five years and beyond. It is also a statement, for audiences both inside and outside the MAA, of how the Association sees itself.

Through the make-up of the task force (20 members including representatives of the NCTM, AMS, and SIAM), through special sessions for the Board of Governors and the Section Officers at the January meetings in Baltimore,and through a questionnaire distributed in the February issue of FOCUS,the task force has tried to involve the general membership of the Association as much as possible in the strategic planning process.

Although significant changes in the report may not be possible by the time this article appears,the task force is interested in any and all reactions to the report. Copies can be obtained by email or mail. Address requests by email to focus@maa.org or by mail or phone to the MAA office in Washington.

With Coxeter at the International Congress on Mathematics Education-7

Tom Banchoff

The Coxeter tribute here at the International Congress on Mathematics Education-7 (ICME) in Quebéc City, took place Wednesday, 19 August, beginning at a small dinner and then continuing at a well-attended film presentation at Laval University At the end, there was a short talk by Coxeter that he almost didn't get a chance to give. Here's how it happened.

On Tuesday morning, I had run into the Coxeters and Michele Emmer near the ICME registration desk, where they were talking to the member of the program committee who had set up the film program. Mrs. Coxeter was explaining that someone had told her husband earlier this Spring that he would be asked to make a presentation, and he had gone to the trouble of preparing one, only to find that there was no slot scheduled for him on the final program. Since there were different persons responsible for different parts of the program, it was easy to see how confusion could arise. One suggestion was that Coxeter could talk at one of the afternoon working groups on Art and Mathematics, but that posed problems since the schedule for those sessions seemed tight and, as Michele pointed out, the audience included only a small fraction of the people who would like to be present to hear and honor Coxeter. The best time seemed to be Wednesday evening after the films featuring him that were to be shown in his honor, especially when he said he could cut his remarks down to half an hour. Unfortunately, it wasn't obvious who should act on this suggestion, and no one did, an omission that nearly caused an awkward situation the next night.

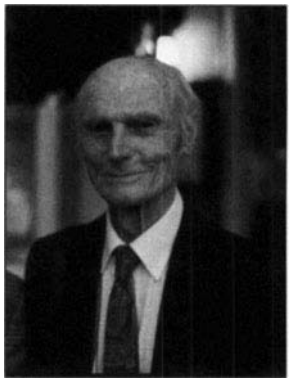
Tuesday evening, Michele Emmer and I were scheduled to present our films and videotapes, and both of us had independently decided to dedicate our presentations to Coxeter. Although the International Congress on Mathematics Education had about 3500 participants, we did not expect too much of a turnout for a film presentation at 8 pm in a town with hundreds of very good restaurants. We were pleased when nearly two hundred people assembled, especially since Professor Donald Coxeter and his wife Rien were in the audience.

At eight o'clock Tuesday night, I began my presentation in the University theater by dedicating it to a young student, whose picture I showed on the screen. I explained that I had become fascinated by higher dimensions when I was a high school student and that this fellow had written his first paper on Dimensional Analogies, when he was sixteen. Twenty-four years later he expanded his ideas into the classic book *Regular Polytopes*, which was first published in 1947, forty-five years ago. At that point, I introduced Professor Coxeter, who stood up to acknowledge the full applause of the audience.

During my presentation I referred to the contributions of Coxeter several other times. I showed videotape footage of the interactive electronic book version of my Scientific American Library volume *Beyond the Third Dimension* (which Coxeter had reviewed in the *American Mathematical Monthly*), and said how nice it would be to have an interactive book version of *Regular Polytopes* so readers would be able to make the three- and four-dimensional diagrams rotate and change on a computer graphics screen. When I introduced the videotape *The Hypersphere: Foliation and Projections*, I referred once again to ideas from Coxeter's *Regular Complex Polytopes* and showed my slide of a decomposition of the regular 24-cell in four-space that I had developed in a correspondence with him.

I finished my presentation at nine and said that the next films and videotapes would be introduced presently by Michele Emmer. But

H.S.M. Coxeter at age 16,



and at age >16.

Michele came to the microphone looking very dejected. Despite the assurances he had received, the tapes he had brought from Italy would not work on the system in the projection booth. Although the technicians had worked very hard to solve the problem all during my presentation, it was impossible for him to show any of his tapes, including the one about Escher featuring Coxeter. He did have with him one film, the final version of *Flatlandia*, so he was able to show that, and he was able to remind people that another of his films would be shown the following evening.

The ICME working group on Art and Mathematics met both Tuesday and Wednesday afternoons, and this was the group Coxeter himself had chosen to attend. It was a photo opportunity for several of the participants, some of whom were meeting their geometrical hero for the first time. After a presentation by Ronald Brown from Bangor, Wales on the sculpture of John Robinson, Coxeter shared with the hundred or so people there a model of four interlocked rings that had been sent to him by an amateur mathematician, and which related to a structure created by Robinson. The final presentation on Wednesday afternoon was on the Alhambra, but Coxeter had to leave early to get ready for the evening event. Someone suggested that he probably had seen enough of the Alhambra in his long career, and it was surprising to learn that he had never been there. One of the people standing by said that they would have to remedy that when the next ICME is held in Seville in 1996.

Wednesday evening at 5:30 those of us invited to a small dinner in Coxeter's honor assembled at the registration desk, among them William Moser. It was only in the car going to the restaurant that I realized that he was the Moser who was the co-author with Coxeter of the 1957 classic *Generators and Relations for Discrete Groups*. On the ride over, I sat next to Asie Weiss from York University and when asked, she said yes, she was a student of Coxeter, in fact his last PhD student and the only female among seventeen PhD students. There was speculation in the car about why Coxeter had had seventeen doctoral students, and someone suggested that probably each of them was associated with one of the repeating two-dimensional patterns decorating the walls of the Alhambra.

By the time we got to the University theater for the films, the audience was pretty well assembled in the theater, with at least twice as many people as the previous night. The first film shown was *I Solidi Platonici*, by Michele Emmer, with Coxeter as the narrator in several parts. The

Please see ***Coxeter*** *on page 16*

Networks in FOCUS

With the MAA now a full-fledged Internet node, plans are underway to develop a wide range of electronic services for members of the Association. As announced in the September issue, FOCUS plans to run a regular feature on electronic networks, covering the why's and the how's of network access and use. In this first issue, Jim Lesslie of Queen's University in Ontario considers reasons for having network access. His article is adapted from one first published in January 1991 by Queen's University, Kingston, Ontario, Canada K7L 3N6. The minor changes that have been made by FOCUS consist of the replacement of remarks specific to Queen's University by more general comments. ***—Keith Devlin***

Networking - What's In It For Me?

Jim Lesslie

The purpose of this article is to outline some of the benefits and capabilities of modern networking and, to some extent, de-mystify an area of computing that can be highly technical and complex.

Writing this article presented somewhat of a challenge. Many articles have been written about networking, but such articles are typically quite technical, riddled with many different networking terms and jargon, and geared to the needs of computing professionals or those who are already quite knowledgeable on the subject. Recognizing that such people are still somewhat of a minority, I set out to write an article which had minimal technical content and as little terminology and jargon as possible. I will attempt to highlight the practical uses and benefits of networking, using language that will be understood by the typical reader and citing examples which relate to common activities throughout the university. While networking is widely used for research and other academic pursuits, it is also being used extensively for administrative purposes. I will attempt to illustrate how networking can benefit both academic and administrative functions.

To a certain extent, the difficulty some people have in understanding what networking is all about and what it can be used for, is that it provides services and capabilities which have not previously been available or possible. At the same time, networking provides us with improved, more responsive ways of doing things we have done for many years. Thus, the benefits of networking can perhaps be categorized as those which present new opportunities and extend our capabilities, and those which apply to traditional academic or administrative activities.

The Information Age Simply stated, the basic purpose of a university is to collect, organize, analyze, summarize, disseminate, and publish information. We all work with information in one form or another, regardless of our role within the university. We live in an information age, and information is our basic commodity. While the amount of information used and what we do with it varies from person to person, access to this information is key to our being able to do our jobs and fulfill our responsibilities. Some of the problems associated with working with information in today's society are:

- The amount of information that is of some value to us is simply enormous and growing very rapidly.
- The cost of finding and obtaining the information we need can be very high and seems to increase almost daily.
- The locations or sources for our information are extremely varied and numerous.

We need to get access to the information quickly. We live in a fast-paced society and the information changes rapidly.

To be able to remain competitive as a higher education institution and to be able to make better use of our time, we must find ways to overcome or minimize the above problems.

Decentralized Meant Disconnected One of the most significant developments in the history of computing was the personal computer. It was relatively inexpensive and easier to use than larger systems, such as a mainframe computer, and all of its computing power was available to a single user. Most would agree that it was a major step towards computing for the masses. People who had never used a computer before, soon found it to be an essential tool. At the same time, people who had been using large, cumbersome mainframe computers began to shift some or all of their computing activities to personal computers.

This overall trend toward decentralization of computing resources is generally thought to have been a positive one. It did, however, result in new problems and limitations, the foremost of which is the relative isolation of each individual from his or her colleagues or other group members. When everyone used the same computer system, it was possible for them to exchange information or share information of common interest, such as a large database. As they abandoned the large, shared system in favor of desktop PCs, it was no longer possible

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for a group of people to share a common set of data, or for one person to easily distribute information to other members of the group. Initially, the only practical way of moving information from one computer to another was on a diskette. This did little to solve the problem of not being able to share something like a database. Sharing meant everyone having their own copy, which was both costly and impractical, especially for information that changed frequently. Shortly after PCs began to arrive in the workplace, it became clear that this isolation would be a significant problem, and researchers began looking for ways to overcome it.

Most will agree that the personal computer remains a very useful and supportive tool, but cannot provide all the computing and information processing needs of an individual. What needs to be done is to extend its reach to access information stored on other computers and to reopen lines of communication within a group or organization. This is precisely what networking is intended to do.

Levels of Networking The term *Network* can mean different things to different people. It can be as simple as a cable connecting two microcomputers together or as complex as a worldwide network consisting of hundreds of thousands of systems. In discussing networks, it helps to define several different levels of networking, each with its own scope and purposes. This is somewhat analogous to our society, which is comprised of households, neighborhoods, municipalities, countries, etc. There are three primary levels of networking within an organization:

- Departmental or Work Group Networks
- Institutional Networks
- External Networks

Where as External Networks consist of several levels, such as regional, national and international networks, departmental networks, usually referred to as Local Area Networks or LANs, link together the computers within a department. Such a network can be used to access departmental resources, such as laser printers, common disk storage, software and, most importantly, departmental information. As well, it provides a means for two or more people within a department to exchange data, documents, electronic mail and other information. Lastly, if it's connected to an institutional network which ties into one or more external networks, a LAN provides a powerful link to the outside world.

An institutional network links together various departmental networks, large central systems such as a mainframe computer, and other central facilities. It can be compared to a major highway which connects the street systems of many different communities to form one large transit system. It provides a pathway for information to flow between different departments and groups within an organization, and provides high-speed access to central systems and facilities. Finally, an institutional network can connect to one or more external networks of varying size and scope.

Much of the information needed by people at a particular institution, and many of the people they collaborate or communicate with, are external to the institution. Access to an external network provides essentially the same capabilities as access to an institutional network does. The difference is merely one of scope. Instead of a few campus or departmental systems, it provides access to hundreds of thousands of systems worldwide. A connection to a large external network opens the door to a community of millions of people with whom you can communicate and exchange information.

Network Fundamentals When discussing the benefits of networks, there is a tendency to focus on their ability to transmit large amounts of information at a high rate of speed. To understand how access to one or more networks might benefit you in your specific situation, it helps to be familiar with the fundamental tasks that can be carried out on a network which exploits high-speed and/or high-volume data transfer. The following are the major tasks or activities that can be done through a network:

File Transfer In a computer, a collection of related information is stored as a file. File transfer is the process of taking a copy of a file stored on one computer, transmitting it over a network, and storing it on a computer at the other end. Networks provide a convenient and fast way of transferring files between computers. Some networks will even handle the conversion of file formats and data representation if the origin and destination computers are not the same type.

Remote Logon Many people at colleges and universities logon regularly to the institution's mainframe computers, typically using a modem and telephone line to establish a connection. It may also be possible for people to logon to those computers through a network rather than a modem, provided the network is linked to the Campus Network (backbone). More importantly, you may then be able to logon to virtually any system on any of the external networks, provided you are authorized to do so by the people who manage that system. This is a much better alternative to older methods, such as using a dial-out modem or commercial data communications services such as DATAPAC. Information can flow back and forth at a much higher speed and there is presently no cost for using these external networks.

File Sharing As discussed above, a file transfer allows you to obtain a copy of a file to use on your computer. Certain networks make it possible to work with a file directly from the computer it is stored on, without having to copy it onto your own system. This is particularly important when the file in question is quite large, or changes frequently. The software you use to work with the information may be able to access it directly, as if it was stored on your hard drive or diskette.

Electronic Mail Electronic mail (e-mail) provides a means of communicating with other computer users through one or more networks. E-mail can be a much more effective way to communicate than conventional mail or the telephone. While e-mail also has limitations, it provides a fast way to exchange messages or textual information with someone in another office, city, or on the other side of the world. The same message can be broadcast to dozens or hundreds of recipients, with no more effort than is necessary to send it to one person.

Information Search and Retrieval A computer can be a very powerful and efficient search tool. It can sort through large quantities of information very quickly and deliver to you precisely what you need. Remote logon over networks makes it possible to exploit the searching capabilities of a computer to a much greater extent. When you consider that thousands of computers are already accessible through external networks and that enormous quantities of data and information are available on all of these systems, the benefits of using networks to search for and retrieve desired information are quite substantial.

Remote Program Execution The ability to logon to other computers through a network makes it possible to run programs on these systems. Perhaps there is a software package or program which is not available at your institution, but is available on another university's computer. Perhaps the program is too large to run on any of the computers you have access to at your institution and needs the power of a supercomputer. There are numerous instances where the need to run programs or software on other computers exists. Networks permit you to do so, and have any result sent back to you or directly stored on your own computer.

If you are still having difficulty understanding what a network connection can actually do for you, perhaps examining a few typical situations where networks are used will help.

Bibliographic Searches Researchers spend much of their time searching for references, etc. pertaining to their field of study. For years, computers have been used to store and manage bibliographic information, and provide an effective tool for locating journals and other intellectual material. Your own institution's library probably operates a system maintaining bibliographic information on all its holdings, and provides a mechanism for doing various kinds of searches of this information. It may also provide network connections to library systems at other universities, making it possible to do bibliographic searches on any or all of these systems from almost any terminal or computer at your institution. It is expected that literally hundreds of library systems will be accessible through networks within a year or two.

What this means to researchers is that they will be able to carry out much more extensive and exhaustive searches for research material, and, more importantly from the privacy and comfort of their office, or even their home. In the past, it was usually necessary to ask library staff, such as the Inter-Library Loan office, to carry out searches at other universities. Now, individual researchers have the capability to do their own searching. For those who choose not to, the bibliographic search process will still be better, since the library staff can use the networks to quickly search many different library catalogue systems.

While finding material of interest is no small task, the research process certainly doesn't stop there. If a desired book or journal issue is in a library at, say, Stanford, how can you get your hands on it? I'll examine this problem in the last section of my article.

Group Discussions Consider the situation where a large research project involves people at a number of different universities around the world. Collaboration means exchanging information, documents, and viewpoints on an ongoing basis. The research process can be significantly accelerated if this can happen conveniently and quickly. This can be, and frequently is, achieved using electronic media such as electronic mail and computer conferencing.

Electronic mail allows for one-to-one exchanges or one-to-many broadcasts, and with networks linking everyone together, these exchanges can take place in a matter of minutes. Computer conferencing allows meetings to take place over a network, linking dozens or even hundreds of participants around the world. When I submit a message or comment to a conference, everyone else receives a copy of what I said, whether they are sitting in front of their computer or not. A side benefit of both electronic mail and computer conferencing is that the participants can automatically have a complete record of all presentations and dialogue maintained for them.

Clearly there are still major advantages to face-to-face meetings and presentations, but there are many instances where the benefits realized by attending a conference or meeting in another city do not outweigh the increasing cost of doing so.

Informed Buying As the economy and university funding continue to decline, all purchases must be carefully considered and be as thoroughly researched as possible. Some one-of-a-kind acquisitions can make this difficult. Wouldn't it be useful if you could talk to someone else who was faced with a similar decision in the past or several people who already have precisely what it is you are looking for? Maybe you'd find out that there really isn't anything suitable to be found, or that there are certain brands to avoid. It would be nice to hear of other people's experiences before making what might turn out to be an unwise choice. For a department administrator or manager, these contacts would be invaluable.

In the past, people have relied on personal contacts and the telephone for seeking advice prior to buying something. The problem with this approach is that you have to know someone to ask, which is not always the case. Networks make us part of a very large community, including many people at hundreds of other colleges and universities, as well as people in the commercial sector. There are thousands of electronic mailing lists, discussion groups, and bulletin boards which operate on networks, providing forums to discuss or ask questions concerning just about any topic you can think of. These electronic discussions began in the early days of networking as a means for the developers to discuss the future and growth of the networks. Soon after, these people began casually talking about personal interests, politics, and many other non-technical subjects. From there the discussions grew to include thousands of other people who weren't involved in developing the networks but were regular users. As more people became involved, the range of topics grew quickly. Chances are now quite good that someone out there on a network has some advice or information to offer you to aid in your purchasing decision. All you need to do is learn the basics of using electronic mail for corresponding with such people over networks.

A Door to Our Future These applications of networking technology are already being widely used. Developments in networking, high-powered workstations, and other related technologies will open new doors or further empower us to do our jobs or research more efficiently and with greater results. Here is an area where networking will play an important role in the near future:

The Electronic Library Computers are being used more and more to store literary and intellectual materials. As high-capacity hard drives and CD-ROM players have become more affordable, the cost to store information has declined significantly. New literary material is often stored on computers as more authors and scholars use word processors for composing their works. Advances in scanning technologies now make it quite easy to take older manuscripts, journals and books, and store copies of their contents on computers. Finally, improved microcomputer and workstation displays make it possible to view very accurate renditions of original documents and images on these devices.

Whatever your current plans for library development, chances are that funding and physical space constraints will reduce the capacity to store all of the original intellectual material needed by both faculty and students. In addition to the lack of space to store books and periodicals, funds available for additional acquisitions may also be limited. Finally, your library administration will want to preserve its special collections, rare volumes and other fragile material for the future. Using computers to store and provide access to massive amounts of intellectual material will be essential in the library of the future. The cost per unit of storage is drastically reduced and the institution can acquire more material faster and more inexpensively. Rare books and limited edition publications can be better preserved, since computerized versions of such valuable material can be made available for general use, and for use by many different researchers at the same time.

Networks will also play a critical role in the library of the future. Access to computer-stored versions of various intellectual holdings will become available in any office or from individuals' homes. More importantly, networks will make it possible to view the holdings of thousands of library systems throughout the world as one big virtual library and provide rapid and convenient access to this almost infinite amount of material.

Protecting your own File System People who use a microcomputer or workstation should ask themselves the following questions:

1. Do you back up your hard drive or important files as often as you should?

2. Is your hard drive really large enough to hold everything you might want to keep there?

*Please see **Networking** on page 17*

Inside the International Mathematical Olympiad

Cecil Rousseau and Daniel Ullman

The 33rd International Mathematical Olympiad (IMO) was held this summer in Moscow, where six high school students representing the US performed with great distinction and earned a combined team score second only to that of China. We would like to share our experiences as leader and deputy leader of the US delegation.

This year's IMO team from the US was composed of Wei-Hwa Huang, North Potomac, MD; Kiran Kedlaya, Silver Spring, MD; Robert (Bobby) Kleinberg, Wales Center, NY (near Buffalo); Sergey Levin, Providence, RI; Lenhard (Lenny) Ng, Chapel Hill, NC; and Andrew Schultz, Evanston, IL. Kiran, Bobby, and Lenny had all represented the US last year at the IMO in Sweden, all earning silver medals. This year all earned gold medals. (Kiran, in fact, had earned a gold medal in 1990 at the IMO in Beijing, when he was only a sophomore in high school.) Wei-Hwa, Sergey, and Andrew all earned silver medals in Moscow. This ties the 1986 team for best American medal performance at an IMO. These six students deserve the praise and recognition of the entire US mathematical community. We salute them.

Each of these students earned a place on the US team by high achievement on a series of mathematical contests, beginning with the American High School Mathematics Exam, including the American Invitational Mathematics Exam and the US Mathematical Olympiad, and ending with three Olympiad-style competitions offered at a month-long training session held at the US Naval Academy in Annapolis, MD for the 25 top performers on the US Olympiad. This training session, which goes by the name of Mathematical Olympiad Program (MOP), was run this summer by the two of us together with Anne Hudson.

The MOP is undoubtedly the most intensive mathematical program for gifted students in the US. We bombard the students with four hours of class per weekday and three or four Olympiad-style tests per week. In addition, one of the unique and innovative activities of the program is a MOP tradition known as the "team contest," a teaching tool we used once or twice a week. The team contests consist of a list of 25 questions, based on our classes, which we hand out a day or two in advance of the event. The group is split into five teams of five each. One at a time we call the 25 students to the board, in a random order. At their turn, the students must solve in three minutes, in front of the entire group, any one of the as-yet-unsolved problems. The performance is then judged by the two graders on staff, who hold up large signs in the style of Olympics gymnastics or skating judging. The whole thing is zany, often hilarious, and a wonderful teaching instrument which ought to be used more often. It is flexible, enjoyable, promotes teamwork, suited for students of widely differing abilities, and encourages clear mathematical communication.

One afternoon at MOP was devoted to solving problems from the latest issue of the American Mathematical Monthly. Twice, we required the students to compose their own original problems. In between these mathematical activities, soccer, frisbee, chess, and bridge were popular pastimes. All told, the four weeks are intended to enrich, rather than accelerate, the students. The focus is on enjoying mathematics, rather than training in test-taking skills. Our primary goal at the MOP is not victory at the IMO but promoting interest in mathematics.

The MOP ended on 7 July, and the members of the IMO team had a few days to catch their breath (and make their traditional tee-shirts) before assembling in the late afternoon of 9 July at Dulles International Airport. Not until the evening of 10 July would the team settle into Hotel Izmailovo in Moscow, an enormous complex built for the 1980 (boycotted) Olympics, where the team began the serious business of overcoming jet lag. Meanwhile, the team leaders from each of the participating countries were assembled—at a location unknown to the team—to begin the first official IMO task, that of setting the exam.

The set of team leaders is known as the jury. Upon arrival, jury members were given a collection of 18 problems (without solutions) to begin evaluating in preparation for the first meeting of the jury, scheduled right after breakfast the next morning. At that time, "official" solutions are handed out and the process of choosing the six problems for the IMO begins in earnest. Individual problems are evaluated on the basis of originality and attractiveness. The exam as a whole is evaluated in terms of balance, both of subject matter (number theory, geometry, combinatorics, classical algebra, inequalities, etc.) and perceived level of difficulty. "Perceived" is an important distinction here, since it is common for jury members to predict with confidence the IMO outcome by suggesting which problems are "hard" and which are "easy," only to have their predictions completely confounded by the IMO participants who approach the problems in different, sometimes dramatically original ways.

The 18 problems were among those submitted earlier by participating nations. A committee of Russian mathematicians had gone through the submissions with care and selected these 18 as the most promising. Later, three other submissions were added to the pool, and in the end two of these problems were selected for the IMO. After two days of intense work, the six problems were selected. Then teams of jury members worked on the wording of the problems in the official languages (English, French, Russian and Spanish). These official language versions of the exam must be approved by the jury as a whole, and often there is as much or more wrangling involved in getting agreement on these translations as there is in choosing the problems. After the official language versions are settled, leaders whose students use some other language (Chinese, Greek, etc.) must translate the exam from one of the official languages to their own. All of the versions are then typed or written by hand and placed on display for inspection by all the jury members. Finally, jury members can relax a bit. For many, it means stepping outside the hotel for the first time since they arrived.

Meanwhile, for the days of 11, 12, and 13 July, tours were provided for the teams to Moscow sites of historic interest. The US team, led by a guide, was paraded through gardens, museums, and churches of the tsars. Frankly, the team was sleepy from the time change and anxious about the upcoming Olympiad, which made the tours seem too long.

The opening ceremony of the IMO was on 14 July. This was the forum for the official welcome by the Russian hosts, speeches by Russian mathematical dignitaries (including Boris Gnedenko), and entertainment in the best Russian tradition. We enjoyed spectacular performances of folk singers and dancers, some ballet, and an act from the famed Moscow circus.

15 and 16 July were the two days of the contest itself. On each day the participants had four-and-a-half hours to do three problems. After the first day, there were a few long faces from the Americans, who said that they had done well, but not well enough to be sure of meeting our goal of placing among the top five teams. After the second day, however, there were smiles. "A good day for the Americans," Lenny predicted. On the evening of 16 July, the team reunited (the sequestering of the jury was over) and we chatted about the likelihood that the US team score would be higher than that of our nemesis Romania or the team from the Commonwealth of Independent States (CIS).

The IMO is officially a competition for individuals. The participants work alone and are scored from 0 to 7 on each of the six problems. They earn gold, silver, or bronze medals if they score in the top 1/12,

Cecil Rousseau, Memphis State University, and Daniel Ullman, George Washington University, co-directed the training session at the US Naval Academy and accompanied the team to Moscow

1/4, or 1/2, respectively, of all competitors. Unofficially, however, the six-member delegations from around the world add up their scores to determine their team rank. This is akin to the medal count in the Olympics and should not be read as a measure of the success of the team. After all, no one expects the top six students from Iceland to be at the same level as those from China. There are no losers at the IMO, so in that sense it is not a competition at all.

On 17 and 18 July, the participants were offered tours while the leader and deputy leader began the task of assessing the papers. After we evaluated the papers of our own team, we presented these papers to the "coordinators," a group of 44 local mathematicians whose role it is to assure consistency, fairness, and accuracy in the distribution of scores. This is an arduous task, but the Russian coordinators were first-rate. This is not surprising, since the USSR had the strongest network of math olympiad programs anywhere in the world, and almost all Soviet mathematicians, it seems, grew up winning olympiads and continue to support the olympiad system.

On 17 July, we obtained scores for the first day of the exam. The Americans were in 6th or 7th place, as predicted, but we looked forward to improving our position on the second day. By the afternoon of 18 July, the Americans were in 4th place, with one problem to go. In fact, we needed only a modest team score on the last problem to pass Romania and the CIS and move into second place. Unfortunately, no American solved this problem, and we were going to have to get those points by earning partial credit for the American efforts. Well (the suspense is already ruined) we earned a few points here and a few points there and just sputtered into second place, like a race car crossing the finish line on an empty tank. Also it became clear that the team would earn all gold and silver medals, a consistent performance that had not been accomplished by a US team since 1986. The organizers of this 33rd IMO obviously endured many obstacles. It was four years ago that the 1992 IMO was officially slated for Moscow, but it has been unclear for most of those four years exactly which country Moscow would be in. The collapse of the Russian economy forced other constraints on the organizers. Although the lack of resources and of planning had certain obvious effects on the IMO, the organizers must be commended for hosting a successful event against tremendous odds.

We had read before departing that food stores in Moscow were empty. This led to obvious apprehension about how our hosts would feed us, and each of us brought emergency rations. As it turned out, we were well-fed, although the food we were served did not suit everyone's palate. One day, Andrew Schultz failed to return from the tour of the day and missed dinner. The other Americans did not know where he was. Five hours later, he staggered into the hotel. He had become separated from the tour without a coin in his pocket and been picked up by some kindly Russians, who had agreed to return him to the hotel (a 30 minute drive away). Was he hungry? No, they had fed him. "Best meal I've had in a week!" he reported. In fact, for nourishment, the American team discovered the Moscow McDonald's, where they ate a few huge meals. (Bobby Kleinberg apparently consumed eight cheeseburgers at one sitting, and he's slim.)

One of the American traditions at the IMO is the middle-of-the-night US vs. Canada Ultimate Frisbee game. Since the Canadian deputy leader had agreed to play, so too did the American deputy leader and alarms were set for 3:00 am. Well, even in Moscow it is pitch black at that hour and Frisbee was impossible to play. We went out nonetheless and had a good time, firing the invisible disk down the invisible field to invisible teammates.

Another American tradition at the IMO is the "official" team tee-shirts. At the IMO, the members of the team ask participants from around the world to sign their hand-painted shirts. By the time the competition neared its end, these tee-shirts looked like graffiti from some international subway wall, with scrawl in dozens of alphabets covering every

Members of the US Delegation to the International Mathematical Olympiad proudly wear their "official" team tee-shirts, signed by many of the participants from around the world.

available spot. It is likely that many of those signatures will in time be autographs of famous mathematicians.

The closing ceremony was on 20 July. The organizing committee awarded the medals. Numerous dignitaries spoke about international friendship and cooperation and using mathematics to solve the problems of the world; such words are not platitudes when one considers the audience. We enjoyed more traditional Russian entertainment. That evening, together with our Russian hosts and the delegations from around the world, we toasted the IMO, the medalists, mathematics, friends, health, family, and on and on, each toast requiring vodka. And early on the morning of 21 July, we headed home.

We hear often about the decline in US math education, the disappearance of the mathematics major, the innumeracy of the American public, and the resultant decline in the health and welfare of our country. Let us now publicize some good news for a change. Our top students are as good as those from anywhere in the world, and our national contest program identifies and honors these students. All but one member of our team was trained in the US; all but one trained in public schools, only one in a special high school for gifted students. If more American students had strong encouragement to achieve in mathematics and strong mentors in the community to motivate them, and if intensive mathematical study could be made socially acceptable to teenagers, many more prodigies would be produced. (Compare with the encouragement and mentoring available to athletes, and compare with the dedication and training that is routinely devoted to skills by outstanding athletes.)

We have achieved this success at the IMO without abandoning the liberal approach to education, of which the members of the US team are clearly products. They are all well-rounded, broadly-educated. Several are outstanding musicians, several are outstanding athletes. Some competed in the national spelling bee. Others have won chess tournaments. All write well. (The Olympiads are writing contests, after all.)

It is a popular American bias to think that talents are innate rather than acquired. This diminishes the effort of those who excel and unnecessarily discourages those who falter. Mathematics is learned. Those who learn a lot may be able to win competitions and may be able to make major contributions to the discipline. It is not a matter of luck but rather a matter of hard work and dedication. Students all over the US should cheer the success of the 1992 IMO team. They should also recognize that what it takes to excel in mathematics is not special

*Please see **IMO** on page 16*

CBMS To Publish Research in Undergraduate Mathematics Education

On the recommendation of The Mathematical Association of America (MAA)-hosted conference, Communicating Among Communities (see MAA's FOCUS, February 1992 or *UME Trends*, March, 1992), the Conference Board of the Mathematical Sciences (CBMS) has agreed to publish a number of annual volumes describing the state of the art in mathematics, and entitled *Research in Collegiate Mathematics Education.* The volumes, will appear in the CBMS series, *Issues in Mathematics Education*, and will be co-edited by Ed Dubinsky, Purdue University; James Kaput, University of Massachusetts at Dartmouth; and Alan Schoenfeld, University of California, Berkeley. The MAA's Committee on Research in Undergraduate Mathematics Education (CRUME), augmented to include individuals from the various communities represented by CBMS, will serve as the Editorial Advisory Board.

It is expected that the first volume will appear in 1994. More specific guidelines for authors will be available by January 1993 and will be disseminated widely throughout the mathematical community. While some of the papers appearing in these volumes will be solicited, others are expected to be contributed by researchers. Authors wishing to submit papers should contact one of the three editors.

The following remarks describe goals and rationale in more detail.

The past half-dozen years have witnessed astonishing changes in (a) the intellectual community's understanding of the importance of collegiate mathematics education, (b) the development of a community of researchers who have made a firm commitment to doing research on issues of mathematics education at the college level, and (c) the mathematical community's willingness to address fundamental issues of undergraduate education in a serious way.

The best one-line summary of our needs is given in *Everybody Counts*, "Reform of undergraduate mathematics is the key to revitalizing mathematics education" (p. 40).

Undergraduate mathematics education affects all aspects of mathematics preparation, for it is in collegiate mathematics classes that the nation's schoolteachers receive their mathematical preparation (and thus the view of mathematics to which their students will be exposed), and it is in those classes that the nation's scientific and mathematical elite receive their fundamental grounding in mathematics.

In the late 1980's, two simultaneous developments resulted in the creation of a strong and growing collection of producers and consumers of research in mathematics education. The first is that a combination of mathematicians and educators have become interested in issues of undergraduate instruction, bringing to those issues the necessary synthesis of mathematics knowledge and increasingly sophisticated research skills. In recognition of the existence and importance of the research community, the MAA has an active Committee on Research in Undergraduate Mathematics Education. It is anticipated that this committee will soon become a joint AMS/MAA committee, with ties to the National Council of Teachers of Mathematics and the American Mathematical Association of Two-Year Colleges.

The second development is a growing recognition by the mathematical community that fundamental curriculum reform can and should be informed by careful, sustained research into learning and teaching, as well as other factors involving undergraduate mathematics education. This recognition is an outgrowth of mathematicians' greatly enhanced interest in educational matters. It is also one consequence of the development of the field of research in collegiate mathematics education.

As little as ten years ago, the thought of education being the topic of serious attention at the Joint Mathematics Meetings would have been almost laughable. But the 1990 meetings featured an invited main presentation on "Teaching Undergraduate Mathematics: Insights from Education Research." Subsequent meetings included an AMS panel on educational issues; and in the past two years' meetings, contributed paper sessions on research in undergraduate mathematics education (in addition to those sponsored by Mathematicians and Educational Reform, and other educationally related sessions) occupied a significant part of the program and were heavily attended.

There is now a substantial community of mathematicians eager to know of and use the results of high quality inquiry into collegiate mathematics education. The existence of UME Trends similarly points to consumer demand — but it doesn't offer a scholarly outlet for the research papers themselves. Indeed, the absence of a central print locus for research in undergraduate mathematics education has had a doubly constraining effect. On the one hand, there has been no straightforward way to consistently bring high quality work on collegiate mathematics education to the attention of the mathematical community. On the other hand, the absence of a clear dissemination mechanism has stifled the growth of the research community. Its presence, however, could have a strong catalytic effect.

"Reform of undergraduate mathematics is the key to revitalizing mathematics education."

– Everybody Counts

In recognition of these problems and opportunities, the MAA conference made the following Recommendation 1: The Mathematical Association of America (MAA) and the American Mathematical Society (AMS), in cooperation with the National Council of Teachers of Mathematics (NCTM), should plan a series of annual special volumes presenting exemplary research papers in collegiate mathematics education. These volumes would serve as precursors to the establishing of a journal.

CBMS has now agreed to publish these volumes in the series noted earlier.

Manuscript Solicitation and Review: Initially, the editors and editorial board will solicit manuscripts designed to focus on major issues and showcase research of the highest quality and significance. Such work may include integrative summaries of what is known in areas of critical importance (e.g. calculus reform, linear algebra, gender and minority issues, the uses of technology in instruction, functions and reasoning about them); they may include discussions of methodological concerns; they may include exemplary individual studies exploring aspects of mathematical thinking or instruction at the collegiate level. Of course, the news of the volumes' impending existence will be widely announced, and manuscripts will be actively solicited through the announcements. All submissions, whether they have been solicited by the editors or not, will receive a minimum of three independent reviews, and final decisions will be made in conference by all three editors (at least one of whom will have been one of the reviewers for the manuscript under discussion).

Contact one of the editors if you would like more information about the volumes or about submitting articles.

Advice from the NSF Graduate Fellowship Panel on the NSF Graduate Fellowship Program

This letter, intended to explain the selection process in awarding of NSF graduate fellowships, should be especially useful to potential applicants, advisors, and writers of letters of recommendations.

1. The mathematics panel reviewed 257 applications for 26 awards. The number of awards in a given discipline is roughly proportional to the number of competitive applications in that discipline. In other words, to a certain extent, we would have more awards in mathematics if more mathematics students applied. Physics and chemistry each had almost twice as many applications as mathematics, with a correspondingly greater number of awards; there were 7,723 applications in all fields.

2. In view of the large number of highly qualified candidates and the small number of fellowships, the award of "honorable mention" should be viewed as a competitive recognition of significant achievements.

As an illustration of the quality of the applicants for mathematics, fifteen percent had perfect GRE subject scores and 3.5 percent (nine) had perfect scores on all four parts of the GRE. (Scores on these exams are just one consideration; letters of recommendation, grades, and individual student statements are also very important.)

3. Carefully written and appropriate letters of recommendation are extremely helpful in the evaluation process. In particular, comparisons between two or more applicants make the panel's job easier, and comparisons to successful mathematicians at a similar stage of development are especially influential. Students should be advised that letters from scientists other than mathematicians tend to carry less weight and letters from non-scientists carry virtually no weight at all.

4. The mathematics panel found research experience desirable but did not consider it essential to a successful application. Many of the applicants have been through one of the Research Experience for Undergraduate programs sponsored by the NSF; several have even published papers.

The panelists viewed rambling and unfocused statements (under career goals, research experience) as detrimental. It is best to be concise and to the point. Panelists must review many applications in a short time, and information buried in long-winded statements will most likely be overlooked. Applicants should play to their strengths; all relevant experiences should be mentioned.

5. First-year graduate students may apply, as well as senior undergraduates. There are fewer of the former than might be expected — just 64 this year and seven of them received awards. Possibly the graduate students have difficulty finding letter writers at their new institutions. It may be that the fellowships should be better advertised to this group; faculty should be encouraged to bring the fellowships to the attention of their advisees and students.

6. In its announcement of the competition, the NSF encourages applications from members of minority groups, women and persons with disabilities, although the panelists are expected to disregard race, sex, and handicap in their deliberations. There is a separate program for minority fellowships. (Many students compete in both.) There is a separate program for women in engineering. There is also additional financing for persons with handicaps who are successful (defined to include honorable mention) in the initial competition.

However, there is no special program for outstanding women in mathematics. The panel wondered if such a program might be initiated for women in mathematics, because (1) there are still various barriers which put women at a disadvantage in this competition and (2) we feel that additional incentives for women would inspire more women to pursue mathematics.

The panel has noticed that women may not do as well in our evaluation process due to a number of factors. Perhaps they have had a harder time finding mentors for research projects; women often score lower than men on tests (although they may have better grades than men); and references may be written with a bias towards men. The panelists are sensitive to these problems, but have not felt that women's applications should be evaluated differently from men's. The panelists would like to see extra fellowships set aside specifically for women. We need more highly qualified women graduate students, more women writing excellent PhD theses, and more women with outstanding careers in mathematics.

There were fewer female applicants this year (83) than last year (90), although overall the number of applicants went up (257 applicants this year versus 222 last year). This year only three fellowships were awarded to women in mathematics; last year ten were awarded to women. (Last year there were 32 awards in all, whereas this year there were only 26.) The picture in computer science and in applied mathematics is equally bleak — last year five fellowships went to women in computer science, this year, two; last year four went to women in applied mathematics, this year, three.

Note: If mathematicians and others are interested in an extra program for women, they should write to Dr. Terry Porter, Division Director for Research Center Development, NSF, and to the Division Director for Mathematical Sciences. (Presently that director is Dr. Judith Sunley, and for the next few months it will be M. Kent Wilson on an acting basis; after that, another individual will be named to the position.)

7. The Panelists present the NSF with three unordered, alphabetical lists. All the applicants in the first list and half the applicants in the second receive awards. The awardees in the second group are chosen by the National Science Foundation, based on geographical and other considerations. This year the first two lists comprised six and eight percent of the applicants respectively. The third list is for those who will receive honorable mention along with those in group 2 who don't get awards.

8. In giving these details, we are concerned that mathematics faculties should not discourage good mathematics students from applying for an NSF Graduate Fellowship. We submit that it is beneficial for our profession and for students to go through the process of applying, even if the application does not result in an award. We hope faculty will explicitly encourage students who are considering graduate school to apply. This would yield an early opportunity to think about graduate school, an early opportunity to refine thinking about what one wants to accomplish in graduate school, and experience in writing about oneself and one's goals with respect to mathematics.

The NSF Graduate Fellowship Panel
Sylvia Wiegand, Chair

FOCUS EDITORIAL

The Second Report of the 1991 Annual AMS - MAA Survey was published over the summer. (See the July/August AMS Notices for a full text.) All in all, it makes depressing reading.

In the period 1 July 1990 through 30 June 1991, U.S. institutions awarded a total of 1125 doctorates in the mathematical sciences. This is the largest number since 1971-72, and is 18% higher than the 1989-90 final count.

Among the 1089 doctoral recipients whose citizenship status is known, 478 were US citizens. This is the largest number of U.S. citizens receiving a doctorate since 1981-82.

A total of 611 non-US citizens were awarded doctorates in 1990-91, the largest number ever reported, and an increase of 105% over the number of non-citizen new doctorates ten years earlier.

So why did I start out by saying that the report was depressing? After all, on the basis of these figures, it looks as though things have never looked brighter for US graduate education in mathematics: more home grown doctorates, and the reputation and success of US graduate education resulting in more doctorates awarded to mathematicians from overseas. Surely that is a great success. Couple it with the fact that the past few years have seen a substantial influx of qualified mathematicians from abroad, China, the former Soviet Union, and Europe (including the current editor of FOCUS!), and it looks as though the United States ought to be set for a real boom in mathematics.

The reason this has not occurred, as everyone, surely, must be well aware, is that at a time of high supply of suitably qualified mathematicians, the academic job market has all but dried up.

According to the survey, doctorate granting mathematics departments in the US attempted to fill 17% fewer full-time positions in 1990—91 than in the previous year (itself already a poor year for jobs); master's degree granting departments sought 34% fewer new faculty members; and undergraduate institutions had 18% fewer openings.

Of the 1070 new doctorates whose employment status is known, 5% were reported to be unemployed and still seeking employment at the time of the spring count—a worryingly large percentage for a field such as mathematics, which is widely acknowledged to be critical to the health of the nation.

As I said at the start, these figures make for depressing reading. But even for mathematicians, figures are just figures, numbers on a page. Behind those percentage points are people, real people, people who, against all the odds it would seem, have chosen mathematics for a career.

Having hired four tenure-track and two temporary faculty at Colby in the period 1989-91, I have read a lot of resumes and talked to a lot of candidates. I wrote about my experiences as a department chair looking for new faculty in an article published in FOCUS last summer, shortly before I took over as editor. In response to that article, a number of first-time job hunters wrote asking my advice. Among them was Ed Aboufadel, just finishing his PhD at Rutgers University in New Jersey.

We exchanged a few email messages, as I tried as best I could to answer his questions. In the course of our discussion, I suggested to Ed that he keep a diary detailing his job search, for possible publication in FOCUS. "Keep it immediate and honest," I said, "with no polishing or editing." What I wanted was a blow by blow account of how he *actually felt* at each stage, not an after-the-event retrospective. And that is exactly what he came up with over the course of the ensuing months.

This month sees the appearance of the first of what will be four installments of his experiences as a fresh PhD on the academic job market. It makes compelling reading, with a lot to say both to future job seekers and to those of us looking for new faculty.

Keith Devlin

The above is the opinion of the FOCUS editor, and does not necessarily represent the official view of the MAA

The Fifth Annual Calculator and Computer Precalculus (C²PC) Teachers Conference and the Second Annual CalcNet and TRANSIT Teachers Conference (known collectively as T ³— Teachers Teaching With Technology) will be held at The Ohio State University, 11 - 12 December 1992. The conference will begin at 1:00 pm on Friday, 11 December and will conclude at 9:00 pm on Saturday, 12 December. There will be no formal activities on Sunday except for a "hands-on" TI-85 workshop. We do hope you can attend. The conference registration fee is $90 which includes two nights lodging (shared double), meals (beginning with Friday dinner and concluding with Saturday dinner), materials and handouts, and a conference tee-shirt. The conference is open to anyone who would like to attend, even if they have never participated in C²PC, CalcNet, or TRANSIT. To obtain additional information and a registration form, please contact Sherrie Lowrey, T ³ Teachers Conference, The Ohio State University, Department of Mathematics, 231 West 18th Avenue, Columbus, OH 43210. The registration form must be completed and returned to Ohio State University before **1 November 1992.**

TRANSIT. The Ohio State University invites applications for an NFS project to establish school / university teams as regional technologic centers. Regional team training will be provided through summer in-service sessions and academic year follow-up conferences at Ohio State University. Local living expenses with stipend support for pre-college team members is available. Regional teams will help create and/or revise inservice training modules. Regional center teams will begin training teachers as school technology specialists during Summer 1994 at their regional sites. Deadline for completed applications is 15 February 1993. Write TRANSIT, c/o Frank Demana and Bert Waits, The Ohio State University, Mathematics Department, 231 West 18th Avenue, Columbus, OH 43210.

PERSONAL OPINION

An Interim Goal for School Mathematics Reform

Philip Miles

GOAL That by the spring of 1998, 90% of college-bound Juniors shall be literate in linear mathematics.

The proposed goal is intended to supplement the much broader and more general list of goals given in the *NCTM Curriculum Standards.* It comes closer than *Standards* to describing desired results in terms of outcomes rather than process, and sets a target time for achieving these outcomes (an issue not considered in *Standards).* It is a possible answer to the question: "If, as a college teacher, you could choose just one goal in *Standards* to be attained by your entering students within six years, which would you pick?"

To understand this statement, it is helpful to reflect on what we mean by "literacy," and to specify what is meant here by "linear mathematics."

LITERACY For literacy in English, we expect students to be able to read new material without any preparation. We can hand them any recent issue of any newspaper, sak them to turn to page three and start reading; we can then ask them to tell us in their own words what they read —and in fact, they can. We can also ask them to write a description of something with which they are familiar —say a description of their family. Here the results will be more varied, and some of the descriptions will not read very well. But most will make sense. Students can do this "out of their heads," without being given a model description of a family as a guide.

Can't we expect students to do a simple word problem at sight in the same way ? Our experience is that we cannot. Over half the students need to have a similar problem done for them, in the text or in class, before they can produce work which makes sense. This is true even when the general area of the problem is one with which students have been familiar for three to five years. We have a well used battery of explanations for this: "they were rusty on that," "they weren't expecting that," etc.

"They weren't expecting that" is certainly true as far as it goes. Students have good reason to expect that they will not be asked to do a math problem without having been given a model in the recent past. We rely heavily on texts and teaching styles in which students are encouraged to use worked examples as templates for answering our questions. We wish to push on, as soon as students can do work with one set of templates, to "new material"—which often means no more than working with a new set of templates. We are reluctant to stay with a given body of material long enough to move students beyond the preliterate template approach.

The goal is that in one area of mathematics, students shall be literate in the same sense as ordinary English literacy. They shall be able to read and write new material without needing a template. Reading and writing includes translating, paraphrasing, interpreting, recognizing equivalent statements, and using what is read as a basis for comparison or a basis for reasoning. All of these activities occur sporadically in current texts. In a text aimed at literacy, they would be dense, since they would be central to the approach. The purpose of these multiple activities is to establish that web of connections we call meaning. When this happens, students will see what they have learned as making sense. When it makes sense, it will be remembered and, when needed, used.

Society judges our teaching accomplishments by what our students can do after they leave our classrooms and our colleges. If we want to claim that what we do is important to society, we need for our students to remember and use our stuff even when they are students no more.

LINEAR MATHEMATICS The goal is meant to cover usage of only the most basic elements: linear equations and inequalities, and their corresponding functions and graphs, in at most four variables. Matrices, linear programming, linear transformations, etc. are not covered. We can hope that when students have achieved literacy in situations involving a few constant rates, they will find it natural to work toward literacy in using more complex mathematics. But, first things first. Achieving literacy is the main goal, and linear mathematics is the easiest place to start.

WHY AN INTERIM GOAL ? The proposed goal is, on its face, significant, challenging and attainable.

Significant – if the goal were attained, the mathematical community would have accomplished something well worthwhile for American society, would have demonstrated feasibility of many of the qualitative goals of reform, and would have produced a cohort of students better prepared than their predecessors for subsequent work in mathematics.

Challenging – attaining the goal would entail real changes in how teachers teach and students learn and how society evaluates the outcome. These changes would be far from easy to accomplish, but their accomplishment would make subsequent beneficial changes easier.

Attainable – this is admittedly an optimistic guess. But if the proposed goal is not attainable in the proposed time, all thinking about the future of mathematics education in America needs to be redone in a more subdued way.

The proposal is not that this goal replace other, longer term, more ambitious goals. Rather it complements these bigger and vaguer goals by adding in one specific aspect that, completion should be attained at a definite and not too distant time. When we, as a teaching community, and when America, as a learning society, have attained the proposed goal, we will all have learned and changed in ways that make the attainment of larger goals more likely.

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Job Search Diary

Part 1

Edward F. Aboufadel

Keith Devlin, chair at Colby College, has asked me to keep track of my progress towards finding a job. Here goes:

Up until October 15, 1991: Over the past few years, as I have worked on my dissertation, I have been keeping track of the job market by reading articles in FOCUS, the AMS Notices, and SIAM *News*, and through conversation with faculty at Rutgers, particularly my advisor. I draw the following conclusions: the job market will be tight for positions in Sept. 1992; an average candidate applies for 100 jobs; each offering gets 600 applicants; all large state universities want to hire stars and will delay hiring for a year in order to get one; teaching is called a "load" while research is called an "opportunity"; the average starting salary (and what I am expecting) is $32,000/year; departments want to hire people with postdoctoral experience; postdocs are very competitive.

October 18: Since September I have been accumulating announcements of job openings. My sources are the bulletin board in the department, FOCUS, the AMS *Notices*, SIAM *News*, and e-MATH (the AMS computer that is discussed at length in the *Notices*.) Today I sit down with all these opportunities and try to sort out which ones I want to apply to. For a while, I have been thinking about geographical location, and, in order to be reasonably close to my family and friends, I have decided to limit my search to states east of the Mississippi River which are not in the deep South. This gives me approximately 22 states to work from, and I also add Ontario to the list.

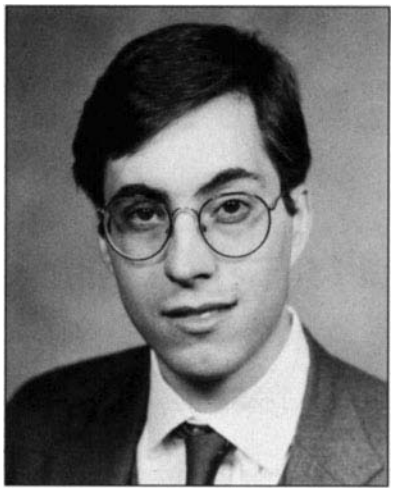
I sort through the positions, rejecting some for one of the following two reasons: geographical area or that the school is looking for a specific specialty (i.e., Operations Research, Discrete Mathematics) that is not my speciality. I decide that it is too early to factor preferences such as rural/urban or big school/small school — I probably will not be able to be choosy. After sorting, I determine 25 positions that I feel I can apply for.

Should I apply for all 25? In some cases, it may be a waste of my time and theirs, but how can I know which cases? I decide to talk with my advisor, Jane Scanlon Cronin.

October 22: Met with my advisor to talk about applying for jobs. She does not steer me away from any position. There is a postdoc at the University of Michigan that she describes as "very competitive" but she does not say, "you won't get it so don't even try." We talk about letters of recommendation, my resume, and my cover letter. My resume at this point mentions my expected PhD, the courses I have taught, and some of the activities I was involved in college (e.g. student government, a service organization). It is difficult for the two of us to decide what should go where, and I decide to talk to someone in our department who was on the hiring committee last year.

We also talk about whether my last name will be a problem. Seriously. For the positions I intend to apply for at smaller, more education-oriented schools, I do not want those personnel committees to think that I am from Iraq. I am born and bred in this country — my father said he wanted to raise my brother and me as Americans — and I have been educated exclusively by the American educational system. (Whether this is something to be proud of is another question.) My advisor suggests that I include my place of birth, birthdate, and high school education on my resume.

October 24: Feeling pretty anxious about applying. I have done most of the work for my dissertation, but is it really any good? Purdue, for instance, demands that you name someone on the faculty there with similar interests as you. I do a little research into the mathematicians



at Purdue and can't find anyone there with similar interests. Yes, there is a group involved in ODEs, but one person is doing Numerical Analysis, for instance, and it is just not clear what "similar" means. Is my dissertation too obscure? I imagine other students completing their Fields-medal quality PhDs and wonder how I can compete for these postdocs. I probably can get an interview at a school which is not too concerned about research, right? But I want to continue my research. But I also want to be involved in Calculus Reform and everything else discussed in FOCUS. After all, I have a subscription to UME Trends. How many graduate students have a subscription to UME Trends?

October 25: Get e-mail from K. Devlin. He suggests writing this diary and that I should consider one year positions. He observes that after a one or two year position, the job market might be better. Good point. But who wants to start applying for jobs as soon as he gets into a position?

October 28: Met today with Joe D'Atri, former chair of our department. He has had experience with fielding applications and I ask him for his preference. A good rule of thumb: the cover letter should not be more than a page. If it is necessary to describe certain research or teaching experiences in detail, then create another document in the application packet and refer the reader to it (e.g., "For a more detailed discussion of my dissertation, see the attached sheet "Description of Dissertation.") He also recommends: make clear whether letters of recommendation are coming; make clear whether or not you are a US Citizen; make clear which position you are applying for; make clear when you expect to receive your PhD.

"Bigger" schools are very concerned with your research experience, so two or three letters should address this. I have a problem in that my advisor is really the only person who has seen my work. I decide that I need to talk with her about this. Perhaps Terry Butler could write a letter for me.

October 30: A few places make it a necessary condition of the application that you name or even be in contact with someone at that school who has interests similar to yours. The night before I spent some time in the library using a list of professors I got from e-MATH and the author index of Mathematical Reviews to find someone with interests similar to mine. An hour later I was sure that either no one in the world has interests similar to mine or else that I am misunderstanding these instructions. I decided to send e-mail to anyone I can find with an e-mail address at these institutions in order to ask for help.

I have also completed drafts of the generic cover letter, my resume, and my description of research. Tomorrow I meet with my advisor.

The November *Notices* arrived today. There are a number of positions there and I am now up to 37 positions that I am applying for. I wonder if I can eliminate a few. Of the 37 positions, a few specify a preference for a certain specialty that isn't mine, but they also say that all applications will be considered. I have heard stories that departments will not always stick to their preferences, so I really cannot drop those.

I still wonder if anyone at the University of Michigan, for instance, is going to give my application more than a moment's notice.

November 1: Talked with Joel Lebowitz today, a professor here who is the head of the math/physics group. Basically, I wanted to understand what a postdoc is. He described it to me in this way: there are some mathematicians who have a grant, and in the grant there is money for a postdoc. If you are hired as a postdoc via this grant, you basically do the research that the senior member asks you to do. On the other hand, there are many Instructorship positions in mathematics departments. With these positions, you teach, are free to do the research that you choose, but it would be nice if you were connected with some seminar or senior faculty member — a mentor, if you will. I had been growing concerned that the mentor-student relationship of my predoc work would be duplicated in my postdoc work, but he believes that that is not the case.

One position I am applying for is the Pew Teacher-Scholar program. Through some luck, I have located someone at the University of Chicago who shares some interests with me. His name is Norman Lebovitz. A search of the library indicates that Lebovitz's research involves geophysics and fluid dynamics. If Lebowitz is right, and if I were to be named a Pew Teacher-Scholar at the University of Chicago, then that would mean that I would not necessarily be working in geophysics and fluid dynamics next year (although it might be interesting). So, it should not hurt me to assert in my application where I see my research going.

I asked my advisor to give me a list of people who are currently working in our area. She is working on it.

Lebovitz also mentioned that, as an American citizen, I can apply for an NSF Postdoctorate. Why am I not surprised to learn that the deadline for applications was Oct. 15?

November 7: I haven't had a lot of time the last few days to work on this. I got a letter out to Oberlin College and tonight I am working with the computer to generate 10 more letters. These deadlines worry me. What if one of my letters of recommendation doesn't get there by the deadline? What about these places that want transcripts? That is going to take some time.

So far, as far as letters go, I have asked Dr. Barlaz to write one about my teaching experience. I expect that it will be a good letter, as he just asked me if I would like to teach 377, Numerical Analysis, in the spring. Tomorrow I will explain my thesis work to Dr. Butler, who is on my committee, so that he can write a letter about my research. I need to talk to my advisor again. We had an appointment for Tuesday that she cancelled and we have yet to connect. I also need to talk to Dr. Greenfield about the letter he is going to write about the service I have done for the department (The "Mr. Chips" letter).

I have been neglecting my dissertation for two weeks now as I work on this (and teach and get everything else done I need to get done like laundry and grocery shopping and trying to spend some time with my girlfriend). I don't know what troubles me more: the listings with November deadlines or the listings that don't have deadlines.

Some disappointing news from the chair of Washington University in St. Louis. No one there is working on ODEs (and why not?!), so I cannot apply for the Pew Fellowship there. At least I can apply at the University of Chicago.

Meanwhile, I have discovered a new source of jobs: Employment Information in the Mathematical Sciences. Unfortunately, I cannot get my hands on the current issue. Last year, the department here didn't get the November, December, or January issues until April, because the University "forgot" to pay the AMS what it owed. Today the chair told me that they have ordered it. I'm not holding my breath.

At this point, I have applied or am about to apply for positions with deadlines before Jan. 1. Let's see if I hear from anyone. Then, next month, I will send out more.

I also left my resume with an IBM recruiter who was on campus this week. Tomorrow there is a Math/Actuary career day here, and I hope to give some other companies my resume. Although I would prefer an academic position, I think, it will be good if I can interview for a few positions in industry. I've been told that solid analytical skills are desired on Wall Street. I wonder if there are any jobs I can be considered for.

November 12: Wanted to insert the e-mail note I received last week from Washington University:

> Date: Thu, 07 Nov 91 14:40:04 CST> From: "Gary R. Jensen" <C31801GJ@wuvmd.bitnet>Subject: Re: Pew Teacher-Scholar Program To: "Edward F. Aboufade!" <aboufade@math.rutgers.edu>In-Reply-To: Your message of Fri, 1 Nov 91 10:26:48 EST Dear Edward, I am sorry that we have nobody in our department who does research in the area of ordinary differential equations. Ours would not be a good department for you to spend a post-doctoral year. Best wishes on finding a more appropriate place. Sincerely yours, Gary Jensen

I sent out 13 applications yesterday and one more today. I also received a letter from Oberlin College saying that they have received my letter and are awaiting transcripts and letters of recommendation. Only a few places have asked for transcripts. I was surprised to learn this week that Michigan State now charges $5.00 for a transcript. At Rutgers it is $3.00.

My advisor today gave me her version of my "Description of Research." She said that what I wrote (and sent to 15 schools) was too technical. I don't want to botch getting an interview because of some sort of procedural thing like this — let them reject me on my merits!

I have 20 more applications to send out, and I will do those next week. It is funny — I think that once they are sent out, I will probably have to wait until the new year for any fireworks.

November 25: The department has received the November issue of Employment Information in the Mathematical Sciences. There are a lot of listings in it. I also checked the listings in e-MATH, and there are a lot of listings there, too. I am trying to determine if one is the subset of the other. Given the number of listings that I see, I am starting to feel more confident that I will at least get an interview.

Those other applications I mentioned I am working on today. Last week I concentrated on my dissertation.

I continue to refine my resume and description of research, even though some places have already received earlier versions.

I have begun receiving confirmations from schools that they have received my application, and many include an affirmative action form to fill out. Maybe that would be a way for schools to discourage people from applying — make them fill out long forms. Or, as I've heard some airline is doing, put a fee on the job application. Actually, I think this is a terrible idea.

The best confirmation I have received so far is from Oberlin College. It is a simple "We got your application — here's what we don't have yet" letter. The worst has been from Duke University, which sent me a form letter that they must send to all who apply, because it included sentences like "If you want your application from last year reconsidered..." and "If you have not sent us a description of your research ...." Basically, the only part of that letter which applied to me was "We have received your application."

I am glad that I am receiving confirmations — it makes me feel that my work so far on this job search project is actually getting somewhere.

*Please see **Job Search** on page 16*

***Job Search** from page 15*

November 27: Problems at the University of Bridgeport and at Columbia worry me a bit. At Bridgeport, they are having a financial crisis, and may have to dip into endowment funds in order to pay faculty on the 29th. At Columbia, the heads of a number of departments are threatening to resign if the administration there follows through on attempts to cut some programs. Are the places I have applied to, particularly those who caution that the available position "depends on funding approval," in at all in similar shape?

On the other hand, my office-mate from last year, Brenda Latka, tells me that Lafayette College, where she has a position, will be hiring again this year and that they are working on the announcement. How many places out there have made similar decisions this week?

November 30: Today I decided to not apply for four positions that I had earlier decided to apply for. I also worked through a new list of positions I got from e-MATH, rejecting many that I felt I was not qualified for or overqualified for. For instance, a few places said they would "prefer an algebraist" or said that "master's degree required." I didn't like this line in an announcement by the University of Missouri: "Selections for the position will be based primarily on demonstrated research achievement in an area complementary to areas of ongoing departmental research," in part because earlier in the announcement they paid lip service to quality teaching and because I feel that one of the strengths of my applications is my teaching experience.

I've spent a lot of time with this process already, and I am getting tired of it. I'm not so quick to say, "It won't hurt to apply there, too."

However, since some of these positions have application deadlines in February or March, I may still have a long way to go. I'm also expecting the new AMS *Notices* this week.

December 5: Here's the score at this point: I have 40 applications out. A Chinese student in our department has 60. Two Americans that I know are just starting to apply, and a third American has 4 applications out, since he wants to stay in New Jersey.

I have more thoughts about better ways to word these job postings. Why can't departments be clearer about who they want to apply for these positions? I appreciate the departments that say" please send a copy of your most recently published paper," since it says to me: "if you haven't had anything published, don't apply." I would like to see ads that say "this position is intended for new PhDs." I understand that departments like to be vague in their position announcements so as not to turn away someone who actually might be a good fit, but, on the other hand, if your search committee is tired of swimming through applications, maybe the announcements should be more direct so as to get fewer applicants. Some ideas: "only graduates of Princeton, Harvard, or Berkeley need apply"; "if you do not enjoy teaching, don't even think of applying here"; "this is a tenure-track position — we are NOT hiring new PhDs." OK, maybe I'm getting a bit silly here.

To be continued . . .

***Coxeter** from page 4*

second, *Dihedral Kaleidoscopes*, featured a somewhat younger Coxeter demonstrating how to generate plane-covering regular and semi-regular tesselations by using vertical rectangular mirrors set at various angles and polygons made of colored paper. Both films were roundly applauded.

Between the films, Moser went to the podium and said some extremely nice words about Coxeter as teacher, co-author, and friend. One thing that delighted the audience is that the Coxeters would be celebrating their fifty-sixth wedding anniversary the following day. In preparation for this evening, Moser said he had gone through his Coxeter files and had come up with several sentences and paragraphs worthy of quotation. For example, in a 1979 interview, Coxeter characterized himself by saying. "I'm someone who tries to find out mathematical truths—and I enjoy doing it."

At the conclusion of the second film, I expected Coxeter to get up and speak, but it was announced that, although Professor Coxeter had planned to say something, the schedule indicated that the next set of films would begin in fifteen minutes, so there wasn't time. Fortunately someone went up to the organizers of the film program and asked if it would be possible to hear Coxeter, at least for the duration of the break before the next films, and when that was suggested to the audience, everyone enthusiastically signaled approval. A moment later, there was Coxeter up at the podium showing some of his favorite Escher images and telling stories about how diagrams from hyperbolic geometry inspired the artist to create some of his most memorable designs. One, based on crosses on a Poincaré disc, Escher said he should probably send to the Pope. Another was a four-color fish design the original of which hangs in the Coxeter home in Toronto. At the end, he showed some transparencies by a new artist, Russell Towle, whose work incorporates many images from geometry. And then he was done, in just fifteen minutes. The rest of the film program was hardly delayed at all.

The people who had been at the dinner left at this point and stood around in the foyer talking appreciatively about the events of the evening. Coxeter and his wife seemed very pleased indeed. He gave to Michele and me copies of his most recent research article, on the evolution of Coxeter-Dynkin diagrams, written last year, sixty years after he had first introduced them, nine years after he had written his paper on Dimensional Analogies as a sixteen-year old. Someone recalled the last quotation Moser had presented, taken from a convocation speech by Coxeter in 1979: "The best that I can wish for each of you is that you may have as full and happy a life as I have had and am still having." To which we all said, "Amen!"

***IMO** from page 9*

mental faculties, but motivation and support. Let's spread the word, motivate students, and support their progress!

It is important to point out that the IMO is a celebration of mathematical talent more than a competition for mathematical supremacy. The team scores are unofficial and informal, and the international rivalries are friendly and good-natured. This summer, the Americans made friends with participants from Romania, Russia, Cyprus, Argentina, Colombia, South Africa, Australia, Germany, Taiwan, Trinidad, and other places. The focus is on cultural exchange, friendships, and mathematics; the competition is there to invigorate that exchange, those friendships, and mathematics. We play this game hard and we play to win, but the real impact of the IMO has little to do with winning and losing and team scores. What is most important is fostering mathematical talent, encouraging mathematical achievement, and unifying the mathematical world. The IMO is an important tool in this effort.

Pi Mu Epsilon and MAA Student Chapters Cooperate in Hosting Student Conference

From 5 August through 8 August, 1992, Miami University in Oxford, Ohio, was the site of a first-ever Pi Mu Epsilon Student Chapter Joint Summer Conference. One hundred students in addition to faculty representatives of the sponsoring organizations were privileged to hear 60 papers presented by students over a wide range of theoretical and applies topics.

In addition to the student presentations, Peter Hilton, State University of New York, at Binghamton, presented an MAA Invited Address, "Another look at Fibonacci and Lucas numbers" and Underwood Dudley, DePauw University, gave the Pi Mu Epsilon J. Sutherland Frame Lecture, "Angle Trisectors." Students also attended one of several minicourses: "Tilings by Hand and Computer" presented by Doris Schattschneider, Moravian College, "Variations on a Spiral" presented by David Kullman, Miami University, and "Environmental Modeling," presented by Ben Fusaro, Salisbury State University. A panel of six representatives from industry discussed the role of mathematics in their companies.

David Ballew, Western Illinois University, is President of Pi Mu Epsilon; and Howard Anton, Drexel University, is Chair of the MAA Committee on Student Chapters. Robert S. Smith, Miami University, directed the conference.

Harold M. Bacon, Professor Emeritus, Stanford University, died on 23 August, at the age of 85. He had been a member of the MAA for 57 years. One of the founders of the Northern California Section, he also was the Section's first Section Governor, 1941-43. He served as a member or chair of many MAA committees and again on the Board as a Governor-at-large, 1957-59. In 1988, he was the first Northern California Section recipient of the Certificate of Meritorious Service. An outstanding teacher and the author of several popular textbooks, he had taught at Stanford since 1930 and in 1967 received the Dinkelspiel Award for outstanding service to undergraduate education.

Center Fund Closes in on Goal

Thanks to the generosity of hundreds of donors, in early September we reached ninety-four percent of our cash goal of $600,000 for the Mathematical Center Fund. Nearly 700 donors have contributed to the campaign, including 269 who have given $300 or more and 43 who have pledged $3,000 or more. Before the year ends, we would like to reach our cash goal. Help us go over the top by making your gift soon.

Our thanks and appreciation are extended to all who have made gifts for the Center. Many members have made gifts in memory or commemoration of someone — a wonderful way to honor mentors, teachers, and colleagues in the mathematical community.

Family tributes to the Mathematical Center Fund include rooms named for Viola and Bernard Hank, Rodney T. Hood, Betts and Andy Sterrett, and Charles W. Trigg. Other room campaigns to which members might like to contribute are named for: Ralph P. Boas, Howard W. Eves, Neal McCoy, Mary Ellen and Walter Rudin, Albert W. Tucker, and Alfred B. Willcox. Campaigns in memory of Burton W. Jones and Joseph Konhauser are also in progress and members may wish to make gifts in honor of them. More than 200 donors to date have contributed to special room naming opportunities.

An Authors' Room, supported by gifts from publishers, and a Michigan Section Room are also part of the Center campaign. The Northeastern Section is spearheading the Howard W. Eves Room campaign. The Mary Ellen and Walter Rudin campaign is being led by the Wisconsin Section.

Donors who make gifts of $300 or more will be remembered with their names on an Honor Roll of Donors wall plaque; all donors will be listed in a *Register of Donors* book. A special reception for donors will be held at the San Antonio meeting in January, at which time the *Register of Donors* will be on display. The Honor Roll of Donors wall plaque will be dedicated at the Center early in 1993.

Rooms are still available for gifts in the $10,000 to $25,000 range. If you would like to remember someone in this way, or if you know of someone who might like to make such a gift, please contact: John W. Kenelly, Campaign Chair, or MAA Executive Director Marcia P. Sward at MAA headquarters, 1529 Eighteenth Street, Northwest, Washington, DC 20036-1385; (202) 387-5200; msward@maa.org.

Networking *from page 7*

The point behind these questions is that each of us is responsible for backing up and managing the limited amount of disk storage in our personal computers.

Your institution may provide, or be able to develop, a central file system which will be a resource intended to address the above questions, as well as other requirements. Typically, it will consist of a very large pool of disk storage space controlled by one or more central systems and will be directly accessible through a local (campus) network. Network transfer speeds will make it possible for a user to back up the hard drive in his or her computer in less than an hour and with little effort. Indeed, such a system could fully automate this process for the user, backing up those files which have been created or changed since the last backup was done to central disk or tape storage.

Such a file system would also function as an extension of your own hard drive, expanding the amount of space you can use, as well as serving as an archive system.

The primary objectives of a such a system are to minimize the cost per unit of disk storage, relieve the users from much of the responsibility of backing up their information, and provide an environment to facilitate the sharing of information and software among individuals and departments.

Conclusion

I hope I have managed to achieve my goals of at least partially demystifying networking and illustrating what a network connection can do for you. Perhaps not everyone has a need at present, but I believe this will soon change, and networks will play an essential role in all of our lives, both at work and at home.

Computers in the Classroom at Denison University

Fifty concerned mathematicians and scientists from colleges and universities, as well as representatives of foundations, recently gathered at Denison University to discuss a pervasive problem: how to improve mathematics instruction. The meeting on "Symbolic Computation in Undergraduate Mathematics" focused on how calculators and computers are used to teach mathematics courses throughout the college curriculum. The conference was supported by a grant from the Alfred P. Sloan Foundation to the Mathematical Association of America.

The conference, organized by Zaven Karian of Denison University, consisted of five sessions:

- *Symbolic computation in post-calculus courses*, organized by Stanley Seltzer, Ithaca College
- *Use of symbolic computation in universities*, organized by William Boyce, Rensselear institute
- *Impact of symbolic computation on learning*, organized by Richard Shumway, Ohio State University
- *Client disciplines*, organized by David Cook, Lawrence University
- *Where do we go from here?* organized by Paul Zorn, St. Olaf College

Seltzer responded affirmatively to a question asking whether computer algebra systems (CAS) are more effective in advanced courses than in calculus, and went on to ask a question of his own: "Is using CAS more effective in advanced courses than not using CAS?" He claimed that graphs generated by CAS are being used by students, not merely produced, and that computers have enabled many students to view calculations as insignificant details, thereby increasing their power of abstraction. Seltzer also asserted that computers have helped instructors capture the attention of students — in and out of class — and that faculty have become more interested in teaching. Participants in this session described their experiences using a CAS in teaching applied mathematics, modern algebra, and discrete mathematics and in guiding student research.

Panelists from universities described three significant programs that involve extensive use of calculators and computers. All students in 52 sections of calculus, differential equations, and linear algebra (approximately half of those offered) at Clemson University possessed an HP-48S calculator in 1991-92; faculty at the University of Iowa are developing and using new materials in which computing plays an important role; and, in 1991-92, Rensselear enrolled all freshman students in a computer-oriented calculus sequence.

During his presentation on "Appropriate Research Strategies," Frank K. Lester, Indiana University-Bloomington, offered three suggestions for research on the use of CAS's in undergraduate instruction:

1. Traditional experimental vs. control group comparisons are not likely to provide much insight into the truly important questions.

2. Careful, thorough descriptions of what goes on in a course (a class, a lab, etc.) are more likely to prove useful than traditional quasi-experimental methods.

3. Generalization of research findings to a wide range of situations should not necessarily be of primary interest.

Participants at the conference were privileged to hear from representatives of four important "client disciplines" — physics, chemistry, economics, and computer science. It was valuable to hear our colleagues report on their attempts to improve instruction in their disciplines and the role that computers play in these efforts.

The fifth and last session of the Denison conference was devoted to assessing where we've come over the last 5-7 years with symbolic computation in undergraduate mathematics and (to the extent possible) predicting where we are headed. What issues — technical, financial, professional, mathematical, pedagogical, etc. — will determine the future of educational symbolic computing? How shall we prepare to meet them?

The two-hour final session was divided into four subsessions:

Technology issues: The first subsession dealt with the tool itself. What developments in symbolic manipulation hardware and software can be expected in the near future, and how will these developments affect educational uses of symbolic computing?

Support issues: The second subsession, briefer than the first, concerned the need for, and strategies for obtaining external support for instructional efforts that involve symbolic computing.

Calculus as a case study: Elementary calculus can serve as an object lesson in undergraduate mathematical computation. Collectively we have 5-7 years of experience using CAS technology for this purpose, and many years of earlier experience with other computing platforms. What have we learned from the experience? What does it portend for the future?

The "big picture": In the last subsession, Samuel Goldberg, of the Sloan Foundation, recounted some of his own experiences, and those of the Foundation, in supporting experiments in symbolic computing.

Proceedings of the conference may be obtained, without charge, by writing to Andrew Sterrett, Visiting Mathematician, MAA, 1529 eighteenth Street, NW, Washington, DC 20036-1385.

MAA VIDEO CLASSICS

Let Us Teach Guessing

George Pólya

"Teaching is not a method, it is not a system. Teaching is not a science—it is an art." With these words, Pólya reveals his approach to teaching mathematics. In a remarkable tour de force, Pólya shows us how to teach guessing. In this classic film, master teacher Pólya leads an undergraduate class to discover the number of parts into which 3—space is divided by five arbitrary planes.

1966, color, 61 minutes
List: $36.95 MAA Member: $29.95
Catalog LTG

John Von Neumann
A Biography

Rare footage and photographs of the legendary von Neumann are to be found in this film biography. Halmos, Morgenstern, Teller, Wigner and Ulam contribute insights about and memories of Johnny. Set theory, computing, game theory, quantum mechanics—how broad were his interests? After viewing this video classic, your picture of von Neumann will enlarge.

1966, b & w, 63 minutes
List: $36.95 MAA Member: $29.95
Catalog Number JVN

Courant in Göttingen and New York

Colleagues of Courant describe his great influence as mathematician, author, and administrator. Part of the film contains footage of Courant in action, lecturing on soap bubbles and minimal surfaces. A significant portion of the film consists of reminiscences of his work at New York University and Göttingen where he succeeded Felix Klein. Forced to flee Hitler's Germany, Courant came to New York University in 1934, where he worked tirelessly to develop the Courant Institute of Mathematical Sciences.

1966, b & w, 43 minutes
List: $36.95 MAA Member: $29.95
Catalog Number CIG

The Moore Method
A Documentary on R.L. Moore

The Moore Method of teaching is presented by Moore himself. In his long career at the University of Texas at Austin, R.L. Moore produced a long list of distinguished mathematicians, and all of them were Moore Method graduates. In this film shot in his classroom, Moore passionately explains his methods of teaching which placed preeminent value on students discovering mathematics on their own. Moore also reflects on the beginnings of his own mathematical education in 1877.

1966, color, 55 minutes
List: $36.95 MAA Member: $29.95
Catalog Number RLM

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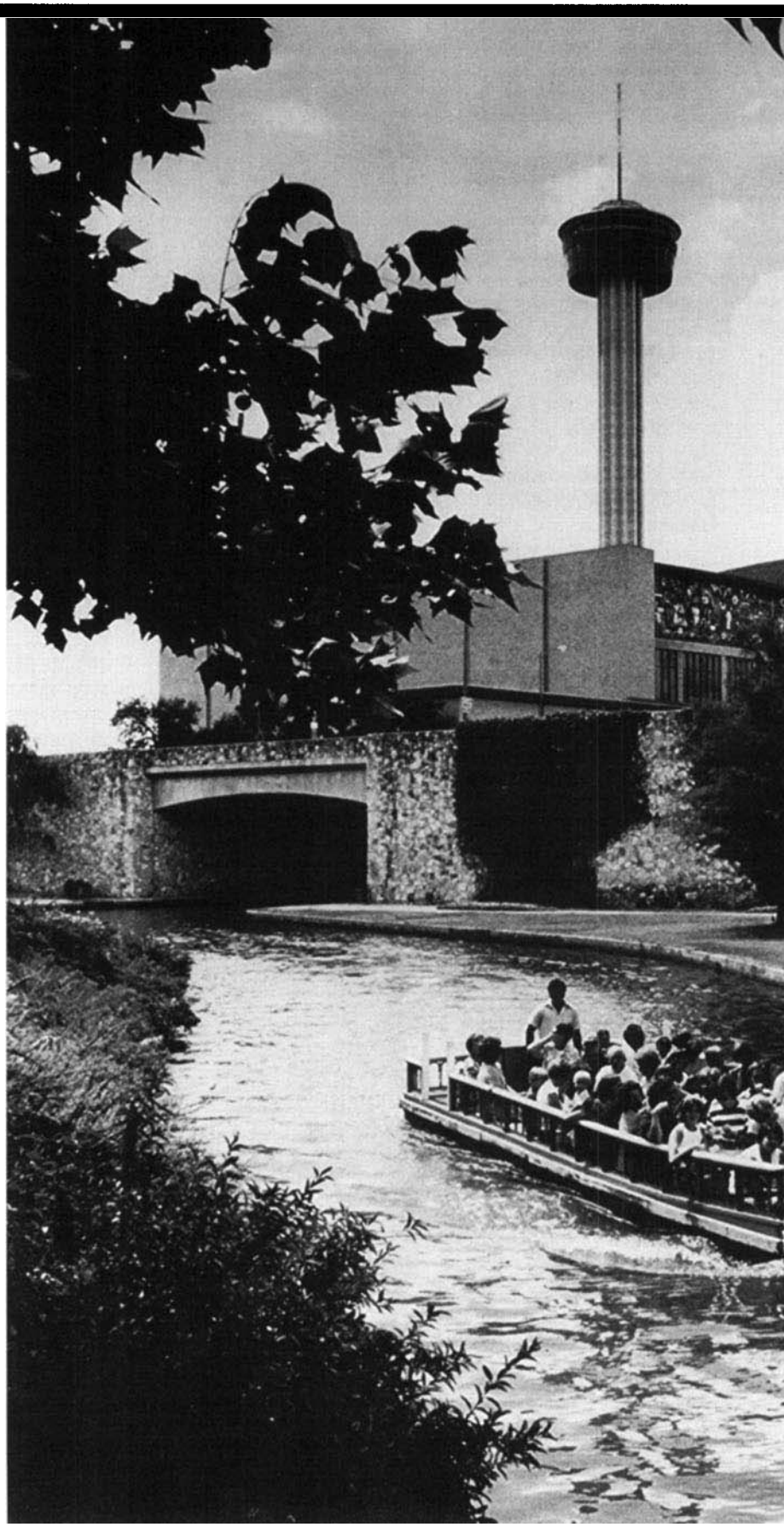
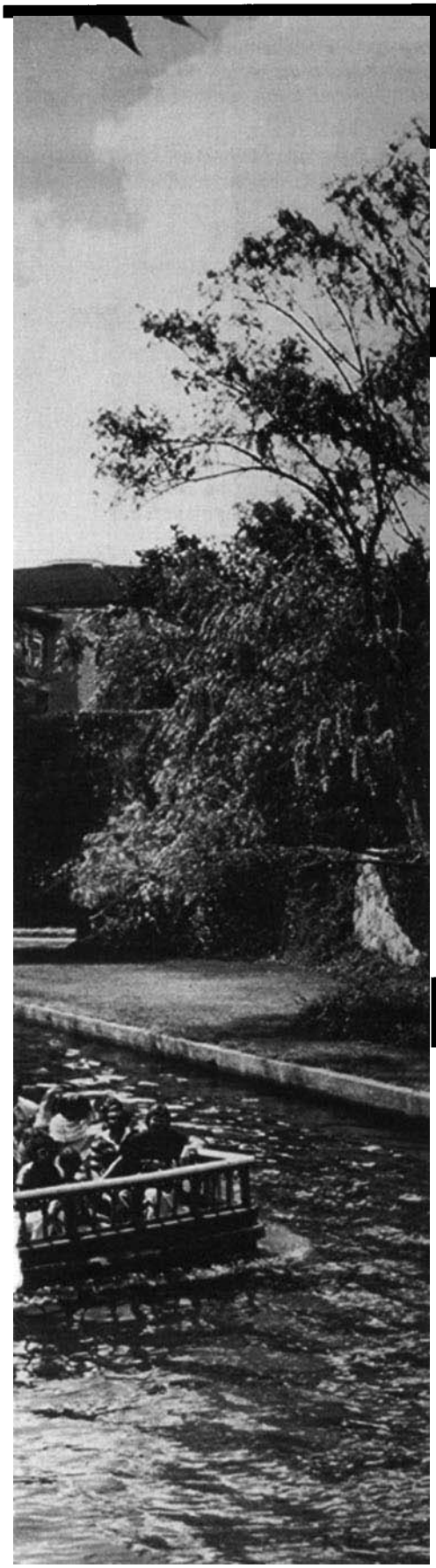
SAN ANTONIO IS LOCATED ON THE EDGE OF THE GULF COSTAL PLAINS. IT HAS A MODIFIED TROPICAL CLIMATE. THE AVERAGE HIGH TEMPERATURE IN JANUARY IS 62°.





San Antonio

MEETINGS PROGRAM GUIDE

IMPORTANT MEETING DEADLINES

Early Preregistration and Housing ..... October 30
Room Lottery Qualification ..... October 30
Ordinary Preregistration and Housing ..... November 13
MAA Minicourse Preregistration ..... November 13
Employment Register ..... November 13
(Both Applicants and Employers)
Final Preregistration *(no housing or tickets)*..... December 11
Banquet Cancellations (50%) ..... December 30
Ticket Cancellations (50%) ..... December 30
Minicourse Cancellation (50%) ..... December 30
Preregistration Cancellation (50%) ..... January 10

Tuesday, 11 January 1993

8:30 - 4:00 **Board of Governors' Meeting**

Wednesday, 12 January 1993

MORNING

8:00 - 10:55 **AMS - MAA Special Session:** *Mathematics and education reform*, Naomi D. Fisher, Harvey B. Keynes, and Philip D. Wagreich, Mathematicians and Education Reform Network (MER)

8:00 - 10:55 **Contributed Paper Session:** *Assessment programs for the undergraduate major*, Charles F. Peltier, Saint Mary's College and James W. Stepp, University of Houston

8:00 - 10:55 **Contributed Paper Session:** *Empowering the mathematical community*, Gloria F. Glimer, Math - Tech, Inc.; Marilyn Frankenstein, University of Massachusetts, Boston; Patricia C. Kenschaft, Montclair State College; and Alvin M. White, Harvey Mudd College

8:00 - 10:55 **Contributed Paper Session:** *Interactive learning environments*, Katherine Pedersen, National Science Foundation (NSF) Statewide Systemic Initiative, South Dakota; and Sandra Z. Keith, St. Cloud State University.

8:00 - 10:55 **Contributed Paper Session:** *Using data and computers in teaching statistics*, Mary Parker, Austin Community College and George Cobb, Mount Holyoke College

8:00 - 10:00 **Minicourse 1A:** *Alternatives to the lecture method in collegiate mathematics*, organized by Julian Weissglass, Mathematical Sciences Education Board (MSEB)

8:00 - 10:00 **Minicourse 2A:** *How to make effective use of inexpensive pocket computers to develop the concepts and techniques of calculus*, organized by Franklin Demana and Bert K. Waits, Ohio State University

8:00 - 10:00 **Minicourse 3A:** *All right! I've got a graphing calculator. What happens next?* organized by Iris Brann Fetta, Clemson University

8:00 - 10:00 **Minicourse 4A:** *Unifying themes in discrete mathematics,* organized by Ralph Grimaldi, Rose-Hulman Institute of Technology

9:30 - 10:55 **Panel Discussion:** *Calculus reform and the AP Calculus Exam,* co-sponsored by the Calculus Reform Study group and CRAFYT, the CUPM subcommittee on Calculus Reform and the First Two Years. The organizers are Howard Lewis Penn, United States Naval Academy and George M. Rosenstein, Jr., Franklin & Marshall College

9:30 - 10:55 **AMS - MAA Panel Discussion:** *Best snapshots from doctoral departments*, sponsored by the AMS - MAA Committee on Preparation for College Training (Bettye Anne Case, chair)

11:10 - 12:00 **AMS - MAA Invited Address:** *Title to be announced.* Robert Osserman, Stanford University

AFTERNOON

2:15 - 3:05 **MAA Invited Address:** *I am ashamed to tell you to how many figures I carried these computations, having no other business at the time.* Peter B. Borwein, Dalhousie University

2:15 - 6:00 **AMS - MAA Special Session:** *Mathematics and Education Reform*, Naomi D. Fisher, Harvey B. Keynes, and Philip D. Wagreich, Mathematicians and Education Reform Network (MER)

2:15 - 6:00 **AMS Special Session:** *History of Mathematics,* Thomas Archibald, Acadia University and Victor J. Katz, University of the District of Columbia

2:15 - 6:00 **Contributed Paper Session:** *Impact of non-traditional instructional methods on testing and evaluation*, Linda H. Boyd, DeKalb College and Elizabeth J. Teles, Montgomery College, Maryland

2:15 - 6:00 **Contributed Paper Session:** *Linear Algebra,* Donald R. LaTorre, Clemson University; Steven J. Leon, University of Massachusetts, Dartmouth; and A. Duane Porter, University of Wyoming

2:15 - 4:15 **Minicourse 5A:** *Using supercalculators to enhance instruction and learning in linear algebra,* organized by Donald R. LaTorre, Clemson University

2:15 - 4:15 **Minicourse 6A:** *Teaching the introductory statistics course,* organized by Donald L. Bently, Pomona College; Robin Lock, St. Lawrence University; Thomas L. Moore, Grinnell College; Mary Parker, Austin Community College; and Jeffrey A. Wirmer, Oberlin College

2:15 - 6:00 **AMS - MAA - NAM Program A:** *Mathematics: A catalyst for education progress in the year 2000 and beyond — Filling the education pipeline.* Sponsored by the Committee on Minority Participation in Mathematics (Manuel P. Berriozabal and Sylvia T. Bozeman, co - chairs) and the AAAS - AMS - MAA Committee on Opportunities in Mathematics for Underrepresented Minorities (Gloria F. Glimer, chair)

3:20 - 4:10 **MAA Invited Address:** *A special curriculum for exceptional students and integration in finite terms,* Robert D. Richtmyer, University of Colorado

4:30 - 6:30 **Section Officers' Meeting**

4:30 - 6:30 **Minicourse 7A:** *Project CALC: Calculus as a laboratory course,* organized by Lawrence C. Moore and David A Smith, Duke University

4:30 - 6:30 **Minicourse 8A:** *Environmental models,* organized by Roland H. Lamberson, Humboldt State University

6:00 - 7:00 **First Time Attendees Social**

Thursday, 13 January 1993

MORNING

8:00 - 9:20 ***Panel Discussion:*** *Mathematical life outside academia: common problems, goals and solutions,* sponsored by the Committee on Mathematicians Outside Academia (Patrick D. McCray, chair) The moderator will be Nathaniel Dean, Bell Communications Research.

8:00 - 9:50 **SUMMA Workshop:** *Intervention Projects for Minority Pre-college Students* Organized by William A. Hawkins, SUMMA director

8:00 - 10:55 **AMS - MAA Special Session:** *Mathematics and Education Reform,* Naomi D. Fisher, Harvey B. Keynes, and Philip D. Wagreich, Mathematicians and Education Reform Network (MER)

8:00 - 10:55 **AMS Special Session:** *History of mathematics,* Thomas Archibald, Acadia University, and Victor J. Katz, University of the District of Columbia

8:00 - 10:55 **AMS - MAA Special Session:** *Environmental Modeling,* William J. Coles, University of Utah and B.A. Fusaro, Salisbury State University

8:00 - 10:55 **AMS - MAA**

8:00 - 10:55 **Contributed Paper Session:** *Assessment programs for the undergraduate major,* Charles F. Peltier, Saint Mary's College, and James W. Stepp, University of Houston

8:00 - 10:55 **Contributed Paper Session:** *Interactive learning environments,* Katherine Pedersen, NSF Statewide Systemic Initiative, South Dakota and Sandra Z. Keith, St. Cloud State University

8:00 - 10:00 **Minicourse 1B:** *Alternatives to the lecture method in collegiate mathematics,* organized by Julian Weissglass, MSEB

8:00 - 10:00 **Minicourse 9A:** *Earth Algebra: College algebra with applications to environmental issues,* organized by Christopher Schaufele and Nancy Zumoff, Kennesaw State College

9:00 - 9:50 **AWM Noether lecture**

10:05 - 10:55 **MAA Invited Address:** *Processing our image of minorities in mathematics.* Sylvia T. Bozeman, Spelman College

11:10 - 12:00 **AMS - MAA Invited address:** *Ramanujan, the lost notebook and I,* George E. Andrews, Pennsylvania State University

AFTERNOON

12:00 - 2:00 **Career Fair**

2:15 - 4:05 **AMS - MAA Special Session:** *Environmental Modeling,* William J. Coles, University of Utah and B.A. Fusaro, Salisbury State University

2:15 - 4:10 **Panel Discussion:** *Progress in mathematics education using computer graphics,* sponsored by the Committee on Computers in Mathematics Education (Gene Herman, chair) and organized by Steven Tanimoto, University of Washington

2:15 - 4:10 **Panel Discussion:** *Assessment: its role in mathematics reform,* sponsored by the Committee on Testing (John G. Harvey, chair) Panelists will be: Wade Curry, Clemson University; Mary M. Lindquist, President of the National Council of Teachers; and Thomas A. Romberg, Director of the National Center for Research in Mathematics

2:15 - 4:10 **AMS Special Session:** *History of Mathematics,* Thomas Archibald, Acadia University, and Victor J. Katz, University of the District of Columbia

2:15 - 4:10 **Contributed Paper Session:** *Empowering the mathematical community,* Gloria F. Gilmer, MathTech, Inc.; Marilyn Frankenstein, University of Massachusetts, Boston; Patricia C. Kenschaft, Montclair State College; and Alvin M White, Harvey Mudd College

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2:15 - 4:10 **Contributed Paper Session:** *Mathematics and the arts,* JoAnne S. Growney, Bloomsburg University

2:15 - 4:10 **Contributed Paper Session:** *Using data and computers in teaching statistics,* Mary Parker, Austin Community College and George Cobb, Mount Holyoke College

2:15 - 4:15 **Minicourse 2B:** *How to make effective use of inexpensive pocket computers to develop the concepts and techniques of calculus,* organized by Franklin Demana and Bert K. Waits, Ohio State University

2:15 - 4:15 **Minicourse 3B:** *All right! I've got a graphing calculator. What happens next?* organized by Iris Brann Fetta, Clemson University

2:15 - 4:15 **Minicourse 4B:** *Unifying themes in discrete mathematics,* organized by Ralph Grimaldi, Rose-Hulman Institute of Technology

2:15 - 4:15 **Minicourse 9B:** *Earth Algebra: College algebra with applications to environmental issues,* organized by Christopher Schaufele and Nancy Zumoff, Kennesaw State College

2:15 - 4:10 **AMS - MAA - NAM Program B:** *Mathematics: A catalyst for education progress in the year 2000 and beyond — Filling the education pipeline.* Sponsored by the Committee on Minority Participation in Mathematics (Manuel P. Berriozabal and Sylvia T. Bozeman, co-chairs) and the AAAS - AMS - MAA Committee in Opportunities in Mathematics for Underrepresented Minorities (Gloria F. Gilmer, chair)

4:25 - 4:55 **MAA Business Meeting**

5:00 - 5:30 **AMS Business Meeting**

5:30 - 7:00 **Two - Year College Reception**

6:00 - 8:00 **Minicourse 5B:** *Bringing calculus to life,* organized by Bob Decker, University of Hartford

6:00 - 8:00 **Minicourse 6B:** *Teaching the introductory statistics course,* organized by Donald L. Bently, Pomona College; Robin Lock, St. Lawrence University; Thomas L. Moore, Grinnell College; Mary Parker, Austin Community College; and Jeffrey A. Wirmer, Oberlin College

6:00 - 8:00 **Minicourse 7B** *Project CALC: Calculus as a laboratory course,* organized by Lawrence C. Moore and David A Smith, Duke University

6:00 - 8:00 **Minicourse 8B:** *Environmental models,* organized by Roland H. Lamberson, Humbolt State University

7:00 - 8:30 **CAS Reunion:** Organized by Donald B. Small, United States Military Academy

7:30 - 10:00 **Contributed Paper Session:** *Linear algebra,* Donald R. LaTorre, Clemson University; Steven J. Leon, University of Massachusetts, Dartmouth; and A. Duane Porter, University of Wyoming

7:30 - 9:30 **Testing User Group:** preliminary meeting organized by John G. Harvey, University of Wisconsin

Friday, 15 January 1993

MORNING

7:00 - 8:00 **Breakfast for Pi Nu Epsilon and MAA Student Chapter Advisors and Section Coordinators:** Sponsored by the Committee on Student Chapters

8:00 - 9:20 **Panel Discussion:** Sponsored by the MAA Science Policy Committee (T. Christine Stevens, Chair and Panel Moderator)

8:00 - 10:55 **AMS - MAA Poster Session:** *Calculus reform,* cosponsored by the Calculus Reform Study Group and CRAFTY, the CUPM subcommittee on Calculus Reform and the First Two Years, and organized by James F. Hurley, University of Connecticut and Paul Zorn, St. Olaf College

8:00 - 10:55 **AMS - MAA Special Session:** *The state of research in undergraduate mathematics education: problems and prospects,* sponsored by the MAA Committee on Research in Undergraduate Mathematics Education and organized by Ed Dubinsky, Purdue University

8:00 - 10:55 **Contributed Paper Session:** *Recreational mathemagical computing,* Dr. Michael W. Ecker, Recreational & Educational Computing, Pennsylvania State University

8:00 - 10:55 **Contributed Paper Session:** *"Capstone" courses for senior mathematics majors,* Pam Crawford and Christopher E. Barat, Randolph - Macon College

8:00 - 10:55 **Contributed Paper Session:** *Teaching mathematics to multicultural and multilingual students,* Richard O'Lander, St. John's University, New York

8:00 - 10:55 **Contributed Paper Session:** *Use of visualization in the teaching of mathematics,* Howard Lewis Penn, United States Naval Academy and James R. King, University of Washington

8:00 - 10:00 **Minicourse 10A:** *Why, When and How to use CAS calculators in calculus and differential equations instruction,* organized by John Kenelly and Gil Proctor, Clemson University

8:00 - 10:00 **Minicourse 11A:** *Using group projects in calculus,* organized by Stephen Hilbert, John Maceli, Eric Robinson, Diane Schwartz and Stanley Seltzer, Ithaca College

8:00 - 10:00 **Minicourse 12A:** *Bringing calculus to life,* organized by Bob Decker, University of Hartford

8:00 - !0:00 **Minicourse 13A:** *Teaching mathematical modeling,* organized by J. S. Hartzler, Pennsylvania State University, Harrisburg

9:30 - 10:55 **Panel Discussion:** *Precalculus reform,* organized by Ben Fusaro, Salisbury State University

9:30 - 10:55 **Panel Discussion:** *Tilting at windmills — Quantitative literacy for college students,* sponsored by CUPM subcommittee on Quantitative Literacy Requirements (Linda R. Sons, chair)

11:10 - 12:00 **AMS - MAA Invited Address:** *Sign-solvable linear systems and their matrices.* Richard A. Brualdi, University of Wisconsin

AFTERNOON

1:00 - 3:00 **Informal Discussion:** *Calculus reform today,* sponsored by the Calculus Reform Study Group (Marcelle Besseman, chair)

1:00 - 4:00 **AMS - MAA Special Session:** *The state of research in undergraduate mathematics education: problems and prospects,* sponsored by the MAA Committee on Research in Undergraduate Mathematics Education and organized by Ed Dubinsky, Purdue University

1:00 - 4:10 **Contributed Paper Session:** *Linear algebra,* Donald R. LaTorre, Clemson University; Steven J. Leon, University of Massachusetts, Dartmouth and A. Duane Porter, University of Wyoming

1:00 - 4:10 **Contributed Paper Session:** *Teaching mathematics to multicultural and multilingual students,* Richard O'Lander, St. John's University, New York

1:00 - 3:00 **Student Workshop A:** Sponsored by the Committee on Student Chapters (Howard Anton, chair)

2:00 - 4:00 **Minicourse 14A:** *Linear Algebra, applications and computing,* organized by Gareth Williams, Stetson University

2:00 - 4:00 **Minicourse 15A:** *The Harvard calculus reform project: hands-on experience with the project materials.* organized by Sheldon P. Gordon, Suffolk Community College; Deborah Highes Hallett, Harvard University, William McCallum, University of Arizona; and Thomnas Tucker, Colgate University

2:15 - 3:05 **Monthly Centennial Celebration Session I:** Opening remarks: Deborah Tepper Haimo, MAA President, University of Missouri at St. Louis; *The birth of the MONTHLY,* Robert A. Rosembaum, Wesleyan University; *Do mathematicians read the MONTHLY? Then and now.* Paul R. Halmos, Santa Clara University

3:20 - 4:10 **Monthly Centennial Celebration Sesison II:** *The MONTHLY problem section,* Murray S. Klamkin, University of Alberta; the PutnamPrize Competition and the *MONTHLY,* Andrew M. Gleason, Harvard University

4:25 - 6:25 **AMS - MAA Joint Prize Session**

7:30 - 9:30 **Monthly Centennial Celebration Banquet:** John H. Ewing, Richard K. Guy, Raoul Hailpern, Doris Schattschneider, Herbert S. Wilf

7:30 - 8:20 **Student Lecture:** *Touring a torus,* by Joseph A. Gallian, University of Minnesota, Duluth. Sponsored by the Committee on Student Chapters (Howard Anton, chair)

7:30 - 9:00 **1992 Micro-inequities Skits:** *The Committee on the Participation of Women* (Particia C. Kenschaft, chair) dramatizes actual events that have happened in the mathematics community, followed by an opportunity for discussion groups.

7:30 - 9:00 **Video Presentations:** *The Alhambra Past and Present — A geometer's odyssey,* two video and a poster display by Lorraine L. Foster, California State University, Northridge

7:30 - 10:00 **Actuarial Faculty Forum:** *Informal session on actuarial education,* organized by the Actuarial Faculty Forum (Jim Daniel, contact person)

Saturday, 16 January 1993

MORNING

8:00 - 10:55 **Contributed Paper Session:** *Mathematics and the arts,* JoAnne S. Grownet, Bloomsburg University

8:00 - 10:55 **Contributed Paper Session:** *Recruitment and retention of women in mathematics revisited,* Marcelle Bessman, Frostberg State Unviersity

8:00 - 10:55 **Student Chapter Session:** Sponsored by the Committee on Student Chapters and organized by Deborah Frantz, Kutztown University; W. Howard Jones, University of the District of Columbia; and Karen Schroeder, Bentley College, Massachusetts

8:00 - 10:00 **Minicourse 16A:** *Instituting a mathematics placement program: Creating order out of chaos in freshman mathematics,* organized by Geoffery Akst, Manhattan Community College / CUNY

8:00 - 10:00 **Minicourse 17A:** *Mathematics in a real and complex world,* organized by Frank Wattenberg, University of Massachusetts

9:00 - 9:50 **Special Presentation:** Patrick W. Thompson, San Diego State University will speak on What students do know, don't know, and could know about functions: Implications for undergraduate mathematics education. Sponsored by the Committee on Research in Undergraduate Mathematics Education (Ed Dubinsky, chair)

9:00 - 10:00 **NAM Panel**

9:00 - 10:55 **Student Workshop B:** Sponsored by the Committee on Student Chapters (Howard Anton, chair)

10:00 - 10:55 **NAM Business Meeting**

10:05 - 10:55 **MONTHLY Centennial Celebration Session III:** *A pearl of algebra from the MONTHLY,* Harley Flanders, University of Michigan; *Ramanujan, the MONTHLY and serendipity,* George E. Andrews, Pennsylvania State University

11:10 - 12:00 **AMS - MAA invited Address:** Mary F. Wheeler, Rice University.

AFTERNOON

1:00 - 2:00 **Poetry Reading:** organized by JoAnne S. Growney, Bloomsburg University, and Alvin White, Harvey Mudd College

1:00 - 5:30 **AMS - MAA Special Session:** *The state of research in undergraduate mathematics education : problems and prospects,* sponsored by the MAA Committee on Research in Undergraduate Mathematics Education and organized by Ed Dubinsky, Purdue University

1:00 - 5:30 **Contributed Paper Session:** *"Capstone" courses for senior mathematics majors,* Pam Crawford and Christopher E. Barat, Randolph-Macon College

1:00 - 5:30 **Contributed Paper Session:** Recreational mathemagical computing, Dr. Michael W. Ecker, Recreational & Education Computing, Pennsylvania State University

1:00 - 5:30 **Contributed Paper Session:** *Recruitment and retention of women in mathematics revisited,* Marcelle Bessman, Frostberg State Unviersity

1:00 - 5:30 **Contributed Paper Session:** *Use of visualization in the teaching of mathematics,* Howard Lewis Penn, United Stated Naval Academy and James R. King, University of Washington

1:00 - 3:00 **Minicourse 10B:** *Why, When and How to use CAS calculators in calculus and differential equations instruction,* organized by John Kenelly and Gil Proctor, Clemson University

1:00 - 3:00 **Minicourse 11B:** *Using group projects in calculus,* organized by Stephen Hilbert, John Maceli, Eric Robinson, Diane Schwartz and Stanley Seltzer, Ithaca College

1:00 - 3:00 **Minicourse 12B:** *Bringing calculus to life,* organized by Bob Decker, University of Hartford

1:00 - 3:00 **Minicourse 13B:** *Teaching mathematical modeling,* organized by J. S. Hartzler, Pennsylvania State University, Harrisburg

2:15 - 3:45 **Panel Discussion:** *Sponsored by the Committee on Symbolic Computer Systems* (Zaven Karian, chair) and organized by Warren Page, New York Technical College — CUNY

3:15 - 5:15 **Minicourse 14B:** *Linear algebra, applications and computing,* organized by Gareth Williams, Stetson Univeristy

3:15 - 5:15 **Minicourse 15B:** *The Harvard calculus reform project: Hands - on expereince with project materials,* organized by Sheldon P. Gordon, Suffolk Community College,; Deborah Huighes Hallett, Harvard University; William McCallkum, University of Arizona; and Thaomas Tucker, Colgate University

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The Scientific Program

The January 1993 Joint Mathematics Meetings, including the 76th Annual Meeting of the Mathematical Association of America, the 99th Annual Meeting of the AMS, the 1992-1993 winter meeting of the Association for Symbolic Logic, and the 1993 annual meetings of the Association for Women in Mathematics and the National Association for Mathematicians, will be held January 13–16 (Wednesday–Saturday), 1993, in San Antonio, Texas. Sessions will be held in the San Antonio Convention Center and the Marriott Riverwalk.

AMS-MAA Invited Addresses

By invitation of the AMS-MAA Joint Program Committee four speakers will address the AMS and MAA on the history or development of mathematics. The names of the speakers, their affiliations, the titles, dates, and times of their talks follow:

George E. Andrews, Pennsylvania State University, *Ramanujan, the lost notebook and I*, 11:10 a.m. Thursday;

Richard A. Brualdi, University of Wisconsin, Madison, *Signsolvable linear systems and their matrices*, 11:10 a.m. Friday;

Robert A. Osserman, Mathematical Sciences Research Institute and Stanford University, *The geometry of the universe*, 11:10 a.m. Wednesday;

Mary F. Wheeler, Rice University, *Mathematical modeling of biodegradation of organic contaminants in ground water*, 11:10 a.m. Saturday.

Other AMS –MAA Sessions and Events

Special Sessions: There will be three Special Sessions jointly sponsored by the AMS and MAA. Titles, organizers, and days follow:

Environmental modeling, **William J. Coles**, University of Utah, and **B. A. Fusaro**, Salisbury State University. Thursday, 8:00 a.m. and 2:15 p.m.

The state of research in undergraduate mathematics education: problems and prospects, **Ed Dubinsky**, MAA Committee on Research in Undergraduate Mathematics Education and Purdue University, on Friday at 8:00 a.m. and 1:00 p.m., and Saturday at 1:00 p.m.

Mathematics and education reform, **Naomi Fisher** and **Philip D. Wagreich**, University of Illinois at Chicago; and **Harvey B. Keynes**, University of Minnesota, on Wednesday at 8:00 a.m. and 2:15 p.m., and Thursday at 8:00 a.m. This session is also cosponsored by the Mathematicians and Education Reform (MER) Network. The sessions on Wednesday and Thursday mornings will present a variety of issues and projects in education reform spanning precollege and undergraduate mathematics education. The Thursday afternoon session will feature speakers from the MER workshop on *Changing the culture: Education and the research community* held in March 1992 in Oakland/Berkeley, California.

An AMS Special Session of interest is *History of mathematics*, **Thomas Archibald**, Acadia University and **Victor Katz**, University of the District of Columbia. Wednesday, 2:15 p.m., and Thursday, 8:00 a.m. and 2:15 p.m.

AMS-MAA Panel Discussion: The AMS-MAA Committee on Preparation of College Teaching (Bettye Anne Case, Chair) is sponsoring a panel discussion from 9:30 a.m. to 10:55 a.m. on Wednesday, titled *Best snapshots from doctoral departments*. Through a FIPSE grant, the committee assists programs in eight doctoral departments: University of Cincinnati, Clemson University, Dartmouth College, University of Delaware, Harvard University, Oregon State University, University of Tennessee, and Washington University. This will be a fast-paced presentation which will focus on one outstanding idea or activity at each site, i.e., a best snapshot locally. Handouts will be available for all eight projects.

AMS-MAA Poster Session: From 8:00 a.m. to 10:55 a.m. on Friday there will be a poster session on *Calculus reform*, cosponsored by the AMS, the Calculus Reform Study Group (Marcelle Bessman, Chair) and CRAFTY, the CUPM subcommittee on Calculus Reform and the First Two Years. The organizers are **James F. Hurley**, University of Connecticut, and **Paul Zorn**, St. Olaf College. The session will feature displays of information about and materials from current calculus reform projects of all types. It will bring those interested in working on calculus reform together with project directors who have already gone through the start-up process. Those interested in displaying materials should contact one of the organizers as soon as possible.

Social for First-time Attendees: The AMS Committee on Membership (Frederick W. Gehring, Chair) and the MAA Committee on Membership, (Shirley Huffman, Chair) are again cosponsoring a social hour on Wednesday from 6:00 p.m. to 7:00 p.m. If this is your first national meeting you are especially encouraged to come and meet some old-timers and pick up a few tips on how to survive the environment of a large meeting. Refreshments will be served.

Joint Prize Session and Reception: In order to showcase the achievements of the recipients of various prizes, AMS and MAA are cosponsoring this session at 4:25 p.m. on Friday. A cash bar reception will immediately follow. All participants are invited to attend.

Other Joint Sessions

AMS-MAA-NAM Sessions: This program titled *Mathematics: A catalyst for educational progress in the year 2000 and beyond –filling the educational pipeline* is sponsored by the AAAS-AMS-MAA Committee on Opportunities in Mathematics for Underrepresented Minorities (Gloria F. Gilmer, Chair) and the MAA Committee on Minority Participation (Manuel P. Berriozábal and Sylvia T. Bozeman, Co-chairs). Program A is from 2:15 p.m. to 6:00 p.m. on Wednesday and will feature *Precollege access programs in Texas* by Manuel Berriozábal of the University of Texas at San Antonio and General Marshall of Huston-Tillotson College; *Women in mathematics* by Etta Falconer of Spelman College, Mary Gray of American University, and Rhonda Hughes of Bryn Mawr College; *Minorities in mathematics* by Evelyn Boyd Granville of the University of Texas at Tyler, and Robert Megginson of the University of Michigan. Program B is from 2:15 p.m. to 4:10 p.m. on Thursday and will feature a continuation of *Minorities in mathematics* by Luis Ortiz-Franco of Chapman University, and *Undergraduate research in mathematics* by Richard Aló of the University of Houston, Downtown, Abdulalim Shabazz of Clark Atlanta University, and Richard Tapia of Rice University.

76th Annual Meeting of the MAA January 13–16, 1993

Invited Addresses: By invitation of the Program Committee there will be three invited fifty-minute addresses. The names of the speakers, their affiliations, the dates, times, and titles follow:

Peter B. Borwein, Dalhousie University, *I am ashamed to tell you to how many figures I carried these computations, having no other business at the time*, Wednesday, 2:15 p.m.;

Sylvia T. Bozeman, Spelman College, *Processing our image of minorities in mathematics*, Thursday, 10:05 a.m.;

Robert D. Richtmyer, University of Colorado, Boulder, *A special curriculum for exceptional students and integration in finite terms*, Wednesday, 3:20 p.m.

***Monthly* Centennial Celebration:** Several special events are scheduled to celebrate the fact that 1993 is the 100th year of the publication of the *American Mathematical Monthly*.

Three celebration sessions are scheduled, two on Friday afternoon and one on Saturday morning. **Deborah Tepper Haimo**, University of Missouri at St. Louis and President of the MAA, will make some opening remarks at the first session. Then, **Robert A. Rosenbaum**, Wesleyan University and Past Editor of the Monthly, will speak on *The birth of the Monthly*. **Paul R. Halmos**, Santa Clara University and Past Editor of the *Monthly*, will discuss the question, *Do mathematicians read the Monthly? –Then and now*. At the second session, Murray S. Klamkin, University of Alberta, will report on *The Monthly problem section*, and **Andrew M. Gleason**, Harvard University, will speak on *The Putnam Prize Competition and the Monthly*. The Saturday session consists of the following two talks: *A pearl of algebra from the Monthly*, by **Harley Flanders**, University of Michigan, Ann Arbor; and *Ramanujan, the Monthly, and serendipity*, by **George E. Andrews**, Pennsylvania State University.

There will also be a *Monthly* Centennial Celebration Banquet on Friday evening. Please see the Social Events section for details.

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

Minicourse #1: *Alternatives to the lecture method in collegiate mathematics*, ***Julian Weissglass***, Mathematical Sciences Education Board. Part A is scheduled from 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B from 8:00 a.m. to 10:00 a.m. on Thursday. Enrollment is limited to 40.

This course will provide participants with information about using alternatives to the lecture method –particularly small group discussion

methods. The goal is to enable teachers to get their students actively involved in doing, discussing and writing about mathematics. Participants will engage in small group learning activity, see video clips, discuss the issues involved and learn about the research literature. Attention will be paid to organizational issues, assessment, and students' reactions.

Minicourse #2: *How to make effective use of inexpensive pocket computers to develop the concepts and techniques of calculus*, ***Franklin Demana*** and ***Bert K. Waits***, Ohio State University. Part A is scheduled from 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B from 2:15 p.m. to 4:15 p.m. on Thursday. Enrollment is limited to 40.

Inexpensive ($100 or less) pocket computers are dramatically changing the way we teach (and students learn) calculus. Participants will use the latest "state of the art" Texas Instruments pocket computers – powerful tools that permit the user to make and test generalizations by looking at a large number of examples quickly, make solving graphically and numerically a realistic and powerful problem solving technique, and make non-contrived examples routine for all students. Topics include limits, continuity, differentiation, integration, optimization, sequences, series, vectors, matrices, and motion simulation.

Minicourse #3: *All right! I've got a graphing calculator. What happens next?*, ***Iris B. Fetta***, Clemson University. Part A is scheduled from 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B from 2:15 p.m. to 4:15 p.m. on Thursday. Enrollment is limited to 80.

What is needed before, during and after graphing calculators are in your classroom? The proper use of graphing calculators, students' attitudes, selection of textbooks, available calculator models and the change in instructional process due to the power of the technology will be discussed. Calculator-enhanced activities for algebra, precalculus, business calculus and introductory statistics will be distributed. Those attending will receive tips for and design calculator-active test questions. Participants should bring a graphing calculator and be familiar with its basic operating procedure.

Minicourse #4: *Unifying themes in discrete mathematics*, ***Ralph Grimaldi***, Rose-Hulman Institute of Technology. Part A is scheduled from 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B from 2:15 p.m. to 4:15 p.m. on Thursday. 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 #5: *Using supercalculators to enhance instruction and learning in linear algebra*, ***Donald R. LaTorre***, Clemson University. Part A is scheduled from 2:15 p.m. to 4:15 p.m. on Wednesday, and Part B from 6:00 p.m. to 8:00 p.m. on Thursday. Enrollment is limited to 30.

This minicourse will be a hands-on exploration of the appropriate pedagogical use of the HP-48SX supercalculator to enhance instruction and learning in introductory linear algebra. Participants will use customized calculator software to investigate each of the following major themes: elimination methods for solving linear systems, associated factorizations; vector space theory associated with matrices; orthogonality concepts, including QR-factorizations with applications to least squares solutions; eigenvalue-eigenvector considerations; and interative techniques. An HP-48SX calculator will be loaned to each participant.

Minicourse #6: *Teaching the introductory statistics course*, ***Donald L. Bently***, Pomona College; ***Robin Lock***, St. Lawrence University; ***Thomas L. Moore***, Grinnell College; ***Mary Parker***, Austin Community College; and ***Jeffrey A. Witmer***, Oberlin College. Part A is scheduled from 2:15 p.m to 4:15 p.m. on Wednesday, and Part B from 6:00 p.m. to 8:00 p.m. on Thursday. Enrollment is limited to 80.

The trend in statistics courses is toward courses in which students are actively involved in statistical thinking, application of statistical concepts, and developing an appreciation for data. This minicourse will illustrate ways of doing this in lectures, laboratory sessions, and student projects. Participants will be engaged in the ways recommended for engaging students. Each participant will be provided with handouts describing examples that can be used back home.

Minicourse #7: *Project CALC: Calculus as a laboratory course*, ***Lawrence C. Moore*** and ***David A. Smith***, Duke University. Part A is scheduled from 4:30 p.m. to 6:30 p.m. on Wednesday, and Part B from 6:00 p.m. to 8:00 p.m. on Thursday. Enrollment is limited to 80.

Project CALC is a reformed calculus course developed at Duke University with support from the National Science Foundation. The course emphasizes real-world problems, an interactive computer lab, writing about mathematics, and cooperative learning. We will present an overview of the philosophy and structure of the course, a simulation of the laboratory experience, examples illustrating the role of writing in the course and the grading of that writing, and a discussion of the implementation of a reformed calculus course.

Minicourse #8: *Environmental models*, ***Roland H. Lamberson***, Humboldt State University. Part A is scheduled from 4:30 p.m. to 6:30 p.m. on Wednesday, and Part B from 6:00 p.m. to 8:00 p.m. on Thursday. Enrollment is limited to 80.

This minicourse will survey the use of simple mathematical models in analyzing environmental policy and management issues. The object is to introduce the subject in such a way as to 1) give the participants insight into how environmental modeling is carried out, 2) open up the literature to them for further study, and 3) provide them with ideas for incorporating modeling into undergraduate courses. Topics include: viability models for endangered species, models for environmmental regulation and resource management, and decision-making models in conservation biology.

Minicourse #9: *Earth algebra: College algebra with applications to environmental issues*, ***Christopher Schaufele*** and ***Nancy Zumoff***, Kennesaw State College. Part A is scheduled from 8:00 a.m. to 10:00 a.m. on Thursday, and Part B from 2:15 p.m. to 4:15 p.m., also on Thursday. Enrollment is limited to 80.

This minicourse is a presentation of the content and methodology of a freshman mathematics course developed by the presenters. *Earth Algebra* uses elementary equations to build models which can be used to study environmental problems. The course is focused on greenhouse gas emission and global warming; brief modules are being developed which can be used independently. The minicourse provides an overview, and participants will work through two of the modules. Graphing calculators are required.

Minicourse #10: *Why, when and how to use CAS calculators in calculus and differential equations instruction*, ***John Kenelly*** and ***Gil Proctor***, Clemson University. Part A is scheduled from 8:00 a.m. to 10:00 a.m. on Friday, and Part B from 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment is limited to 30.

The minicourse will be a hands-on consideration of why the power of CAS calculators is needed in undergraduate mathematics and how their portability gives special advantages in both day-to-day classes and testing. The participants will work specific examples showing when and how to use calculators to enhance instruction in calculus and differential equations.

Part A will concentrate on calculus with an emphasis on differentiation and integration concepts, arc length, power series and selected topics. Part B will focus on differential equations with an emphasis on (1) using graphs to illustrate concepts such as the dependence of the solutions of differential equations on initial conditions, stability, and parameter values, and (2) using computational tools to determine eigenvalues, associated eigenvectors and approximate values of definite integrals.

Minicourse #11: *Using group projects in calculus*, ***Stephen Hilbert, John Maceli, Eric Robinson, Diane Schwartz*** and ***Stanley Seltzer***, Ithaca College. Part A is scheduled from 8:00 a.m. to 10:00 a.m. on Friday, and Part B from 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment is limited to 80.

Many have recommended using projects and/or cooperative learning in calculus courses. The organizers have been teaching calculus using group projects since Spring 1989. Open-ended projects challenge students to develop problem-solving skills beyond looking for a similar problem solved in the text or class notes. This minicourse will address issues relating to the use of group projects in calculus, including an overview, examples of projects, hands-on experience working in a group on a project, and the impact on the curriculum.

Minicourse #12: *Bringing calculus to life*, ***Robert Decker***, University of Hartford. Part A is scheduled from 8:00 a.m. to 10:00 a.m. on Friday, and Part B from 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment is limited to 80.

The minicourse will focus on the use of graphing calculators in solving problems using real data, some of which is collected from experiments performed in class. The calculus lab manual *Bringing Calculus to Life*, published by Prentice Hall and written by the presenters, provides the projects which will be addressed. The projects are geared toward a standard Calculus I and II sequence. The Casio FX7700G will be used in the workshop, but any graphing calculator can be used

with the manual. Participants are strongly encouraged to bring their own calculator to the workshop in order to gain the greatest benefit; some experience with a graphing calculator would enhance the experience. Loaners will be provided for those who cannot bring their own.

Minicourse #13: *Teaching mathematical modeling*, ***J. S. Hartzler***, Pennsylvania State University, Harrisburg. Part A is scheduled from 8:00 a.m. to 10:00 a.m. on Friday, and Part B from 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment is limited to 80.

This minicourse will deal with the development and implementation of a mathematical modeling capstone course for mathematics majors. Following a discussion of course philosophy, format, and logistics, considerable emphasis will be placed on selection of appropriate modeling projects for students. Projects used successfully in Dr. Hartzler's course will be distributed and discussed. A knowledge of calculus, differential equations, applied statistics and linear algebra will be assumed.

Minicourse #14: *Linear algebra, applications and computing*, ***Gareth Williams***, Stetson University. Part A is scheduled from 2:00 p.m. to 4:00 p.m. on Friday, and Part B from 3:15 p.m. to 5:15 p.m. on Saturday. Enrollment is limited to 40.

A workshop on an introductory linear algebra course that meets the needs of students from many disciplines. Important computational ideas will be discussed. Applications will include models of population movement, seriation in archaeology, weather prediction, and space-time. The software packages, demonstrated on a Macintosh, will include *Linear Algebra Computer Companion, MATLAB,* and *Stella.* IBM and Macintosh versions of *Linear Algebra Computer Companion* will be distributed to participants. No previous computing experience necessary.

Minicourse #15: *The Harvard calculus reform project: Hands-on experience with the project materials*, ***Sheldon P. Gordon***, Suffolk Community College; ***Deborah Hughes Hallett***, Harvard University; ***William McCallum***, University of Arizona; and ***Thomas W. Tucker***, Colgate University. Part A is scheduled from 2:00 p.m. to 4:00 p.m. on Friday, and Part B from 3:15 p.m. to 5:15 p.m. on Saturday. Enrollment is limited to 40.

This minicourse will familiarize the participants with the philosophy and the materials being developed under the Harvard Calculus Reform Project. It will describe the philosophy behind the project and its implementation at a variety of institutions. The project is based on the *Rule of Three* in which most topics are presented geometrically, numerically and symbolically to enhance student understanding of the concepts of calculus. Participants will be provided sample materials to examine, try out and take home to incorporate into their own classes.

Minicourse #16: *Instituting a mathematics placement program: Creating order out of chaos in freshman mathematics*, ***Geoffrey Akst***, Manhattan Community College/CUNY. Part A is scheduled from 8:00 a.m. to 10:00 a.m on Saturday, and Part B from 3:15 p.m. to 5:15 p.m., also on Saturday. Enrollement is limited to 80.

Members of the MAA Committee on Testing will use lectures, worksheets, and question and answer sessions to present an overview of the task of establishing a mathematics placement program. Topics covered will include: reasonable expectations of a placement program, tests available through the MAA Placement Test Program (PTP), selection or creation of a placement test or series of tests, statistical analysis of test items and tests, methods of establishing a cutoff score, and administration of a placement program.

Minicourse #17: *Mathematics in a real and complex world*, ***Frank Wattenberg***, University of Massachusetts, Amherst. Part A is scheduled from 8:00 a.m. to 10:00 a.m. on Saturday, and Part B from 3:15 p.m. to 5:15 p.m., also on Saturday. Enrollment is limited to 80.

This minicourse describes courses aimed at giving science, non-science, math, nonmath, and engineering majors the ability to exploit the power of mathematical reasoning and computers to investigate real and engaging problems. Such problems are typically more complex than the artificial problems found in most mathematics books, and for this reason have been difficult to study within the limited time devoted to mathematics in the undergraduate curriculum. We have developed several courses that teach mathematics in this context. Our first course, aimed at nonscience, nonmath majors was developed as part of the Sloan Foundation New Liberal Arts Program, and we are developing other courses as part of the NSF calculus reform effort. A second year course intended to replace Calculus III, Linear Algebra, and ODEs is also currently under development. We will discuss some of the applications we use in these courses. Although we use computers, these courses can be taught successfully with a range of different hardware/software – ranging from high-end personal computers through more modest machines, even graphics calculators.

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 November 13 deadline. ***Do not send this form to Providence***. Please note that these MAA Minicourses are ***not*** the AMS Short Course. To check on availibility for onsite registration 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 registration fee for each of the MAA Minicourses #1, 2, 5, 10, 14 & 15 is $45. All other MAA Minicourses are $36 each.

The MAA Minicourses are open only to persons who register for the Joint Meetings and pay the Joint Meetings registration fee. ***If the only reason for registering for the Joint Meetings 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 Joint Meetings preregistration fee. Otherwise, the Joint Meetings 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 Joint Meetings preregistration, since if no instruction is given, the Joint Meetings registration will also be cancelled. Preregistration forms for the Joint Meetings should be mailed to Providence ***prior to the deadline of November 13***.

Contributed Papers: Contributed papers have been accepted on twelve topics. The topics, organizers, their affiliations, and the probable days they will meet are:

- *Assessment programs for the undergraduate major*, ***Charles F. Peltier***, Saint Mary's College and ***James W. Stepp***, University of Houston, Wednesday and Thursday mornings.
- *"Capstone" courses for senior mathematics majors*, ***Christopher E. Barat*** and ***Pamela Crawford***, Randolph-Macon College, Friday morning and Saturday afternoon.
- *Empowering the mathematical community*, ***Gloria F. Gilmer***, MathTech, Inc.; ***Marilyn Frankenstein***, University of Massachusetts, Boston; ***Patricia C. Kenschaft***, Montclair State College; and ***Alvin M. White***, Harvey Mudd College, Wednesday morning and Thursday afternoon.
- *Impact of non-traditional instructional methods on testing and evaluation*, ***Linda H. Boyd***, DeKalb College and ***Elizabeth Teles***, Montgomery College, Maryland, Wednesday and Thursday afternoons.
- *Interactive learning environments*, ***Katherine Pedersen***, NSF Statewide Systemic Initiative, and ***Sandra Z. Keith***, St. Cloud State University, Wednesday and Thursday mornings.
- *Linear algebra*, ***Donald R. LaTorre***, Clemson University; ***Steven J. Leon***, University of Massachusetts, Dartmouth; and ***A. Duane Porter*** (for the LACSG), University of Wyoming, Wednesday and Friday afternoons, and Thursday evening.
- *Mathematics and the arts*, Thursday afternoon and Saturday morning, ***JoAnne S. Growney***, Bloomsburg University.
- *Recreational mathemagical computing*, ***Michael W. Ecker***, Pennsylvania State University, Wilkes-Barre, and Editor/Publisher, Recreational & Educational Computing, Friday morning and Saturday afternoon.
- *Recruitment and retention of women in mathematics revisited*, ***Marcelle Bessman***, Frostburg State University, Saturday morning and afternoon.
- *Teaching mathematics to multicultural and multilingual students*, ***Richard O'Lander***, St. John's University, St. Vincent's College, Friday morning and afternoon.
- *Use of visualization in the teaching of mathematics*, ***Howard Lewis Penn***, United States Naval Academy and ***James R. King***, University of Washington, Friday morning and Saturday afternoon.
- *Using data and computers in teaching statistics*, ***Mary Parker***, Austin Community College and ***George Cobb***, Mount Holyoke College, Wednesday morning and Thursday afternoon.

Presentations are normally limited to ten minutes, although selected contributors may be given up to twenty minutes. The deadline for submitting papers was ***September 10***. Details were published in the June issue of *Focus* and the May/June, July/August and September issues of the *Notices*.

Rooms where sessions of contributed papers will be held are equipped with an overhead projector and screen. Blackboards are ***not*** available. Persons having other equipment needs should contact the MAA Associate Secretary (Kenneth A. Ross, Department of Mathematics, University of Oregon, Eugene, OR 97403-1222; electronic mail: ross@math.uoregon.edu) as soon as possible, but in any case ***prior to***

November 9. Upon request, the following can be made available: one additional overhead projector/screen, 35mm carousel slide projector, or $1/2''$ or $3/4''$ VHS video cassette recorder with one color monitor.

Organizers are cautioned that requests for equipment made at the meeting may not be able to be satisfied because of budgetary restrictions.

Other MAA Sessions

Calculus Reform and the AP Calculus Exam: This panel discussion, scheduled from 9:30 a.m. to 10:55 a.m. on Wednesday, is co-sponsored by the Calculus Reform Study Group and CRAFTY, the CUPM subcommittee on Calculus Reform and the First Two Years. The organizers are ***Howard Lewis Penn***, United States Naval Academy, and ***George M. Rosenstein, Jr.***, Franklin & Marshall College. The moderator will be ***Howard Lewis Penn*** and panelists will include ***Kevin Bartkovich***, North Carolina School of Science and Mathematics; ***Daniel Kennedy***, Baylor School in Tennessee and Chair of the Test Development Committee for the AP Calculus Exam; ***Bernard L. Madison***, University of Arkansas and member of the Development Committee; ***J. Jerry Uhl, Jr.***, University of Illinois and a Director of the Calculus Reform Project, *Calculus and Mathematica*.

Mathematical Life Outside Academia: Common problems, goals and solutions: This panel discussion is scheduled from 8:00 a.m. to 9:20 a.m. on Thursday, and is sponsored by the Committee on Mathematicians Outside Academia (Patrick D. McCray, Chair). The moderator is ***Nathaniel Dean***, Bell Communications Research. The committee sees its mission as promoting the goals of the MAA among non-academic mathematicians, promoting the welfare and understanding of non-academic mathematicians among the MAA membership as a whole, and encouraging the development of MAA activities which are of special mutual interest to both academic and non-academic members. This panel picks up and develops the theme presented by the panel last January in Baltimore on mathematical life outside academia (subtitled *Input from the real world*). The focus will be on situations mathematicians outside academia face and ways in which these situations can be addressed. Items for discussion will include: maintaining mathematical currency and familiarity with other sciences; attracting students and countering student apathy; educating students, parents and society; and the need for curricular change.

SUMMA Workshop: *Intervention projects for minority pre-college students*, ***Harvey Keynes***, University of Minnesota, Minneapolis; ***Rodolfo Tamez***, California State University at Los Angeles; and ***Irvin Vance***, Michigan State University. This workshop is scheduled from 8:00 a.m. to 9:50 a.m. on Thursday and will be directed by ***William A. Hawkins***, Director of SUMMA (Strengthening Underrepresented Minority Mathematics Achievement).

Progress in Mathematics Education using Computer Graphics: Organized by ***Steven Tanimoto***, University of Washington, this panel discussion will take place 2:15 p.m. to 4:10 p.m. on Thursday. The Committee on Computers in Mathematics Education (Gene Herman, Chair) is sponsoring this event. This panel will present some of the current approaches of using computer graphics in mathematics education. Computer graphics help make abstract concepts concrete and accessible, and help motivate students to learn mathematics. Objectives of the panel are to stimulate interest in new methods of teaching and learning mathematics through graphics and to foster a dialogue within the community about exciting new instructional approaches and their evaluation.

Assessment – its role in mathematics reform: A panel discussion from 2:15 p.m. to 4:10 p.m. on Thursday, sponsored by the Committee on Testing (John G. Harvey, Chair). ***John Harvey***, University of Wisconsin, Madison, is the moderator and the panelists are ***Wade Curry***, Director of the Advanced Placement Program, College Board; ***John W. Kenelly***, Clemson University; ***Mary M. Lindquist***, President of the National Council of Teachers of Mathematics; and ***Thomas A. Romberg***, Director of the National Center for Research in Mathematics. This panel will discuss the ways in which assessment at all levels influences and is influenced by current mathematics curriculum reform efforts. The panel members have experience in designing and administering assessment programs across the entire spectrum of mathematics assessment at both the school and college levels.

CAS Reunion: This has been organized by ***Donald B. Small***, United Sates Military Academy, and is scheduled from 7:00 p.m. to 8:30 p.m. on Thursday.

Testing User Group: This is a preliminary meeting from 7:30 p.m. to 9:30 p.m. on Thursday, organized by ***John G. Harvey***, to discuss the creation of a user group consisting of the members of the COT (Committee on Testing) Prognostic Testing Network, the subscribers of the Placement Testing Program, and the participants in the COT minicourses on placement testing. All interested persons are encouraged to attend.

MAA Science Policy Session: This panel discussion is sponsored by the MAA Science Policy Committee, ***T. Christine Stevens***, (Chair), St. Louis University, and is scheduled from 8:00 a.m. to 9:20 a.m. on Friday. The Committee Chair will act as moderator.

Precalculus Reform: This is a panel discussion from 9:30 a.m. to 10:55 a.m. on Friday, organized by ***Ben Fusaro***, Salisbury State University. The moderator is ***William F. Lucas***, Claremont Graduate School. Precalculus reform seems to be at about the same stage that calculus reform was several years ago. Several precalculus projects with different approaches will be discussed.

Tilting at Windmills – Quantitative Literacy for College Students: This panel, sponsored by the CUPM Subcommittee on Quantitative Literacy Requirements, will discuss subcommittee views on the why, what and how of quantitative literacy. It is scheduled from 9:30 a.m. to 10:55 a.m. on Friday. The participants are ***Robert Bernhardt***, East Carolina University; ***Donald Bushaw***, Washington State University; ***Larry Curnutt***, Bellevue Community College; and ***Robert Northcutt***, Southwest Texas State University. The moderator is the Chair of the committee, ***Linda R. Sons***, Northern Illinois University.

Calculus Reform Today: The Calculus Reform Study Group is sponsoring this informal discussion of current issues in calculus reform. The organizer is the Chair of the Study Group, ***Marcelle Bessman***, Frostburg State University. The session is scheduled on Friday from 1:00 p.m. to 3:00 p.m. Particular emphasis will be on the status and transportability of existing programs and on future directions of this reform movement. All persons involved in calculus projects or interested in the calculus reform initiative are encouraged to participate.

1992 Micro-Inequities Skits: At 7:30 p.m. on Friday, the Committee on the Participation of Women is presenting its sixth program of skits about incidents reported by mathematicians that reveal the current relationship between the sexes within our community. Individually many of these are funny in retrospect, but cumulatively they chip away at women's professional strength like drops of water on a rock. The acting is by mathematicians. There will be a brief opportunity for response between the skits. Formal discussion groups, led by pecially prepared mathematicians, will follow the set of skits. Suggestions for skit material and volunteers for acting are welcomed by the CPW Chair, Patricia Clark Kenschaft.

The Alhambra Past and Present – A Geometer's Odyssey: A presentation by ***Lorraine L. Foster***, California State University, Northridge, on Friday evening from 7:30 p.m. to 9:00 p.m. The first video outlines the remarkable history of The Alhambra and discusses the many geometric motifs found there. The second describes the seven frieze pattern and seventeen wallpaper patterns by presenting brief characterizations and several examples from The Alhambra of the past and present. Both videos include computer animations. Eight large posters composed of computer-drawn color renditions of Alhambra's patterns will be displayed.

Actuarial Faculty Forum Informal Session on Actuarial Education: Prospective and present actuarial educators are invited to this informal meeting on Friday evening, from 7:30 p.m. to 10:00 p.m., to get together for discussions, brief presentations on pre-actuarial and actuarial programs, questions and answers on actuarial education, etc., organized by the Actuarial Faculty Forum. The contact person is ***James W. Daniel***, University of Texas, Austin, (512-471-7168; electronic mail: daniel@math.utexas.edu).

Special Presentation on Research in Undergraduate Education: Patrick W. Thompson, San Diego State University, will speak from 9:00 a.m. to 9:50 a.m. on Saturday on *What students do know, don't know, and could know about functions: Implications for undergraduate mathematics education*. This presentation is sponsored by the Committee on Research in Undergraduate Mathematics Education (Ed Dubinsky, Chair).

Poetry Reading: This reading, scheduled for Saturday from 1:00 p.m. to 2:00 p.m., has been organized by ***JoAnne Growney***, Bloomsburg University and ***Alvin White***, Harvey Mudd College. Persons interested in reading poetry at this session should contact the organizers prior to November 15.

Symbolic Computer Systems Panel Discussion: is sponsored by the Committee on Symbolic Computer Systems (Zaven A. Karian, Chair) and organized by ***Warren Page***, New York City Technical Col-

lege – CUNY. This panel will be held on Saturday from 2:15 p.m. to 3:45 p.m. Three different applications will be described: one will be given by ***Zaven Karian***, Denison University. The organizer will raise critical issues concerning the instructional use of CAS's. Respondents: ***Benton Leong***, University of Waterloo, will describe exciting, forthcoming technology-based innovations, and ***Frank Lester***, Indiana University will address some of the research-related issues raised.

Student Activities

The MAA Committee on Student Chapters, Pi Mu Epsilon, and the AMS are co-sponsoring a ***Student Hospitality Center*** in the VIP and Rehearsal Room in the Convention Center which will be open during the same hours the Joint Meetings registration desk is open, from Wednesday morning until 3:00 p.m. on Saturday. The center will be a gathering place for all students (undergraduate and graduate) who are attending the Joint Meetings.

There will be a ***Career Fair*** on Thursday from 12 noon to 2:00 p.m. sponsored by the MAA Committee on Student Chapters. This special event provides an opportunity for prospective employers of mathematically prepared people to acquaint the academic mathematical community with the needs of such employers and the variety of career opportunities available to those with a mathematical sciences background. The Career Fair is open to all who register for the Joint Meetings. However, high school or undergraduate students or high school teachers interested in attending ***only*** the Career Fair, should contact the MAA office in Washington at 202-387-5200 for information.

A special ***Student Day Program***, sponsored by the MAA, will take place on Thursday for local area high school students and their teachers. In addition to the Career Fair, that day will include special presentations for students and teachers on visualization in mathematics and various opportunities for "hands-on" activities.

A ***Continental Breakfast for MAA Student Chapter Advisors and Section Coordinators***, held jointly with Pi Mu Epsilon, is scheduled from 7:00 a.m. to 8:00 a.m. on Saturday in the Student Hospitality Center.

Student Workshops are being sponsored by the MAA Committee on Student Chapters. Workshop A is scheduled from 1:00 p.m. to 3:00 p.m. on Friday, and workshop B is scheduled from 9:00 a.m. to 10:55 a.m. on Saturday.

The ***Third Annual Student Chapters' Lecture*** is titled *Touring a torus* and will be given by ***Joseph A. Gallian***, University of Minnesota, Duluth, at 7:30 p.m. on Friday. The lecture is sponsored by the MAA Committee on Student Chapters.

A ***Student Chapter Session*** is sponsored by the MAA Committee on Student Chapters and organized by ***Deborah Frantz***, Kutztown University; ***W. Howard Jones***, The University of the District of Columbia; and ***Karen Schroeder***, Bentley College. This will serve as a forum for the exchange of ideas among advisors and section coordinators of the student chapters. Each of the fifteen-minute talks will focus on one or several activities implemented by a local chapter or a section. This session is scheduled from 8:00 a.m. to 10:55 a.m. on Saturday.

Other MAA Events

Two-Year College Reception: The Committee on Two-Year Colleges is sponsoring an informal reception for two-year college faculty and their friends from 5:30 p.m. to 7:00 p.m. on Thursday.

Business Meeting: The MAA Business Meeting is scheduled from 4:25 p.m. to 4:55 p.m. on Thursday. This meeting is open to all members of the Association.

Prizes: Prizes will be awarded at the Joint Prize Session beginning at 4:25 p.m. on Friday, and include the Yueh-Gin Gung & Dr. Charles Y. Hu Award for Distinguished Service to Mathematics, the Chauvenet Prize, the Allendoerfer, Pólya and Ford Awards, and several Certificates of Meritorious Service. Awards for Distinguished College or University Teaching will also be presented.

Special Inaugural Teaching Award Session: A special event honoring the 1993 winners of the Awards for Distinguished College or University Teaching of Mathematics is scheduled from 3:30 p.m. to 5:00 p.m. on Saturday and will be immediately followed by a reception. The recipients will be the first winners of this newly-established prestigious award. Some of the honorees, who will have received their awards at the Prize Session on Friday, will report on the secrets of their success.

Board of Governors: The MAA Board of Governors will meet from 8:30 a.m. to 4:00 p.m. on Tuesday, January 12. This meeting is open to all members of the Association.

Section Officers: There is a Section Officers' meeting from 4:30 p.m. to 6:30 p.m. on Wednesday, January 13.

99th Annual Meeting of the AMS

January 13 – 16, 1993

Sixty-Sixth Josiah Willard Gibbs Lecture: The 1993 Gibbs Lecture titled *Fluid dynamics and fiber architecture of the heart and its valves* will be presented at 8:30 p.m. on Wednesday by ***Charles S. Peskin***, New York University.

Prizes: Three Steele Prizes, the Satter Prize, and the AMS Citations for Public Service will be awarded at the Joint Prize Session on Friday, beginning at 4:25 p.m.

Colloquium Lectures: A series of three Colloquium Lectures on *Nonlinear differential equations and Lagrangian coordinates* will be given by ***Luis A. Caffarelli***, Institute for Advanced Study. The lectures will be given at 1:00 p.m. daily, Wednesday through Friday.

Invited Addresses: By invitation of the AMS Program Committee for National Meetings, there will be six fifty-minute invited addresses. The names and affiliations of the speakers, their titles, and the days and times they will talk are as follows:

Jim Douglas, Jr., Purdue University, *Simulations of flows in porous media*, Saturday, 2:15 p.m.;

Carolyn Gordon, Dartmouth College, *You can't hear the shape of a drum*, Thursday, 3:20 p.m.;

Wu-Yi Hsiang, University of California, Berkeley, *On the maximal density of sphere-packing in Euclidean* 3*-space*, Wednesday, 10:05 a.m.;

Bernd Sturmfels, Cornell University, *Sparse systems of polynomial equations*, Thursday, 2:15 p.m.;

Leon Takhtajan, State University of New York at Stony Brook, *Quantum groups: at the gates of the non-commutative world*, Friday, 10:05 a.m.;

Alexander Varchenko, University of North Carolina, Chapel Hill, *General hypergeometric functions and representation theory of Lie algebras and quantum groups*, Friday, 9:00 a.m.

AMS Short Course on Wavelets and Applications

A two-day Short Course on *Wavelets and applications* will be held on Monday and Tuesday, January 11 and 12, 1993. The program is under the direction of ***Ingrid Daubechies***, Rutgers University and AT&T Bell Laboratories.

The concept of wavelets is a synthesis of ideas from very different fields, ranging from the analysis of integral operators in pure mathematics to the design of efficient compression techniques for speech in electrical engineering. The basic feature of wavelets is that each of them is localized in space (or time) and scale; a decomposition of the object at hand into wavelets is therefore a decomposition into well-localized components, each with its own scale. All this is possible with orthonormal wavelet bases, which are associated with fast numerical algortithms.

The Short Course will explain the mathematics of orthonormal wavelet bases and other orthonormal bases with good time-frequency localization properties; it will also give descriptions of several applications of wavelets.

The speakers, affiliations and titles are:

Gregory Beylkin, University of Colorado, Boulder, *Wavelets and fast numberical algorithms*;

Ronald R. Coifman, Yale University, *Adapted waveform analysis, wavelet-packets and local cosine libraries*;

Ingrid Daubechies, *Orthonormal wavelet bases and other wavelet transforms*;

David Donoho, Stanford University, *Nonlinear wavelet methods for recovery of objects from noisy and indirect observations*;

Yves Meyer, Université Paris-Dauphine, *Title to be announced*;

Philipe Tchamitchian, Faculté des Sciences et Techniques de Saint-Jérôme, *Wavelets and differential operators with variable coefficients*;

M. Victor Wickerhauser, Washington University, St. Louis, *Adapted bases in analysis and signal processing.*

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

Activities of Other Organizations

The ***Association for Symbolic Logic*** (ASL) will hold its 1992-1993 winter meeting on Friday and Saturday. The invited speakers, their affiliations, and the days and times they will speak are:

Richard Laver, University of Colorado, Boulder, 9:00 a.m. on Friday;

Eberhard Herrmann, Humboldt University, Berlin, 10:00 a.m. on Friday;

Toniann Pitassi, University of Toronto, 1:00 p.m. on Friday;

Sy Friedman, Massachusetts Institute of Technology, 9:00 a.m. on Saturday;

David Seetapun, University of Chicago, 10:00 a.m. on Saturday.

Jan Krajicek, Czechoslovak Academy of Sciences, 1:00 p.m. on Saturday;

Chris Laskowski, University of Maryland, College Park, 2:00 p.m. on Saturday;

Titles for the invited speakers will be announced later. There will also be a session for contributed papers on Friday afternoon.

All interested participants are invited to a cash bar reception on Thursday at 5:30 p.m. to be held poolside at the Marriott Riverwalk.

The ***Association for Women in Mathematics*** (AWM) will conduct a workshop for women graduate students and postdocs in mathematics similar to the ones held at the recent past Joint Meetings. The AWM has applied for additional funding from the National Science Foundation and the Office of Naval Research to continue this series.

Pending NSF and ONR approval, the AWM will offer funding for travel, subsistence, and registration fees for ten women graduate students and ten women postdocs to attend the AWM Workshop and the Joint Meetings. The Workshop will provide the participants the opportunity to present and discuss their research and to meet with other women mathematicians at all stages of their careers. The workshop will also include a panel discussion on issues of career development a luncheon, and a dinner.

All mathematicians (female and male) are invited to attend the entire program even though only 20 women will be funded. Departments are urged to help graduate students and postdocs obtain some institutional support to attend the Workshop and the Joint Meetings that follow.

All applications must be postmarked by ***November 1, 1992*** and sent to AWM, Box 178, Wellesley College, Wellesley, MA 02181. For application procedures or additional information contact Jodi Beldotti, Executive Director, at 617-237-7517. (Address and telephone number are subject to change.)

Information on the AWM Workshop Dinner can be found in the ***Social Events*** section of this announcement.

The AWM is sponsoring a panel discussion at 3:20 p.m. on Wednesday.

The fourteenth annual AWM Emmy Noether Lecture will be given at 9:00 a.m. on Thursday, speaker and title to be announced.

The AWM Business Meeting and Prize Session is scheduled from 4:20 p.m. to 4:50 p.m. on Wednesday. The Louise Hay Award for Contributions to Mathematics Education will be given at this session.

An open reception is planned for 9:30 p.m. on Wednesday.

The ***Consortium for Mathematics and its Applications*** (COMAP) will hold its Council meeting on Tuesday from 5:00 p.m. to 10:00 p.m.

The ***Interagency Commission for Extramural Mathematics Programs*** (ICEMAP) will have a session at 7:15 p.m. on Wednesday titled *Opportunities at ICEMAP agencies.* Representatives from these various agencies will be on hand for this discussion with interested participants.

The ***Joint Policy Board for Mathematics*** (JPBM) will hold its annual public policy address on Thursday evening at 6:30 p.m. The ***Honorable Barbara Mikulski*** (D-Maryland) and the ***Honorable George Brown*** (D-California) have been invited to speak. Both are Chairs of congressional committees having to do with science.

The JPBM Committee on Professional Rewards and Recognition (Calvin C. Moore, Chair) will sponsor a discussion on Friday from 1:00 p.m. to 2:30 p.m. concerning its interim report. Presentations will be made by ***Carolyn Mahoney***, California State University, San Marcos and ***Calvin Moore***, University of California, Berkeley, followed by a rebuttal by ***Ruth Gonzales***, Exxon Corporation and ***D. J. Lewis***, University of Michigan, Ann Arbor. After the presentations, the group will answer questions from the floor.

The JPBM Mathematics Department Chairs' Committee (Frank Gilfeather, Chair) will sponsor a panel discussion on Friday evening at 7:00 p.m. titled *Chairing the mathematics department in the* 1990's. This discussion is intended for mathematics department Chairs, associate Chairs, and others interested in or active in departmental or university administration.

The ***National Association of Mathematicians*** (NAM) will receive the William W. S. Claytor Lecture at 1:00 p.m. on Saturday, January, 16 by ***Fern Y. Hunt***, Howard University, on *Some results on the approximation of invariant measures of finite dimensional mathematics.*

At 2:15 p.m. on Friday NAM will have a session on *Presentations by recent doctoral recipients*, moderated by ***John W. Alexander, Jr.***

NAM has scheduled a "birds of a feather" session on Friday evening at 7:00 p.m.

A panel discussion on *Underrepresented minorities in the graduate school mathematical pipeline* will take place from 9:00 a.m. to 10:00 a.m. on Saturday. The moderator is ***Robert Bozeman***, Morehouse College.

The NAM Business Meeting will take place from 10:00 a.m. to 10:55 a.m. on Saturday, January 16.

The ***National Science Foundation*** (NSF) is sponsoring an address from 3:30 p.m. to 4:20 p.m. on Wednesday on *The fiscal year 1993 budget and opportunities at NSF.* The speaker will be the newly appointed Division Director of the Division of Mathematical Sciences.

NSF invites participants at the Joint Mathematics Meetings to meet informally with staff members over the lunch hour (noon to 1:00 p.m.) daily, Wednesday to Saturday, January 13 – 16.

The NSF will also be represented at a booth in the exhibit area. NSF staff members will be available to provide counsel and information on NSF programs of interest to mathematicians. The booth is open the same days and hours as the exhibits. Times that staff will be available will be posted at the booth.

The ***Rocky Mountain Mathematics Consortium*** (RMMC) Board of Directors will meet on Friday from 2:15 p.m. to 4:10 p.m.

Other Events of Interest

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 meeting. The book sales will be open the same days and hours as the exhibits.

Exhibits: The book, educational media, and software exhibits will be open 1:00 p.m. to 5:00 p.m. on Wednesday, 9:00 a.m. to 5:00 p.m. on Thursday and Friday, and 9:00 a.m. to noon on Saturday. All participants are encouraged to visit the exhibits during the meeting. ***Participants visiting the exhibits will be asked to display their meeting badge or acknowledgement of preregistration from the Mathematics Meetings Service Bureau in order to enter the exhibit area.***

Joint Books, Journals and Promotional Materials Exhibit: This exhibit will be open the same hours as the other exhibits, and affords participants the opportunity to order publications from various commercial publishers not represented at the meeting.

Mathematical Sciences Employment Register: Those wishing to participate in the San Antonio Employment Register should read carefully the important article about the Register which follows this meeting announcement.

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 percent refund, returned tickets must be received by the Mathematics Meetings Service Bureau ***by December 30.*** 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.

Country-Western Social: The life of the cowboy was not all bullets, bottles and branding irons. Occasionally, the hard life was put aside for a little "boot-scooting" and "toe-tapping"! Come and experience some of this fun as you dance the night away. Western music will set the mood for a lively night of country-western entertainment. Dance instructors will be on hand to help with such favorites as the "Texas two-step", "cotton-eyed Joe", and "Schottish." The fun will take place at the Villita Assembly Hall in La Villita from 8:00 p.m. to 11:00 p.m. on Thursday. Tickets are $10 per person, and a cash bar with light snacks will be available.

Banquet to Honor 25-year Members of AMS: All meeting participants are invited to attend the annual banquet to honor individuals

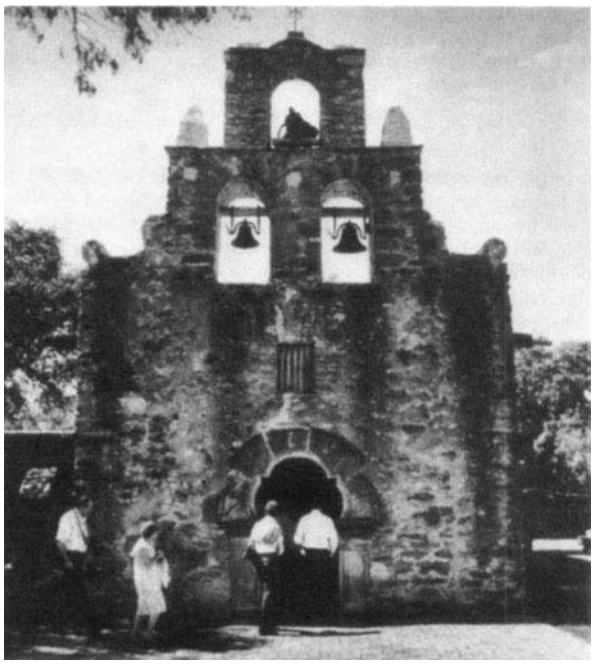
who have been members of the Society for twenty-five years or more. This banquet provides an excellent opportunity to socialize with fellow participants in a relaxed atmosphere. The banquet will be held on Saturday, January 16, with a cash bar reception at 6:30 p.m. and dinner at 7:30 p.m. The attendee who has been a member of the Society for the greatest number of years will receive a special tribute. Each attendee will receive a memento of the occasion and there will be a drawing for door prizes.

The menu includes fresh spinach salad, apple almond chicken, wild rice, seasonal vegetables, dinner rolls, carrot cake, coffee and tea. Vegetarian meals are available by advance request. Tickets are $27 each; the price includes tax and gratuity.

AWM Workshop Dinner: Association for Women in Mathematics will host a dinner after the conclusion of their Workshop on Tuesday at 6:30 p.m. participants are invited to attend the dinner, whether or not they attended the Workshop. The menu will be announced at a later date, and vegetarian meals will be available upon advance request. Tickets are $28 each, including tax and gratuity. Should funding for the Workshop not be approved, this dinner will be canceled.

MER Banquet: The Mathematicians and Education Reform (MER) Network welcomes all mathematicians who are interested in issues in precollege mathematics education to attend the MER Banquet on Wednesday at 6:30 p.m. This is an opportunity to make or renew ties with other mathematicians who are involved in educational projects. There will be a brief presentation of the current activities and future plans of the MER Network, but the evening's main feature promises to be lively conversation among the participants. There will be a cash bar beginning at 6:30 p.m. Dinner will be served at 7:30 p.m. and includes Southwest bella keye salad, marinated London broil with sherry mushroom sauce, buttered noodles, fresh seasonal vegetables, dinner rolls, chocolate mousse cake, coffee and tea. Vegetarian meals are available by advance request. Tickets are $28 each, including tax and gratuity.

MAA Monthly Centennial Celebration Banquet: The Master of Ceremonies will be the *Monthly* Editor, ***John H. Ewing***, Indiana University. Speakers will be ***Richard K. Guy***, University of Calgary; ***Raoul Hailpern***, Former Editorial Director of the MAA; ***Doris Schattschneider***, Moravian College; and ***Herbert S. Wilf***, University of Pennsylvania, Philadelphia. This event will take place Friday evening at 7:30 p.m. Dinner includes Southwest bella keye salad, marinated London broil with sherry mushroom sauce, buttered noodles, fresh seasonal vegetables, dinner rolls, chocolate mousse cake, coffee and tea. Vegetarian meals are available upon advance request. Tickets are $27 each; the price includes tax and gratuity.



Photograph courtesy of the San Antonio Convention & Visitors Bureau

The Mission San Francisco De La Espada, *known as "La Espada," the sword, was the first of the five San Antonio Missions to be constructed of stone. It received the title of La Espada because of its tower built in the shape of a sword hilt.*

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 meeting. Participants who preregister by the ordinary deadline of November 13 may utilize the housing services offered by the Mathematics Meetings Service Bureau (MMSB).

Joint Mathematics Meetings

Member of AMS, ASL, Canadian Mathematical Society, MAA	$115
Emeritus Member of AMS, MAA	30
Nonmember	178
Student/Unemployed	30
Librarians/High School Teachers	30
High School Students	02

Employment Register

Employer	$125
Additional interviewer (each)	60
Applicant	30
Employer posting fee	30

AMS Short Course

Student/Unemployed	$ 30
Emeritus Member of AMS, MAA	30
All Other Participants	70

MAA Minicourses
(if openings available)

Minicourses #3, 4, 6, 7, 8, 9, 11, 12, 13, 16, 17	$ 36
Minicourses #1, 2, 5, 10, 14, 15	45

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 enter the exhibit area, to obtain discounts at the AMS and MAA Book Sales, and to cash a check with the Joint Meetings 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 MMSB 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 MMSB to refund amounts less than $2. Preregistration forms received well before the deadline of November 13 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, 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. Students are asked to determine whether their status can be described as graduate (working toward a degree beyond the bachelors'), undergraduate (working toward a bachelors' degree), or high school (working toward a high school diploma), and make the appropriate indication on the preregistration/housing form.

The librarian registration category refers to any librarian who is not a professional mathematician.

The unemployed status refers to any person currently unemployed, actively seeking employment, and 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 because of age or long term disability from his or her latest position.

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

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

EARLY Preregistration	October 30
ORDINARY Preregistration (and Housing)	November 13
FINAL Preregistration (no Housing, tickets, Employment Register)	December 11

EARLY Preregistration: Those who preregister by the ***EARLY*** deadline of October 30 will be eligible for a drawing to select the winners of complimentary hotel rooms in San Antonio. Multiple occupancy of these rooms is permissible. The location of rooms to be used in this lottery will be based on the number of complimentary rooms available in the various hotels. Therefore, the free room may not necessarily be in the winner's first choice hotel. Winners will be randomly selected from the names of all participants who preregister by October 30. The winners will be notified by mail prior to December 31. ***So preregister early!*** (A list of the winners in Baltimore appears in the section titled ***How to Get a Room***.)

ORDINARY Preregistration: Those who preregister by the ***ORDINARY*** deadline of November 13 may still utilize the housing services offered by the MMSB, but are not eligible for the room lottery.

FINAL Preregistration: Those who preregister by the ***FINAL*** deadline of December 11 must pick up their badge and program at the meetings. Unfortunately, it is not possible to provide ***FINAL*** preregistrants with housing, tickets to special events, or Employment Register preregistration. However, participants may register on-site for the Employment Register and tickets may still be available for purchase at the meetings. ***Please note that the December 11 deadline is firm and any forms received after that date will 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.ORG 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, and the same deadlines apply. Receipt of the Preregistration/Housing Form and payment will be acknowledged by the MMSB. Participants are advised to bring a copy of this acknowledgement with them to San Antonio. The same deadlines apply as for preregistration by mail.

All ***EARLY*** and ***ORDINARY*** preregistrants will receive formal acknowledgements prior to the meetings. ***FINAL*** preregistrants will receive instead a letter from the MMSB (including receipt of payment) prior to the meetings.

Both ***EARLY*** and ***ORDINARY*** preregistrants will receive their badge, program, and prepurchased tickets by mail two to three weeks before the meetings, 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 Joint Meetings 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 San Antonio. Unfortunately, it will not be possible to make changes in San Antonio to badges received through the mail before the meetings.

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.

There will be a list of preregistrants sorted by area of mathematical interest posted at the meetings. 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 and MAA abstract forms.) 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 Get a Room

Participants must preregister by the ***ORDINARY*** deadline of November 13 in order to obtain hotel accommodations through the MMSB. Be sure to complete the Housing section of the Preregistration/Housing Form completely, after reading the information in this section thoroughly. Participants are asked to rank all hotels on the form after reviewing the hotel pages.

Physically challenged participants: People with special requirements for housing should make these clear when submitting the Preregistration/Housing Form.

The following participants received complimentary hotel rooms during the Baltimore meetings. They qualified for these rooms by submitting their Preregistration/Housing Form by the ***EARLY*** preregistration deadline. Since these rooms can be occupied by as many as four persons, this represented a considerable savings.

Days Inn

John Akeroyd
Joseph G. Brown
Charles R. Diminnie
Robert Kennedy

Holiday Inn

Leon Brown
James L. Rovnyak
David Seppala-Holtzman
Robert Troyer
Michael B. Ward

Marriott

Jerry Glynn
Bernard Harris
Meg Hartenstein

Omni

Elsie Anderson
William J. Barnier
Harriet C. Edwards
Charles Hampton
Daniel G. Willis

Sheraton

Hall Bennet
Mary Connolly
Susanna D. Fishel
Mako Haruta
Susan E. Hurley
John Stoughton

All participants wishing to preregister for the San Antonio meetings are urged to consider the ***EARLY deadline of October 30*** in order to qualify for the San Antonio room Lottery. (See the section titled ***How To Preregister***.)

Participants who did not reserve a room during preregistration and would like to obtain a room at one of the hotels listed on the following pages should call the hotels directly ***after December 16***. However, after that date the MMSB can no longer guarantee availability of rooms or special convention rates.

Participants should be aware that it is general hotel practice in most cities to hold a nonguaranteed reservation until 6:00 p.m. only. When one guarantees a reservation by paying a deposit or submitting a credit card number as a guarantee in advance, however, the hotel usually will honor this reservation up until checkout time the following day. If the individual holding the reservation has not checked in by that time, the room is then released for sale and the hotel retains the deposit or applies one night's room charge to the credit card number submitted.

If you hold a guaranteed reservation at a hotel, but are informed upon arrival that there is no room for you, there are certain things you can request the hotel do. First, they should provide for a room at another hotel in town for that evening, at no charge. (You have already paid for the first night when you made your deposit.) They should pay for taxi fares to the other hotel that evening, and back to the meetings the following morning. They should also pay for one telephone toll call so that you can let people know you are not at the hotel you expected. They should make every effort to find a room for you in their hotel the following day and, if successful, pay your taxi fares to and from the second hotel so that you can pick up your baggage and bring it to the first hotel. Not all hotels in all cities follow this practice, so your request for these services may bring mixed results, or none at all.

The AMS-MAA Joint Meetings Committee always endeavors to obtain the lowest possible sleeping room rates for participants at annual meetings. The committee is also responsible for maintaining a sound fiscal position for these meetings. As the meetings have grown in scope and complexity over the years, it has been necessary to find larger facilities with more and more session rooms. Unfortunately, the cost of these facilities is higher than can be covered by the registration fees, and the committee has arranged for all of the hotels to collect an extra $3 per room per night from participants, which will be used to offset the rental cost of the Convention Center. (The rates quoted on the hotel information page include this extra charge.)

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 not available.*** Participants who require audio-visual assistance should come to the Registration Desk.

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 must be received ***by November 9***.

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.ORG ***by November 9***.

Speakers are cautioned that requests for equipment made at the meeting may not be satisfied because of budgetary restrictions.

Child Care: Many hotels have a list of bonded child care services. Participants should inquire at their hotel and are responsible for making individual arrangements.

A Parent/Child Lounge will be located in the San Antonio Convention Center. 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. Any child using this lounge must be accompanied by a parent (not simply an adult) who must be responsible for supervision of the child. This lounge will be unattended and parents assume all responsibility for their children. This lounge will only be open during the hours of registration and all persons must leave the lounge at the close of registration each day.

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

A second table is set up in the exhibit area for the dissemination of information of a ***mathematical*** nature ***not*** promoting a product or program for sale.

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 exhibit area at the Joint Books, Journals and Promotional Materials exhibit for a fee of $35 per item.

If a person or group would like to display material in the exhibit 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 $35 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 Joint Mathematics Meetings. The following rules and procedures apply.

1. Announcements submitted by participants should ordinarily be limited to a single sheet no more than $8\frac{1}{2}" \times 14"$.
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 6887, 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, 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 on Saturday, 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 Joint Meetings should be addressed as follows: Name of Participant, Joint Mathematics Meetings, San Antonio Convention Center, PO Box 2277, San Antonio, TX 78298. Mail and telegrams so addressed may be picked up at the mailbox outside the meetings registration area. U.S. mail not picked up will be forwarded after the meetings to the mailing address given on the participant's registration record.

Petition Table: At the request of the AMS Committee on Human Rights of Mathematicians, a table will be made available in the exhibit 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 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. ***At the end of registration on Saturday, 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.***

Telephone Messages: A telephone message center is located in the registration area to receive incoming calls for participants. The center is open from January 12 through 16 during the hours that the 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 registration desk has closed for the day there is no mechanism for contacting participants other than calling them directly at their hotel. The telephone number of the message center will be announced later.

Travel: In January, San Antonio is on Central Standard Time. There is regular airline service to the San Antonio International Airport by several major airline carriers. The airport is a little over eight miles from the city center, which takes about ten minutes to reach by taxi For Amtrak information call 1-800-872-7245. Most major car rental agencies maintain desks at the airport. The Joint Meetings Committee has designated Hertz as the official car rental company for the meeting. Participants should contact the Hertz representative at 1-800-654-2240 as early as possible and use the meeting number 10934 to take advantage of special rates. These rates are guaranteed one week prior to and one week after the meeting.

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. Every ticket ordered through the official agency helps to reduce the AMS and MAA costs. This service is being performed by TRAVCON; their advertisement can be found elsewhere in this meeting announcement.

Weather: The location of San Antonio on the edge of the Gulf Coastal Plains results in a modified subtropical climate, predominantly continental during the winter months. The average daily high temperature for January is 62° F, and the daily low 42° F.

AMS-MAA Joint Program Committee

Richard A. Askey, Hermann Flaschka, Roger A. Horn (Chair), and Richard A. Tapia.

MAA Program Committee for the San Antonio Meeting

Richard A. Askey, David W. Ballew (ex-officio), Manuel P. Berriozábal, Linda H. Boyd, James W. Daniel, Leonard Gillman, Roger A. Horn, Maria M. Klawe, Bruce P. Palka (Chair), Don W. Scheuer, Jr., and Robert S. Smith.

AMS Program Committee for National Meetings

Spencer Bloch, Hermann Flaschka, Robert M. Fossum (ex-officio), Dusa McDuff, H. W. Lenstra, Nancy K. Stanton (Chair), and Mary F. Wheeler.

Local Arrangements Committee

Shair Ahmad (Chair), Don Bailey, W. Wistar Comfort (ex-officio), William H. Jaco (ex-officio), Carol Redfield, Kenneth A. Ross (ex-officio), David Sanchez, Gene Sims, Marcia P. Sward (ex-officio), and Betty Travis.

How to Obtain Hotel Accommodations

The hotels listed below are listed by descending order of rates. This order does not reflect distance from the Convention Center. Estimated distance from the Convention Center is indicated below each hotel name. These hotels are full service hotels. They offer a **LIMITED** number of nonsmoking rooms and are equipped for the physically challenged. All hotels are in compliance or working towards being in compliance with the Americans with Disabilities Act (ADA). Special attention will be given to participants with special needs and every effort will be taken by the Mathematics Meetings Service Bureau (MMSB) to insure that such participants are placed in hotels that are in compliance with the ADA.

The rates listed below are subject to a 13 percent sales/occupancy tax. Checkin time for all hotels except for the two Marriotts is 3:00 p.m.. Checkin time for the Marriotts is 4:00 p.m. Checkout time for all hotels except for the Hilton, the Emily Morgan, and the Plaza is noon. Checkout time for the Hilton is 11:00 a.m. Checkout time for the Emily Morgan and the Plaza is 1:00 p.m. Hotels that have sleeping rooms with windows that open are: Marriott Riverwalk, Plaza, Menger, Holiday Inn Riverwalk, and the Travelodge.

Participants desiring confirmed reservations for the following hotels **must** make the reservations through the MMSB **prior to the November 13, 1992 deadline**. Reservations, cancellations, and/or changes at these hotels CANNOT be made by calling the hotel directly until after December 16, 1992. Please make all changes to or cancellations of hotel reservations with the MMSB (401-455-4143) in Providence **through December 7, 1992**. The MMSB **cannot** accept changes after December 7, 1992; however, changes and cancellations can be called in directly to the hotels after December 16, 1992. Please allow the MMSB and the hotels from December 7 to December 15 to process and input final housing lists and changes. It is imperative that all hotels listed on the back of the preregistration form be numbered in order of preference to insure accurate hotel assignments.

GUARANTEE REQUIREMENTS: $50 by check **OR** a credit card guarantee with VISA, MasterCard, or American Express (for housing only). **American Express cards may be used for housing guarantees only and not for preregistration.** For room payments, the hotels accept all major credit cards. Personal checks are accepted with personal identification and a credit card backup at all properties except the Plaza. The Plaza does not accept personal checks from out of state. The Marriott Rivercenter and the Hilton use telecheck approval.

	Location	**Description**	Single	Double	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suites (starting rates)
Hyatt Regency .30 miles	123 Lasoya Street San Antonio, TX 78205 512-222-1234	Restaurants, Lounge, Outdoor Pool Parking $9.50 valet (In/Out), $7.50 self Children 18 yrs. and younger free								
REGULAR			$90	$100	$100	$100	$110	$100	$110	$465+
Hilton Palacio Del Rio .06 miles	200 South Alamo San Antonio, TX 78205-3299 512-222-1400, 1-800-HILTONS	Restaurants, Lounge, Outdoor Pool Parking $6 self (In/Out), $14 valet Children all ages free								
REGULAR			$83	$93	$93	$103	$103**	$113	$113**	$325+
STUDENT*			$73	$73	$73	$73	$93	$73	$93	N/A
Marriott Riverwalk **(HEADQUARTERS)** .06 miles	711 East Riverwalk San Antonio, TX 78205 512-224-4555	Restaurant, Lounge, Indoor/Outdoor Pool Parking $7 (In/Out), $10 valet (In/Out) Indoor/Outdoor Pool								
REGULAR			$83	$93	$93	$103	$113	$113	$123	$478+
STUDENT*			$73	$73	$73	$73	$83	$73	$83	N/A
Marriott Rivercenter .10 miles	101 Bowie Street San Antonio, TX 78205 512-223-1000	Restaurants, Lounges, Indoor/Outdoor Pool Parking $7 self (In/Out), $10 valet (In/Out) Children 16 yrs. and younger free								
REGULAR			$82	$92	$92	$112	$132	$132	$152	$225
STUDENT*			$72	$72	$72	$72	$92	$72	$92	N/A

All parking rates quoted above are per day rates. Ages listed above for children free in the room apply to children in existing beds only. There is an extra charge for rollaways, where applicable.

* Participant must be a certified student or unemployed to qualify for these rates.

** Rollaway fee for non-family members is an additional $20 per day.

(CONTINUED ON NEXT PAGE)

How to Obtain Hotel Accommodations (continued)

	Location	Description	Single	Double	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suites (starting rates)
Plaza San Antonio .10 miles (Resort hotel)	555 S. Alamo Street San Antonio, TX 78205 512-229-1000	Restaurants, Lounge, Outdoor Pool Parking $7 valet (In/Out), $5 self Children 12 yrs. and younger free 2 Tennis Courts, Bicycles								
REGULAR			$81	$91	$91	$101	$111	$111	$121	$250
STUDENT*			$71	$71	$71	$71	$81	$71	$81	N/A
The Crockett .20 miles	320 Bonham Street San Antonio, TX 78205-2083 512-225-6500	Restaurants, Lounge, Outdoor Pool Parking $7 valet (In/Out) Children 16 yrs. and younger free								
REGULAR			$77	$77	$77	$77	$87	$77	$87	$250
STUDENT*			$67	$67	$67	$67	$77	$67	$77	N/A
Menger .20 miles	204 Alamo Plaza San Antonio, TX 78205 512-223-4361	Restaurant, Lounge, Outdoor Pool Parking $7.95 valet (In/Out), $3.95 self Children 17 yrs. and younger free								
REGULAR			$74	$84	$84	$94	$104	$104	$114	$152
STUDENT*			$70	$70	$70	$70	$80	$70	$80	N/A
Emily Morgan .80 miles	705 E. Houston Street San Antonio, TX 78205 512-225-8486	Restaurant, Lounge, Outdoor Pool Parking $6.50 self (In/Out) Children 17 yrs. and younger free								
REGULAR			$73	$73	$73	$83	$93	$93	$103	N/A
STUDENT*			$63	$63	$63	$63	$73	$63	$73	N/A
Holiday Inn Riverwalk .50 miles	217 North St. Mary's Street San Antonio, TX 78205 512-224-2500, 1-800-445-8475	Restaurant, Lounge, Outdoor Pool Parking $4 self (In/Out), $5.50 valet Children 16 yrs. and younger free								
REGULAR			$65	$65	$65	$75	$85	$85	$95	$165
Travelodge on the River .50 miles	100 Villita Street San Antonio, TX 78205 512-226-2271, 1-800-554-4678	Restaurant, Lounge, Outdoor Pool Parking $4.75+tax self (In/Out) Children 18 yrs. and younger free								
REGULAR			$65	$65	$65	$75	$83	$75	$83	N/A

All parking rates quoted above are per day rates. Ages listed above for children free in the room apply to children in existing beds only. There is an extra charge for rollaways, where applicable.

* Participant must be a certified student or unemployed to qualify for these rates.

Preregistration/Housing Form, San Antonio, Texas

January 13–16, 1993

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:	Room Lottery Qualification	October 30, 1992
	Joint Meetings & AMS Short Course Preregistration/ Employment Register/Hotel Reservations/Tickets	November 13, 1992
	Final Preregistration ONLY (No housing, Employment Register, and/or tickets)	December 11, 1992
	Housing Changes/Cancellations	December 7, 1992
	50% Refund on Tickets	December 30, 1992 (no refunds after this date)
	50% Refund Joint Meetings Preregistration/Employment Register/AMS Short Course	January 10, 1993 (no refunds after this date)

		REGISTRATION FEES Preregistration by December 11, 1992 $
JOINT MATHEMATICS MEETINGS		
	Member of AMS, ASL, CMS, MAA	115
*	Emeritus Member of AMS or MAA	30
	Nonmember	178
*	Students:	
	High School	2
	Graduate or Undergraduate	30
*	High School Teachers or Librarians	30
*	Unemployed	30
AMS SHORT COURSE		
	Member/Nonmember	70
*	Student, Unemployed, or Emeritus	30

		Preregistration by November 13, 1992
EMPLOYMENT REGISTER	– Employer fee (1st Interviewer)	125
	– Employer fee (2nd / 3rd Interviewer)	60
	– Applicant fee	30
	– Posting fee for job descriptions for noninterviewing employers	30

(N.B.: A separate form appears in this issue for preregistration for MAA Minicourses)

* See section on "How to Preregister" in *Notices* or *Focus* for definitions of various registration categories.

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

Joint Meetings ☐ AMS Short Course (January 11–12, 1993) ☐ Employer ☐ Co-Interviewer ☐ Applicant ☐ Posting ☐

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

2) _____ _____
(Mailing address) (e-mail address)

I do not wish my badge, program, and/or Employment Register material to be mailed; however, the mailing address for my acknowledgement is given above. ☐

3) Badge information: Affiliation _____

4) Students: Grad ☐ Undergrad ☐ High School ☐ 5) Emeritus member ☐ Unemployed ☐ Librarian ☐ High School Teacher ☐

6) Member of: AMS ☐ ASL ☐ CMS ☐ MAA ☐ Nonmember ☐ AWM ☐ NAM ☐ MR Classification # _____

7) Joint Meetings fee $ _____ 8) **AMS** Short Course fee $ _____ 9) Employer fee(s) $ _____ 10) Co-Interviewer fee(s) $ _____

11) Applicant fee $ _____ 12) Posting fee $ _____ 13) Hotel deposit $ _____ **(necessary ONLY if paying deposit by check)**

14) **Tickets:** ____ AMS 25-Year Banquet @ $27 each = $ ____ Veg. meal ☐ ____ MAA Monthly Banquet @ $27 each = $ ____ Veg. meal ☐
____ MER Banquet @ $28 each = $ ____ Veg. meal ☐ ____ AWM Workshop Dinner @ $28 each= $ ____ Veg. meal ☐
____ Country Western Social @ $10 each = $ _____

15) **Total amount enclosed for 7 through 14 $**_____ **Method of Payment:** ☐ Credit Card (Visa or MasterCard only)
☐ Purchase Order (original institutional PO attached) ☐ Check (payable to AMS; Canadian checks must be marked in "U.S. Funds")

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)

See reverse for hotel reservations. ☐ I will not require housing. ☐ I am making my own arrangements. ☐ I am staying in the local area.

For office use only:

Codes:	Options:	Hotel:	Room type:
Dates:	Hotel Deposit	Total Amt. Paid:	
Special Remarks:			

HOUSING SECTION: PREREGISTRATION/HOUSING FORM, San Antonio, Texas January 13–16, 1993

Please rank hotels in order of preference by writing 1, 2, 3, etc. in the spaces at the left on form, and by circling the requested room type and rate. If the rate requested is no longer available, you will be assigned a room at another hotel at the next available rate. **If not all hotels are ranked, and all rooms have been filled at the ranked hotels, the assignment will be made at an unranked hotel with the next available rate.** Rates listed below are subject to 13% sales/occupancy tax. **GUARANTEE REQUIREMENTS:** $50 by check **OR** a credit card guarantee with VISA, MasterCard, or American Express (for housing only). PLEASE SUPPLY THIS INFORMATION ON THE REVERSE, together with mailing address for confirmation of room reservation.

Order of choice		Distance from Conv. Ctr.	Single	Double 1 bed	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suites* (starting rates)
	Hyatt Regency	.30 miles	$ 90	$ 100	$ 100	$ 100	$ 110	$ 100	$ 110	$465+
	Hilton Palacio Del Rio	.06 miles								
	Regular		83	93	93	103	103**	113	113**	325+
	Student***		73	73	73	73	93	73	93	N/A
	Marriott Riverwalk (HEADQUARTERS)	.06 miles								
	Regular		83	93	93	103	113	113	123	478+
	Student***		73	73	73	73	83	73	83	N/A
	Marriott Rivercenter	.10 miles								
	Regular		82	92	92	112	132	132	152	225+
	Student***		72	72	72	72	92	72	92	N/A
	Plaza	.10 miles								
	Regular		81	91	91	101	111	111	121	250+
	Student***		71	71	71	71	81	71	81	N/A
	The Crockett	.20 miles								
	Regular		77	77	77	77	87	77	87	250+
	Student***		67	67	67	67	77	67	77	N/A
	Menger	.20 miles								
	Regular		74	84	84	94	104	104	114	152+
	Student***		70	70	70	70	80	70	80	N/A
	Emily Morgan	.80 miles								
	Regular		73	73	73	83	93	93	103	N/A
	Student***		63	63	63	63	73	63	73	N/A
	Holiday Inn Riverwalk	.50 miles	65	65	65	75	85	85	95	165+
	Travelodge on the River	.50 miles	65	65	65	75	83	75	83	N/A

*** Reservations for suites must be made directly with the Service Bureau. The hotel can supply general information only.**
**** Rollaway fee for non-family members is an additional $20 per day.**
***** Participant must be a certified student or unemployed (as described in the "How to Preregister" section of *Notices* or *Focus*) to qualify for these rates.**

Special housing requests: _____

☐ Please check here if you are physically challenged and have special needs. A staff member will call you for further information to insure that you are placed in a property that is complying with ADA rules and to insure that your stay in San Antonio is comfortable. Phone number where you can be reached: _____

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 their full name, arrival, and departure. Please also indicate ages of children. Please check here if one of the occupants is your spouse ☐

_____

DOWNTOWN SAN ANTONIO

★ San Antonio Convention Center

1. Emily Morgan Hotel
2. Hilton Palacio del Rio
3. Holiday Inn Riverwalk
4. Hyatt Regency Hotel
5. Marriott Rivercenter Hotel
6. Marriott Riverwalk Hotel
7. Menger Hotel
8. Plaza San Antonio Hotel
9. The Crockett Hotel
10. Travelodge on the River

MAA Minicourse Preregistration Form, San Antonio, Texas

January 13–16, 1993

NOTE: This is NOT an AMS Short Course Form. Please use the Joint Meetings Preregistration/Housing Form to preregister for the AMS Short Course.

To register for MAA Minicourse(s), please complete THIS FORM or a PHOTOCOPY OF THIS FORM and return it with your payment to:

Minicourse Coordinator
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: November 13, 1992 (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: December 30, 1992
- 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 Minicourse Coordinator 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. Alternatives to the lecture method in collegiate mathematics	Julian Weissglass	$45
2. How to make effective use of inexpensive pocket computers to develop the concepts and techniques of calculus	Franklin Demana & Bert K. Waits	$45
3. All right! I've got a graphing calculator. What happens next?	Iris Brann Fetta	$36
4. Unifying themes in discrete mathematics	Ralph Grimaldi	$36
5. Using supercalculators to enhance instruction and learning in linear algebra	Donald R. LaTorre	$36
6. Teaching the introductory statistics course	Donald L. Bently, Robin Lock, Mary Parker, Thomas L. Moore & Jeffrey A. Witmer	$36
7. Project CALC: Calculus as a laboratory course	Lawrence C. Moore & David A. Smith	$36
8. Environmental models	Roland H. Lamberson	$36
9. Earth algebra: College algebra with applications to environmental issues	Christopher Schaufele & Nancy Zumoff	$36
10. Why, when and how to use CAS calculators in calculus and differential equations instruction	John Kenelly & Gil Proctor	$45
11. Using group projects in calculus	Stephen Hilbert, John Maceli, Eric Robinson, Diane Schwartz & Stanley Seltzer	$36
12. Bringing calculus to life	Bob Decker	$45
13. Teaching mathematical modeling	J. S. Hartzler	$36
14. Linear algebra, applications and computing	Gareth Williams	$45
15. The Harvard calculus reform project: Hands-on experience with the project materials	Deborah Hughes Hallett, Sheldon P. Gordon, William McCallum & Thomas Tucker	$45
16. Instituting a mathematics placement program: Creating order out of chaos in freshman mathematics	Geoffrey Akst	$36
17. Mathematics in a real and complex world	Frank Wattenberg	$36

☐ I plan on preregistering for the San Antonio, Texas meetings **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 San Antonio meetings preregistration fee will be made.

Mathematical Sciences Employment Register January 13, 14, & 15 San Antonio Convention Center

Overview of the 1993 Employment Register

The Mathematical Sciences Employment Register, held annually at the Joint Mathematics Meetings in January, provides opportunities for mathematical scientists seeking professional employment to meet employers who have positions to be filled. Job announcements and brief résumés, prepared by employers and applicants respectively, are assigned code numbers and circulated to preregistered participants in advance and at the meetings, so that members of each group may determine which members of the other group they would like to have an opportunity to interview. Requests for interviews are submitted on forms that are turned in at the Employment Register desk by all participants the day before interviewing begins. **The algorithm used in the interview scheduling program selects interviews solely from among the requests submitted by employers and applicants. Since it does NOT compare an applicant's brief résumé with an employer's job announcement, participants should be aware that interviews between poorly matched participants may occur, if requested.**

A new and substantially improved algorithm for scheduling employer-applicant interviews will be used at the San Antonio Employment Register. For the first time, priority will be given to certain classes of employer and applicant requests. Most importantly, mutual requests (requests where an applicant and employer have each asked to interview the other) will be given the highest priority. An improvement over previous years' schedules for employers is that they may expect to see most of the applicants they request. And applicants now have the opportunity to designate a limited number of their requests as "high priority" requests. The system will implement these priorities while still scheduling a maximal, or near-maximal, number of total interviews over the two days at the Register. The new system is based on computer code developed by J.P. Jarvis, D.R. Shier, and M. Myers of the Department of Mathematical Sciences, Clemson University, under a contract with the AMS sponsored jointly by AMS and Mathematical Association of America.

One significant procedural change at the 1993 Employment Register will be the collection of ALL interview requests at one time on Wednesday; therefore, participants must appear to submit their request/availability forms by 4:00 p.m. Wednesday, since the entire two-day interview schedule will be produced Wednesday night.

Preregistration Procedures for Applicants

Preregistration is an important step in Employment Register participation that offers several advantages to applicants:

- Each applicant's typed résumé form will be photographically reproduced in the December 1992 issue of *Employment Information in the Mathematical Sciences*, which will be distributed in advance to all preregistered employers. Applicant résumé forms received after November 13 cannot be included in *EIMS*. No changes can be made to the form after the November 13 deadline.
- Employment Register preregistration fee for applicants is $30. The on-site registration fee is $60. In addition, all participants must also pay appropriate preregistration fees, or the higher on-site registration fees, for the Joint Meetings.
- Preregistered applicants will receive their badge, program, and Employment Register materials two to three weeks in advance of the meeting, unless they indicate otherwise. This year, the package will include the complete job announcements received from preregistered employers.

Applicants may preregister by submitting the Joint Meetings Preregistration/Housing form and applicant résumé form (all found in the back of this issue) to the Mathematics Meetings Service Bureau **by November 13, 1992.** These forms must be accompanied by payment of the appropriate fees. Those who preregister for the Joint Meetings after November 13 must register for the Employment Register on-site. Please follow the instructions on preparation of the applicant résumé form (found near the résumé form in the back of this issue).

Applicants not planning to attend

Applicants seeking professional positions in the mathematical sciences who do not plan to attend the meeting in San Antonio may submit résumés for publication in the December issue of *EIMS* if they use the Mathematical Sciences Employment Register Form for Applicants at the back of this issue and observe the deadline of November 13. There is no charge for this service. (Applicants' résumés will not be posted at the Employment Register if the applicant is not attending the meeting.)

Preregistration Procedures for Employers

Employers are encouraged to preregister one or more interviewers for the Employment Register. The fee for preregistered employers is $125 for the first interviewer, and $60 for each additional interviewer. On-site registration fees are $175 for the first interviewer and $75 for each additional interviewer. Preregistered employers, and employers registered on-site, must also register for the Joint Meetings and pay the appropriate Joint Meetings fee.

This year employer forms submitted by preregistered employers will be photographically reproduced in a booklet which will be distributed to all preregistered applicants. Employers will receive their badges, programs, and Employment Register material in advance, including the December issue of *Employment Information in the Mathematical Sciences*, which contains all the résumé forms of preregistered applicants.

To preregister employers should submit the Employer form and the Joint Meetings Preregistration/Housing form (both found in the back of this issue), along with payment of the appropriate fees, to the Mathematics Meetings Service Bureau **by November 13, 1992.**

One employer form should be submitted for each position, or set of positions, for which interviews will be conducted. The number and names of co-interviewers must be listed on the employer form and the interviewers will be assigned to adjacent tables. All co-interviewers should preregister at the same time.

Each interviewer listed on an employer form will be charged separate Joint Meetings and Employment Register fees; however, the "additional interviewers" listed on the form will be charged a lower Employment Register fee. If individuals from an institution want to interview separately for different positions, they will be assigned a separate code number and will each pay "first interviewer" fees.

It is the policy of some institutions to pay directly for employer fees. If a payment of this type is made separately from the submission of the preregistration materials, it is important that the institution's fiscal department include the name of the department and interviewer with their payment so that proper credit can be made in Providence.

Employers Not Planning to Interview

Employers who do not plan to participate in the Employment Register may display a job description. This description must be submitted on the employer form which appears in the back of this issue, with the appropriate box checked indicating that no interviews will take place. A fee of $30 is charged for this service. If the form is received in the Providence office (with payment) **by the November 13 deadline**, it will appear in the Winter List of Employers. Forms received with payment in the Providence office after that deadline will be displayed at the meeting along with the on-site postings. For on-site postings, the fee must be paid at the Joint Mathematics Meetings Registration Desk. Participants should inform the cashier that they would like to post a job description but are not planning to interview and should obtain the proper receipt in order to receive the form necessary for posting. Forms are available at the Employment Register desk.

Registration On-Site

Applicants and employers who do not preregister **by November 13** may register on-site in San Antonio at the Joint Meetings Registration desk. They must bring their receipt to the Employment Register desk between 7:30 a.m. and 4:00 p.m. on **Wednesday, January 13** to receive their materials. Every effort should be made to type the applicant résumé or employer form (found in the back of this issue) and bring it to the Register. Forms of on-site applicants and employers will be assigned a code number and displayed at the Employment Register. **Unlike previous years, there will be no on-site registration for the Employment Register after 4:00 p.m. Wednesday, January 13.**

1993 Employment Register Schedule

Wednesday, January 13

7:30 a.m. Distribution of Employment Register material for on-site registrants and preregistered participants who did not receive materials by mail.

9:00 a.m. Short (optional) orientation session.

9:30 a.m. – 4:00 p.m. Submission of all interview request forms for both Thursday and Friday interviews. This applies to both preregistered and on-site registrants. Those who do not submit interview request sheets by 4:00 p.m. will be unable to participate in the Employment Register on Thursday and Friday.

N.B. **No interviews are held on Wednesday.**

Thursday, January 14

8:00 a.m. Distribution of interview schedules for both Thursday and Friday.

9:00 a.m. – 5:00 p.m. Interviews.

Friday, January 15

9:00 a.m. – 5:00 p.m. Interviews.

This year the interview requests for both days must be submitted by 4:00 p.m. on Wednesday, January 13. (No changes can be made to the form once it has been submitted.) **All participants in the 1993 Employment Register must submit their interview request/availability forms between 9:30 a.m. and 4:00 p.m. on Wednesday or they will not be included when the interview scheduling program runs Wednesday night.** This applies to all employers and applicants, whether preregistered or on-site registrants. Forms submitted with preregistration achieve preregistration for the Employment Register only. These forms do not automatically include the participants in the interviewing process.

Fifteen-minute intervals are allowed for interviews, including two or three minutes between successive interviews. The interviews are scheduled in half-day sessions: Thursday morning and afternoon, and Friday morning and afternoon, amounting to four half-day sessions for interviews. Participants may choose to indicate unavailability for one or more sessions when they submit interview request forms. However, once scheduled, participants need to make a good faith effort to meet each appointment. Employers or applicants who must cancel an interview should fill out a cancellation form at the Employment Register desk well in advance.

Advice to Applicants

Mathematicians seeking employment who participate in the Employment Register should be aware of some objective information concerning recent Employment Registers:

- At the 1992 Employment Register in Baltimore, the ratio of applicants to interviewers was close to six applicants to one interviewer.
- On the first day of interviewing in Baltimore, the average number of interviews for each applicant was between three and four.
- Applicants whose highest degree is a master's or bachelor's should be aware that most jobs listed have required a doctorate.
- Most jobs listed have been academic positions.
- In Baltimore, only 8% of employers interviewing represented Ph.D.-granting mathematical sciences departments.
- Over 50% of the employers interviewing at the Employment Register in Baltimore indicated on their employer forms that they were restricted by their institution or company to hiring only U.S. Citizens or Permanent Residents.

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

December Issue of Employment Information in the Mathematical Sciences (EIMS)

The periodical *EIMS* publishes five issues per year listing open positions in academic, governmental, and industrial organizations, primarily in North America. *EIMS* is a joint project of the American Mathematical Society (publisher), the Mathematical Association of America, and the Society for Industrial and Applied Mathematics.

The December issue of *EIMS* contains résumés of persons seeking professional positions in the mathematical sciences. Résumés of applicants taking part in the Employment Register and those not attending will be included in the December 1992 issue provided they are received before the November 13 deadline. Other mathematical scientists who wish to be included may have their résumés printed if the same deadline is observed.

Additional copies of the December issue of *EIMS* will be for sale at the AMS Exhibit and Book Sale at the meeting. The price at the meeting is $10. Any copies remaining after the meeting will be available from the Providence office of the Society for $17 each.

Winter List of Employers

The Winter List of Employers consists of the position listings submitted by the employers who preregistered for the Employment Register, and also those who submitted job descriptions by November 13 but are not interviewing. It will be distributed to the applicants participating in the Register. Others may purchase the Winter List of Employers at the AMS Exhibit and Book Sale at the meeting for $10 each. Any copies remaining after the meeting will be available from the Providence office of the Society for $17 each. The list will not be updated with employers who register at the meeting.

List of Retired Mathematicians Available for Employment

The *List of Retired Mathematicians* will be included in the December and January issues of the publication *EIMS*. Retired mathematicians who are interested in being included in the list may send the following information to the Coordinator, Mathematical Sciences Employment Register, P.O. Box 6887, Providence, RI 02940.

1. Full name
2. Mailing address
3. Highest degree, year, university
4. Most recent employment, institution
5. Type of position desired
6. Academic or industrial employment preferred
7. Date available for employment (month/year)
8. Geographic location preferred

The deadline for receipt of this information is **November 13.** Offprints of the list will be available from the Mathematical Sciences Employment Register at the above address.

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

Questions about the Employment Register should be addressed to the Employment Register Coordinator, the American Mathematical Society, at 401-455-4142, or by electronic mail: CAK@MATH.AMS.ORG. A telephone number will be announced at a later date that will be in service during the hours the Register is open in San Antonio. Participants should note that this telephone number is to be used for contacting the Employment Register desk and is not for contacting participants nor for taking messages. Those who wish to leave messages should call the message center telephone number which will be announced in a future update of the San Antonio meeting announcement.

APPLICANT FORM

MATHEMATICAL SCIENCES EMPLOYMENT REGISTER
JANUARY 13-15, 1993
SAN ANTONIO, TEXAS

1. **Form must be typed. (Please see instructions on facing page. No other format will be accepted.)**
2. **This form CANNOT be submitted by electronic mail.**
3. **Hand lettered forms will be returned. Do not type beyond the box.**
4. **Please check if Preregistration/Housing Form previously sent.** ☐
5. **Return form with payment with your Preregistration/Housing Form by November 13 to AMS, PO Box 6887, Providence, RI 02940, in order to be included in the December issue of EIMS.**

APPLICANT: Name _____
CODE: Mailing Address (include zip code) _____

Ⓐ Specialities _____

Ⓑ Career objectives and accomplishments

ACADEMIC: ☐ Research ☐ University Teaching College Teaching: ☐ 4-year ☐ 2-year

Would you be interested in non-academic employment? ☐ yes ☐ no

Near-term career goals _____

Significant achievements _____

Paper to be presented at this meeting: _____

Ⓒ Degree Year (expected) Institution

_____ _____ _____ Ⓓ No. of abstracts, internal reports _____

_____ _____ _____ Ⓔ No. of papers accepted _____

_____ _____ _____ Ⓕ No. of books and patents _____

PROFESSIONAL EMPLOYMENT HISTORY:

Ⓖ Employer	Position	Ⓗ Experience	Years
1.			____ to ____
2.			____ to ____
3.			____ to ____
4.			____ to ____

DESIRED POSITION:

Ⓘ Duties _____

Available mo. _____ /yr. _____ Ⓙ Desired geographical location _____

References (Name and Institution)

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

AVAILABLE FOR INTERVIEWS:

Session 1 ☐	Session 2 ☐	Session 3 ☐	Session 4 ☐
Thurs. AM 9:00-12:15	Thurs. PM 1:30-4:45	Fri. AM 9:00-12:15	Fri. PM 1:30-4:45

I do not plan to attend the San Antonio meetings. ☐

EMPLOYER FORM

MATHEMATICAL SCIENCES EMPLOYMENT REGISTER
JANUARY 13-15, 1993
SAN ANTONIO, TEXAS

1. **Form must be typed.**
   (Please see instructions on page facing Applicant Form. No other format will be accepted.)
2. **This form CANNOT be submitted by electronic mail.**
3. **Hand lettered forms will be returned. Do not type beyond the box.**
4. **Please check if Preregistration/Housing Form previously sent.** ❑
5. **Return form with payment with your Preregistration/Housing Form by November 13 to AMS, PO Box 6887, Providence, RI 02940, in order to be included in the Winter List of Employers.**

EMPLOYER CODE

Institution _____

Department _____

City, State, Zip _____

Name of Interviewer(s) 1. _____

2. _____

3. _____

4. _____

(A) Specialties Sought _____

(B) Title(s) of Position(s) _____

(C) Number of Positions _____

(D) Starting Date _____ / _____
Month Year

(E) Term of Appointment _____
Years

(F) Renewal ❑ Possible ❑ Impossible
Tenure Track Position ❑ Yes ❑ No
Teaching Hours per Week _____

(G) Degree Preferred _____ Degree Accepted _____

(H) Duties _____

(I) Experience Preferred _____

Citizenship Restriction (Check One) ❑ U.S. Citizen ❑ Non-U.S. Citizen, Permanent Resident ❑ Non-U.S. Citizen, Temporary Resident

Available for Interviews
❑ **Session 1** (Thurs. AM, 9:00–12:15) ❑ **Session 2** (Thurs. PM, 1:30–4:45)
❑ **Session 3** (Fri. AM, 9:00–12:15) ❑ **Session 4** (Fri. PM, 1:30–4:45)

Number of Interviewers
Session 1: _____ Interviewers **Session 2: _____ Interviewers**
Session 3: _____ Interviewers **Session 4: _____ Interviewers**

❑ Not Interviewing

Instructions for Applicant and Employer Forms

Applicant forms submitted for the Employment Register by the November 13 deadline will be photographically reproduced in the December 1992 issue of *Employment Information in the Mathematical Sciences (EIMS)*. Résumés of only those attending will be posted at the meeting.

Employer forms submitted by the November 13 deadline will be photographically reproduced for the Winter List of Employers. Employers are encouraged to provide more than one interviewer when they are able to do so, in order to increase the number of interviews which may be scheduled. Please take care to indicate the number of interviewers for whom simultaneous interviews may be scheduled. Please refer to the Employment Register text for specific instructions.

The forms **must be** carefully **typed** using a fresh black ribbon. It is important that the keys be clean and make a sharp, clear impression. Do not erase—it causes smudges which reproduce when photographed. Use a correcting typewriter or correction tape or fluid if necessary. Submit the original typed version only. Copies will not reproduce properly and are not acceptable. **Hand lettered forms will be returned. Do not type outside the box.**

All forms must be received by the Society by November 13, 1992 in order to appear in the special issue of *EIMS* or the Winter List of Employers and must be accompanied by the Preregistration/Housing Form printed in this issue, if attending the meeting.

(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

(H) (I) Duties and Experience

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

(J) Location

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

FOCUS EMPLOYMENT ADVERTISEMENTS

The Mathematical Association of America's more than 32,000 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 picas or 2.33 inches wide. Advertisements spanning two columns measure 29 picas or 4.83 inches wide. Advertisements spanning three columns measure 44 picas or 7.33 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: February, April, June, September, October, and December. Advertising copy deadlines include:

- December issue
  Monday, 12 October 1992
- February issue
  Monday, 14 December 1992

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:

FOCUS Employment Advertisements
The Mathematical Association of America
1529 Eighteenth Street, NW
Washington, DC 20036-1385
(202) 387-5200
email: focus@maa.maa.org
fax: (202) 265-2384.

THE UNIVERSITY OF THE SOUTH
Department of Mathematics and Computer Science

Tenure-track position in mathematics, to begin Fall 1993, at a highly selective church-related (Episcopal) liberal arts college of 1100 students located on a 10,000-acre forested domain in the Tennessee uplands. Applicants should have an appreciation for the liberal arts and some interest in computing. Applications from women and minorities are especially encouraged. The position is at the level of assistant professor, with excellence in teaching and continued interest in research expected. A complete application will include a letter stating one's professional aims, a resumè, graduate and undergraduate transcripts, and three recommendations. All should be sent to **Sherwood F. Ebey, The University of the South, 735 University Avenue, Sewanee, TN 37375-1000.** Applications received by 27 November will have first consideration

WILLIAMS COLLEGE
Department of Mathematics
Williamstown, Massachusetts 01267

One or possibly two anticipated positions, one of them preferably in statistics, probably at the rank of assistant professor, for Fall 1993. Strong commitment to both teaching and scholarship is essential. Please have a vita and three letters of recommendation on teaching and research sent to Hiring Committee. Formal evaluation of applications will begin 15 November 1992, and continue until the positions are filled. AA/EOE.

WASHINGTON AND LEE UNIVERSITY
Department of Mathematics
Lexington, VA 24450
RADFORD PROFESSOR / DEPARTMENT HEAD

The Radford Chair of Mathematics will be filled in September 1993. An applicant should have a background that warrants tenure and the rank of full professor, a record of effective teaching and scholarship, and a commitment to mathematics education in a liberal-arts setting. The Radford Professor will assume the position of department head for a five-year term,

The mathematics faculty numbers seven, all with Ph.D.'s. The University is primarily a liberal-arts college with 1600 undergraduates. It is 240 years old and is located in the lower Shenandoah Valley. Address inquiries to **Prof. T.O. Vinson, Search Committee, Mathematics Department. The selection process will begin in November 1992.**

THE JOHNS HOPKINS UNIVERSITY
Department of Mathematical Sciences

Applications are invited for 3 anticipated faculty positions within the areas of

- **Numerical Linear Algebra**
  (Senior applicants preferred)
- **Statistics**
- **Operations Research**
- **Applied Discrete Mathematics**

Selection is based on demonstration and promise of excellent research, teaching and innovative applications.

Minorities and women are encouraged to apply. The Johns Hopkins University is an Affirmative Action/Equal Opportunity Employer.

Applicants are asked to furnish a curriculum vitae, transcripts (junior applicants only), reprints (if available), a letter describing professional interests and aspirations, and to arrange for three letters of recommendation to:

Prof. John C. Wierman, chair
Department of Mathematical Sciences
220 Maryland Hall
The Johns Hopkins University
Baltimore, Maryland 21218-2689

Applications are requested by 15 January 1993.

Applicants whose primary research is in algebra, analysis, geometry, logic, number theory, or topology will not be considered.

COLUMBIA COLLEGE
Assistant Professor of Mathematics

Columbia College, one of the ten oldest women's colleges in the country, is seeking a qualified individual to fill the position of assistant professor, tenure track, in the Department of Mathematics beginning fall 1993.

Candidates are required to have a PhD in mathematics, evidence of excellence in teaching and a commitment to continued professional growth. A background in computer science is also desirable. Interested individuals should submit a curriculum vita, a letter of application, statement of teaching philosophy and the names of three references to:

Dr. Laurie Hopkins
Mathematics Department Chair
Columbia College
1301 Columbia College Drive
Columbia, SC 29203

Applications must be postmarked no later than 30 November 1992 for consideration. Columbia College is an affirmative action, equal opportunity employer.

Dartmouth College

John Wesley Young Research Instructorship in Mathematics

The John Wesely Young Research Instructorship is a two year post-doctoral appointment for promising new or recent PhD's whose research interests overlap a department member's. Current departmental interests include areas in algebra, analysis, algebraic geometry, combinatorics, computer science, differential geometry, logic and set theory, number theory, probability and topology. Teaching duties of four ten-week courses spread over two or three quarters typically include at least one course in the instructor's speciality and include elementary, advanced and (at instructor's option) graduate courses. Nine-month salary of $34,000 supplemented by summer (resident) research stipend of $7,556 (two-ninths). Send letter of application, rèsumè, graduate transcript, thesis abstract, description of other research activities and interests if appropriate, and 3 or preferably 4 letters of recommendation (at least one should discuss teaching) to **Phyllia A. Bellmore, Mathematics and Computer Science, 6188 Bradley Hall, Hanover, NH 03755-3551.** Applications received by 15 January 1993 receive first consideration: applications will be accepted until position is filled. Dartmouth College is committed to affirmative action and strongly encourages applications from minorities and women.

Director of Learning Enhancement Center

Indiana University Kokomo is seeking s Director for its Learning Enhancement Center (LEC). The Director will be responsible for establishing tutor-training programs, creating and implementing a student progress assessment system, providing statistical and narrative reports and supervising staff.

Qualifications: Master's degree required, doctorate prefered. Administrative experience in a learning center is required. Additionally, demonstrated success as a teacher, involvement in program and development highly desirable.

To apply, send letter of application, resume, and names and telephone numbers if three references to: **Shirley Wilson, Director of personnel, 2300 S. Washington, P.O. Box 9003, Kokomo, IN 46904-9003.** To be assured of receiving consideration, applications should be submitted by October 23, 1992.

Indiana University Kokomo is an Affirmative Action Equal Opportunity Employer.

Training in Biostatistics

The University of Rochester invited applications for NIH funded postdoctoral positions, available 1 January 1993. Postdoctoral fellows will participate in design and analysis of medical studies, as well as independent research. This program requires U.S. citizenship or permanent residency. Applications from women and minorities are encourages (AA/EOE). Contact: Martin A. Tanner, Department of Biostasstics, University of Rochester Medical School, Box 630, Rochester, NY 14642.

Yeshiva University

Department of Mathematics

The small, selective liberal arts colleges of Yeshive University invite applications for a tenure-track position starting in Fall 1993 at the rank of assistant/associate professor. Responsibilities include teaching 12 hrs/sem and active scholarship at a level consistent with the teaching load. Rank and salary commensurate with background and experience. Qualifications: PhD, postdoctoral college teaching experience with a record of excellence, and a commitment to undergraduate teaching and productive scholarship. Send letter, vita and have three letters of reference sent to: **Dean Norman S. Rosenfeld, Yeshiva College, New York, NY 10033.** (EOE)

Calendar

National MAA Meetings

13-16 January 1993 Seventy-sixth Annual Meeting, San Antonio, Texas (Board of Governors, 12 January 1993)

15-19 August 1993 Sixty-eighth Summer Meeting, Vancouver, British Columbia (Board of Governors, 14 August 1993)

12-15 January 1994 Seventy-seventh Annual Meeting, Cincinnati, Ohio (Board of Governors, 11 January 1994)

Sectional MAA Meetings

Allegheny Mountain Penn State-Behrend Campus, Erie, PA,16-17 April 1993

Eastern PA & Delaware Muhlenberg College, Allentown, PA, 14 November 1992, Villanova University, Villanova, PA, Spring 1993

Florida University of Central Florida, Orlando, FL, 5-6 March 1993

Illinois St. Mary's College, Notre Dame, IN, 23-24 April 1993 (Joint meeting with Indiana & Michigan Sections)

Indiana Indiana University-East, Richmond, IN, 17 October 1992, 23-24 April 1993 (Joint meeting with Illinois & Michigan Sections)

Intermountain University of Utah, Salt Lake City, Utah, 9-10 April 1993

Iowa Luther College, Decorah, IA, Spring 1993

Kansas Emporia State University, Emporia, KS, 19-20 March 1993

Louisiana-Mississippi University of Southern Mississippi, Biloxi, MS, 5-6 March 1993

Maryland-District of Columbia-Virginia Coppin State College, Baltimore, MD, 13-14 November 1992, Christopher Newport College, Newport News, VA, 16-17 April 1993

Metropolitan New York York College, Jamaica, NY, 1 May 1993

Michigan St. Mary's College, Notre Dame, IN, 23-24 April 1993 (Joint meeting with Indiana & Illinois Sections)

Missouri Westminister College, Fulton, MO, 2-3 April 1993

Nebraska University of South Dakota, Vermillion, SD, 16-17 April 1993

New Jersey Drew University, Madison, NJ, 14 November 1992, Middlesex County College, Edison, NJ, 20 March 1993 (Joint meeting with MAAJN & MATYCNJ)

North Central Moorhead State University, Moorhead, MN, 23-24 October 1992, Riverwood Conference Center, Monticello, MN, 30 May—1 April 1993

Northeastern Trinity College, Hartford, CT, 20-21 November 1992, University of Massachusetts/Dartmouth, No., Dartmouth, MA, 11-12 June 1993

Ohio Xavier University, Cincinnati, OH, 30-31 October 1992, Kent State University, OH, 16-17 April 1993

Oklahoma-Arkansas Oral Roberts University, Tulsa, OK, 26-27 March 1993

Pacific Northwest University of Montana, Missoula, MT, 18-20 June 1993

Rocky Mountain Colorado School of Mines, Golden, CO, 2-3 April 1993

Seaway Cornell University, Ithaca, NY 13-14, November 1992, SUNY at Binghamton, Binghamton, NY, 23-24 April 1993

Southeastern University of South Carolina-Conway, Conway, SC, 2-3 April 1993

Southwestern New Mexico Institute of Mining & Technology, Scorro, NM, 16-17 April 1993

Southern California University of Southern California, Los Angeles, CA, 7 November 1992, California State University, San Marcos, CA, 6 March 1993

Texas Abilene Christian University, Abilene, TX, 1-3 April 1993

Wisconsin University of Wisconsin- La Crosse, La Crosse, WI, 10 October 1992, University of Wisconsin - Fox Valley, Menasha, WI, 16-17 April 1993

Other Meetings

23-25 April 1993 The 1993 Annual Meeting of New York State Mathematics Association of Two-Year Colleges (NYSMATYC) will be held at the Radison Hotel, Utica Centre, Utica, NY. For additional information contact: Judy Cain, NYSMATYC President-Elect, Tompkins Cortland Community College, 170 North Road, Dryden, NY 13053.

2-4 July 1993 The Global Awareness Society International Annual Meeting, "Global Interdependence" at the Marriott Marquis in New York City. Abstract deadline is December 1 1992. For additional information please contact Jim Pomfret, Department of Mathematics and Computer Science, Bloomsburg University, Bloomsburg, PA 17915.

6-7 November 1992 Sixth Annual Southeastern Small College Computing Conference. For more informaiton please contact Dr. Frank Cheatham, CPO 1321, Campbellsville College, Campbellsville, KY 42718.

16-17 October 1992 The 1992 Mathematical Department Chairs Colloquium, Arlington, VA. For more information please contact the Board on Mathematical Sciences, National Research Council, NAS 312, 2101 Constitution Ave., NW, Washington, DC 20418.

30-31 October 1992 Seventh Annual Pi Mu Epsilon Regional Undergraduate Mathematics Conference. For more information please contact R. Poss at 414/337-3198 or e-mail Poss@SNCAC.SNC.EDU.

The Mathematical Association of America
1529 Eighteenth Street, NW
Washington, DC 20036-1385

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